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OREGON
ENVIRONMENTAL QUALITY
COMMISSION MEETING
MATERIALS

State of Oregon
Department of Environmental Quality

Director's Statement

Agenda Item No. A, June 8, 1984, EQC Special Meeting

Proposed Adoption of Woodstove Certification Rules, OAR 340-21-100 through -166 as a Revision to the State Implementation Plan.

The 1983 Oregon Legislature ~~passed~~ enacted HB2235 which requires the Commission to adopt rules dealing with woodstove certification by July 1, 1984.

The Department has developed proposed rules with the aid of a Woodstove Advisory Committee, ~~which~~ primarily represent~~ed~~ing Oregon's woodstove industry. Hearings were held on the proposed rules in five locations throughout the State in early May.

As a result of hearing testimony, the Department is proposing revisions to the proposed rules in four areas. The most significant revision is a change in the second stage emission standard to a level originally recommended by the Woodstove Advisory Committee which would achieve ~~about~~ between a 70%-74% reduction in woodstove emissions. This revision is being proposed on the basis that downward revisions in population growth projections indicate airshed improvement needs are not quite as great as first thought and that production stove technology is not quite as effective in reducing emissions as prototype technology tested earlier by DEQ.

Other revisions proposed include: (1) revisions in the particulate sampling method equivalency criteria which may allow ~~limited~~ use of the Condar particulate sampler; (2) provisions to reduce emission tests from four to two as a cost saving measure with an intent that this be used only for low sales volume, specialty stoves; (3) and minor modifications to testing equipment specifications.

The Department proposes that these rules be adopted today in order to insure meeting the statutory deadline.

John Kowalczyk of our Air Quality Division is present to answer any questions you may have.

VICTOR ATIYEH
GOVERNOR

Environmental Quality Commission

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MEMORANDUM

To: Environmental Quality Commission

From: Director

Subject: Agenda Item No. A, June 8, 1984, EQC Meeting

Proposed Adoption of Woodstove Certification Rules, OAR 340-21-100 Through 340-21-166 As A Revision To The State Implementation Plan.

BACKGROUND

The 1983 Oregon Legislature passed HB 2235 which requires the EQC to adopt rules by July 1, 1984 which deal with certification of new woodstoves. Over the last 9 months the Department developed proposed rules with the aid of a Woodstove Advisory Committee. The proposed rules cover testing procedures, lab accreditation requirements, certification application procedures and fees, labeling criteria, and emission standards. The Woodstove Advisory Committee, which primarily represented the Oregon woodstove industry, supported the proposed rules with the exception of the emission standard. On March 16, 1984, the EQC authorized hearings on the proposed rules drafted by the Department (Agenda Item A, March 16, 1984, EQC Meeting).

Hearing Testimony

Day and night public hearings were held on the proposed rules in Portland, Eugene, Medford, Bend and Pendleton. The hearings officers' reports, along with supporting written testimony, are included as Attachment 1. A summary of written testimony received while the hearing record was kept open is included in Attachment 2, along with copies of the written testimony. Written testimony submitted after the close of the hearing record is included as Attachment 3.

Fifty-six individuals testified in person at the hearings, and fifty individuals submitted written testimony while the hearing record was kept open. Six individuals submitted written testimony after the hearing record was closed. Most testimony came from the woodstove industry which primarily criticized the proposed second stage of the emission standard as being unjustified and unachievable, and not in keeping with legislative intent. Testimony supporting this position included information to indicate the baseline stove emission rate should be higher, population growth projections in airshed strategies should be lowered and the test fuel density was too low to represent reality.

Other significant issues raised by woodstove industry testimony included:

- The Condar particulate sampling method should be recognized as equivalent to Oregon Method 7.
- The Condar heating efficiency method should be recognized as equivalent to calorimeter room and stack loss heating efficiency methods.
- Testing costs should be reduced by reducing the number of tests required.
- A provision should be made to protect confidentiality of stove designs.
- Certification fees should be paid at the retail level.
- A fireplace insert test procedure should be provided.
- DEQ should not spend time inspecting stoves at the manufacturing facility when testing laboratories can provide this service.
- DEQ should let testing laboratories review woodstove design changes.
- DEQ should not immediately revoke manufacturer's certification if a testing lab is found to have conducted an improper test.
- Uncertified stove advertising and sales should be allowed in Oregon between manufacturers and dealers and to out-of-state customers.
- Degradation of non-catalyst stoves should be considered in setting the emission standard.
- Stoves should not have to be recertified every five years.
- Catalyst warranty requirements should allow a 5-year pro-rated provision instead of 2-year full replacement provision.
- The Woodstove Advisory Committee should periodically review the program.
- Some testing equipment specifications should be revised.

Several individuals submitted testimony in support of regulation of woodstoves and some felt the Department was not being strict enough.

Several organizations, such as the Sierra Club, League of Women Voters of Oregon, Oregon Environmental Council, and Oregon Lung Association, felt the strictest standards should be adopted as a single stage standard as they expressed fears that the second stage may never be implemented.

Only one local government, the City of Union, submitted testimony and asked to be exempt from the rules.

Organizations, such as the Lane Regional Air Pollution Authority (LRAPA) and Associated Oregon Industries, generally supported the proposed rules. Suggestions were made by LRAPA that public education should be included on economic and safety benefits of catalysts and that the value of a financial incentive should not be forgotten in relation to the possibility of accelerated woodstove pollution clean up.

EVALUATION AND ALTERNATIVES

The appropriateness of the second stage 7 gram/hour non-catalytic and 3 gram/hour catalytic stove particulate emission standard (7/3 standard) was the major issue raised by hearing testimony. The woodstove industry generally supported the first-stage standard but felt that either a second-stage standard was unnecessary to clean up airsheds or that more information was necessary in order to identify an appropriate standard. The Woodstove Advisory Committee had unanimously voted to support a 9/4 second-stage standard and some testimony was received from a few members of the woodstove industry in support of adoption of the Advisory Committee recommendations. There was considerable woodstove industry testimony that a 7/3 standard was not achievable with available stove technology.

Airshed Model Uncertainties

In terms of the needed airshed improvements which were the basis for the second-stage emission standard, testimony cited uncertainties of about ± 25% in the airshed models used to calculate these needs. Regarding these model uncertainties, the Department believes there is an equal likelihood that airshed needs have been underestimated as overestimated. The only reasonable approach in such instances, in the Department's opinion, is to rely on average values predicted by the models as has been done.

Population Growth Projections

When the issue of population growth projections and related increased wood burning used in airshed models was reviewed with the Advisory Committee last Fall, a check was made to verify that latest available population growth projections were being used by the Department. Subsequent to this check, hearing testimony pointed out that Portland State University published preliminary revised growth projections about the first of the year which indicate revised downward growth projections of about 25% for the Portland and Medford areas for the periods of interest. While these projections are preliminary in nature, it is clear that actual growth within the first several years of the periods of interest have been much lower than anticipated because of the lingering economic recession in Oregon. Thus, it appears reasonable that these revised growth projections, which take into account this fact, should be used in reevaluating airshed improvement needs. Revised growth projections were used to revise the Portland and Medford airshed model control strategy needs. The results are shown below.

Airshed Reduction Needs From Woodstove Certification

	Daily Standard	Annual Standard
Medford Area (original)	80%	76%
Portland Area (original)	75%	75%
Medford Area (revised)	78%	74%
Portland Area (revised)	72%	72%

As can be seen from the above table, although growth projections have been revised downward about 25%, airshed improvement needs do not go down accordingly. This is because population growth is not the major cause of future projected increases in wood heating emissions. The main cause of such increases is projected further conversion of wood now burned in fireplaces to woodstoves or fireplace inserts.

In general, revisions of airshed control strategy needs based on revised population projections indicate needs have been reduced from a 75-80% range to a 72-78% range. The lower end of this range would be most important, considering population weighting to the Portland area needs and EPA's recent proposal to drop the secondary daily total suspended particulate standard.

Baseline Stove Emission Rate

Once the needed airshed emission reduction from woodstove certification is identified, the appropriate emission standard to achieve such a reduction can be calculated based on the average emissions from existing or baseline stoves. The baseline emission rate identified by the Department (in the range of 30 to 34 grams per hour) was criticized by many members of the woodstove industry as too low.

The Department identified a baseline particulate emission factor of 20 grams/kilogram of wood in actual airshed monitoring and modeling studies. This compared favorably with EPA's current emission factor of 21 grams/kilogram. The Department estimated an average baseline burn rate of 1.7 kilogram/hr (which when multiplied by the 20 gram/Kg emission factor equals an emission rate of 34 g/hr) as being the baseline burn rate based on the average Oregon heat demand for an average sized home with average insulation in Oregon. The estimated 1.7 kilogram/hr average burn rate translates to an equivalent heat load of 13,000 Btu/hr. The average baseline burn rate estimated by the Department was also challenged by certain members of the woodstove industry who thought it should be higher. The only known study conducted which measured actual burn rates in several homes under heat load conditions similar to those of Oregon indicated burn rates closer to 1 Kg/hr. This study, by Dr. Stockton Barnett in New York, concludes that average burn rates may be slightly less than calculated heat loads because extremities of homes are kept cooler. Thus, the Department is confident that the burn rates used to calculate the average baseline emission rate should not be higher than 1.7 Kg/hour as claimed by woodstove industry testimony.

Recent testing of conventional woodstoves (December, 1983/January, 1984) using the proposed test procedures has also indicated a baseline stove emission rate of about 30 grams/hour. The National Wood Heating Alliance (WHA), however, presented substantial testimony which pointed to much higher baseline emission rates for conventional stove tests.

WHA pointed to 4 tests conducted by DEQ in 1980 of conventional stoves which averaged 81 grams per hour. A close examination of this data indicates tests were conducted with unrealistically dry wood with a moisture content of 14%. Wood at this moisture content has been shown by EPA studies to have very high emission rates. The proposed test procedure uses a more realistic average moisture content in the range of 16-20%. If the Department's 1981 test data is adjusted from 14% moisture to 18% moisture, using EPA derived moisture/emission relationships, an emission rate of about 36 grams/hour results.

WHA also cites 2 conventional stove tests conducted in 1981 within the Department's proposed moisture range which average 48.5 grams per hour. A close examination of this data indicates both tests were at higher heat outputs than the Department's reference 13,000 Btu/hr. Projecting this data to 13,000 Btu/hr results in an emission rate of between 34 and 39 grams per hour, depending on the assumed stove efficiency (50% or 65%).

WHA further cites test data by the State of Vermont which averages 51.8 grams per hour for conventional stoves. A close examination of this data indicates an average emission factor of about 20 grams/kilogram (which agrees with DEQ's factor) but at an average burn rate of about 3 Kg/hr which is much higher than DEQ estimates and actual measured values for Oregon heat loads. The Department therefore believes its estimate of baseline stove emissions in the range of 30 to 34 grams/hour is justifiable and usable to calculate an appropriate emission standard.

Test Fuel Loading

WHA also contends that the Department's test fuel density of 7 #/cubic foot of fire box volume is unrealistically low and thus produces unrealistic baseline emission rates and unrealistic test conditions for certification purposes. Investigation of this issue reveals that the actual Department test fuel density is about 9 #/cubic foot since a test fuel bed of 20-25% of a 7 #/cubic foot test fuel charge is also required. WHA points out that a major study of woodstove emissions by Battelle used equivalent test fuel densities of 5 to 16 #/cubic foot. This would put the Department's test fuel density in about the mid-range of such testing. The Department would also point out that other major studies, like those of Tennessee Valley Authority (1981-1983), used densities of 2.0 to 6.5 #/ft^3. Dr. Stockton Barnett, a leading woodstove researcher, also pointed out in testimony that he supports DEQ's fuel loading density for medium and large size stoves on the basis of extensive experience he has requiring homeowners to record weights of their fuel loads. He indicated that homeowners' overnight loads of hardwoods in the Fall and Spring average 7-8#/ cubic foot and 9-10#/cubic foot in the coldest parts of winter. He postulates that loading densities are not greater because ash buildup is irregular and several inches deep, reducing useable firebox volume; logs are often non-optimum and variable length to fully utilize firebox length; and log diameters and irregular cross-section geometry make tight packing impossible.

The Department, therefore, concludes that a baseline emission rate of 30-34 grams/hour is appropriate and justifiable, based on: airshed modeling and monitoring studies; calculated and measured heat loads and burn rates for typical average Oregon homes; and actual emission tests of conventional stoves using reasonable test fuel densities and the proposed test procedure.

Needed Airshed Improvements and Emission Standards

Estimated emission reduction achievable for a 30-34 g/hr range of base-line emission rates for the two most prominently considered emission standards are shown below.

Emission Reductions Achievable
(%)

Emission Standard	30 g/hr Baseline	34 g/hr Baseline
9/4	70%	74%
7/3	77%	79%

Since revised airshed emission reduction needs have brought the need down from a 75-80% range to a 72-78% range with the population weighted number much closer to the lower end of this range, it appears a 9/4 emission standard is more solidly justified than a 7/3 standard. The case is further supported by the recent EPA proposal to drop the daily particulate standard which, if it happens, would then result in a 72-74% reduction need. A 9/4 emission standard resulting in an emission reduction in the range of 70 to 74% would also be more in keeping with DEQ legislative testimony which indicated a 68-75% reduction in emissions was achievable from new woodstove technology.

Best Practical Woodstove Control Technology

The woodstove industry severely criticized the proposed 7/3 emission standard on the basis that it was unachievable by available technology, even catalytic technology. Such criticism even came from the manufacturers of the Blaze King stove, the stove upon which the Department justified the achievability of the standard, and the Condar Company, the company that supplied the design technology for the Blaze King stove.

The Department had substantiated the achievability of the 3 g/hr catalytic standard on the basis of a Blaze King stove test with the proposed test procedure which resulted in an emission rate of 1.2 g/hr. Industry testimony criticized this data on the basis that the stove tested was a prototype and that production models have been "detuned" in terms of emission control to provide better catalyst life and better overall stove performance. Also, it was pointed out that the 25 cell-3" thick - 6,000 hour catalyst used in the DEQ test is being phased out and replaced with a less emission efficient 16 cell - 3" thick-12,000 hour catalyst in order to provide better catalyst longevity and improved burn rate and smoke leakage characteristics of the stove.

Upon learning of these facts several weeks ago, the Department decided to test three production-model, Condar-technology stoves using the new 16 cell-12,000 hour catalyst. Testing was conducted near the 13,000 Btu/hr reference heat output level using the proposed test procedure. The results are shown below.

Condar Technology Production Stoves	Emission Rate g/hr (Btu/hr)	g/hr (Corrected to 13,000 Btu/hr)
Blaze King Princess	2.39 (11,191)	2.75
Blaze King Princess	1.44 (13,032)	1.44
Brand X	2.49 (11,520)	2.65
Brand Y	1.06 (14,381)	0.93
Average	1.85	1.94
(95% Confidence Limit)	(3.23)	(3.74)

The above results indicate there is some variability in emission performance using Condar-technology. Test results would indicate that Condar-technology production stoves with the new catalyst designs do emit slightly more than the prototype stove tested earlier by DEQ, but still slightly under 3 g/hr. A statistical analysis of the data, though, indicates that the variability at the 95% confidence limit would put Condar technology over a 3 g/hr standard but under a 4 g/hr standard. The Condar Company, which analyzed past DEQ test data, had concluded an emission standard for catalysts in the range of 4-6 g/hr was achievable, however, this conclusion was based on longer aged (higher emitting) catalysts than called for under the proposed test procedure. A 4 g/hr emission standard, therefore, is strongly justifiable on the basis of test data of several production model Condar technology stoves with latest catalyst design. A 3 g/hr catalytic emission standard, while achievable for some tests, would likely exclude a significant portion of the Condar technology stove population.

Recommended Emission Standard

In summary, the Department's proposed 7/3 second stage emission standard was based on a strong case of airshed needs and available technology. Information gained through the public hearing process has led the Department to conclude that airshed needs are slightly less than originally projected due to downward revisions in population projections and that best practical catalytic stove control technology is only capable of consistently complying with a 4 g/hr standard. In essence, the Department concludes that a weaker case exists to support a 7/3 standard while a stronger case can be made to support a 9/4 standard. Considering many other plus and minus arguments, (such as: potential further future population growth and wood use reductions; many actual stoves being certified at significantly less than the emission standard; potential revisions to Federal Particulate Ambient Air Standards; some non-replacement of catalysts and bootlegging of non-certified stoves), the Department believes the most reasonable and justifiable approach is to select a 9/4 standard. This standard can be clearly and strongly supported on technical merits. The 9 g/hr portion of the standard is likely technology forcing for non-catalytic stoves, but general woodstove industry views have been that such a standard would provide a potentially achievable goal and would not discourage research in meeting this goal.

Condar Particulate Measurement Method Equivalency

Considerable testimony was submitted by the Condar Company in support of recognizing the Condar particulate sampler as equivalent to the Oregon Method 7 method now in the proposed rules. Equivalency criteria has been proposed in the rules and the Condar sampler has been simultaneously tested against the Oregon Method 7 for equivalency. The original equivalency criteria was generally based on EPA equivalency criteria for ambient lead sampling. The criteria would require consistency relationships between the reference method and candidate method test points of ± 24%. Fourteen simultaneous tests were run with both methods and 7 of the 14 failed the ± 24% criteria. Condar has requested that the consistency criteria be modified to ± 41.6%. At this level, Condar's analysis of the data indicates 1 of 14 data pairs would fail the new criteria, while Department analysis indicates 3 of 14 would fail.

If the weighted average of the four required tests over the full heat output of the stoves are used to compare consistency relationships between these two methods, the consistency relationship improves. EPA has new consistency criteria out for the proposed new 10 micron particulate matter standard which requires consistency between methods of ± 20%. This would be more appropriate criteria to apply to woodstove particulate testing.

Applying this criteria to the weighted average Condar data would result in 1 of 3 tests failing. However, if dual Condar sampler data is used (averaging the results of the dual samplers), then all three tests would meet the criteria. The Department proposes to modify equivalency criteria to more closely match proposed EPA ambient particulate matter equivalency criteria. This should allow dual Condar sampling to be recognized as equivalent to Oregon's Method 7 with just a minimal amount of further equivalency testing. The recognition of equivalency would not be expected to reduce testing costs significantly or reduce the stringency of meeting applicable emission standards. Recognition of the Condar sampler, though, would make it much easier for manufacturers to perform the same certification tests independent labs would perform. This could give manufacturers more confidence in the ability of their unit to pass the emission standard before incurring the large expense of actual independent certification testing.

There was some assertion made that the Condar sampler simulated ambient particulate measurement better than Oregon Method 7 and hence, it should be the reference method. The Department sees no convincing proof of this assertion. On the contrary, it can be argued that the Condar method includes some water associated with hydrophilic particulate in woodstove emissions. Oregon Method 7 and EPA's ambient high volume sampling method both dessicate samples, thus removing water before weighing in contrast to the Condar method which does not.

Condar Heating Efficiency Method Equivalency

Condar Company supplied extensive testimony in support of recognition of a simplified heating efficiency test method which could potentially substantially reduce certification testing costs. An actual statistical analysis of the simplified method in comparison to Department results using the reference stack loss or calorimeter room method was not provided. The Department has shown that calorimeter room data is within 1% on an average of the stack loss method. If Condar Company can show similar consistency in the future, then potentially, this method could be recognized as equivalent. Equivalency criteria has been added to the proposed rules to allow recognition of other heating efficiency test methods.

Reduction of Required Number of Tests

Some testimony suggested that testing costs should be reduced by reducing the number of tests, especially for smaller manufacturers or for specialty stoves with limited sales. The Department had originally felt two tests would be sufficient to accurately judge stove compliance with emission standards near the referenced 13,000 Btu/hr heat output level. Advisory Committee and national industry views strongly supported requiring four tests over an entire heat output range in order to: provide better consumer information for optimum stove operation; correctly size stoves to home heating needs; and provide useful data for other parts of the country which might adopt a regulatory program at heat output levels different than the Oregon 13,000 Btu/hr reference level. Manufacturers generally felt the extra cost of testing at four points would, in the long run, save manufacturers testing costs in other areas of the country. The Department concurred with the Advisory Committee and industry views.

In certain instances, though, where stove model sales are very small because of the size of the manufacturer or the specialty nature of the stove, the Department can see value in allowing a two emission/efficiency test option near the 13,000 Btu/hr reference point and a heat output efficiency test at maximum firing rate. This would provide the necessary information for determining compliance with the emission standard and for sizing stoves to home heating needs. This alternative could reduce testing costs by about 1/3 and provide an incentive to get more stoves certified and thus provide more consumer selection.

Should too many manufacturers opt for the two emission test alternative though, the overall airshed benefits of label information could be lost. A policy of allowing the two emission test option in special cases of very small sales volume of a stove model and requiring notification to the Department prior to such testing could provide some protection from abuse of this alternative. If the option appeared to become too widely used, the Department would propose to deal with the issue through further rule change.

Confidentiality of Stove Design

Some testimony raised concern about the need to protect certain stove design plans with a confidentiality provision. ORS 468.095(2) provides such protection if any stove manufacturer would request such confidentiality protection in writing.

Payment of Certification Fees

There were some concerns that certification fees were too high and that they should be collected through retail sales. HB 2235 specifically authorizes certification application fees from the manufacturer or dealer with the intent to cover costs of the program. No other options are considered feasible without a change in the legislation.

Fireplace Insert Test Procedure

Some testimony indicated a test procedure was needed for fireplace inserts. Stove-like fireplace inserts are consuming a large portion of the stove market and they are being proposed to be regulated in the certification program. Specific test procedures were originally incorporated in the proposed test procedure to cover testing of such devices and must have been overlooked by the person providing such testimony.

DEQ Inspection of Stove Manufacturers and DEQ Review of Stove Design Changes

Some testimony questioned the value of DEQ inspecting manufacturing facilities to see that stove manufacturers continually met certification designs. Also questioned was the need for DEQ to review and approve design changes in stoves. Suggestions were made to let accredited labs do this since they already do this for safety testing follow-up.

The Department has never had any intent to check manufacturing facilities. The Department's primary enforcement mechanism is planned to be random stove retailer checks where changes in designs by the manufacturer or retailer can be identified. The Department will also check for the selling of non-certified stoves during the retailer visits.

Considering the differences in areas of expertise between testing labs and Department staff and the overall responsibility of the Department to enforce the certification program, the Department believes it is reasonable for the Department to review design changes to determine if they have the potential to change emission and efficiency performances and hence affect the continued validity of certification status.

Revocation of Certification

Testimony was submitted requesting a one year period before revocation of certification in cases where labs are found to have improperly conducted tests.

The Department believes procedures for revocation in OAR 340 Division 11 will provide due process and reasonable time for the revocation process.

Sale of Non-Certified Stoves

Questions were raised about the legality of manufacturers and dealers (distributors) selling non-certified stoves and retailers selling non-certified stoves to out-of-state residences. The Attorney General's office advises that manufacturers and dealers in Oregon could sell uncertified stoves to each other or businesses in other states but not to retailers in Oregon. Retailers could not sell uncertified stoves to non-Oregon residents. A clarification of this interpretation has been incorporated in the proposed rules.

Degradation of Non-Catalyst Stoves

Some testimony requested that degradation of non-catalyst stoves be considered in setting the emission standards in a manner similar to what is proposed for catalyst stoves.

The Department recognizes that degradation in non-catalyst stove emission performance can occur. However, this degradation in the form of warped doors, burned out baffles and deterioration of thermostats are common to both technologies and difficult to quantify. Catalyst degradation is quantifiable and failure is expected before the total wearout of the stove itself, therefore, the Department feels it is justifiable to apply a degradation factor just to catalyst stoves.

Recertification Every Five Years

Some concern was raised about the need and costs for recertification every five years. The Department had originally proposed that recertification fees and testing requirements can be waived if no changes have been made to the stove design which affect emissions. The Department believes it is a reasonable policy to review the certified design specifications of each certified stove against the actual production model stove each five years to insure that no changes have been made without prior approval.

Catalytic Warranties

One catalyst manufacturer requested that the Department's proposed 2-year free replacement warranty requirement be changed to a 5-year prorated warranty. The Department believes prorated warranties do not offer as much consumer protection as full replacement warranties, therefore, the Department does not propose to change this requirement.

Advisory Committee Periodic Program Review

HB 2235 indicates an Advisory Committee may be formed to aid and advise the Commission on adoption of emission standards and test procedures for woodstoves. While testimony requested the Advisory Committee periodically meet to review the program, the Department believes the proper role of an Advisory Committee in the future should continue to be to review and comment on rule changes that the Department may propose in the future.

Test Procedure Equipment Specifications

Some testimony requested some minor changes in testing equipment specification. Changes considered reasonable have been made to the proposed rules.

SUMMATION

1. The 1983 Oregon Legislature passed HB 2235 which requires the EQC to adopt rules by July 1, 1984 to cover certification of new woodstoves.

2. The Department has worked extensively with a Woodstove Advisory Committee, primarily representing Oregon's woodstove industry, to develop proposed rules.

3. The Department and Woodstove Advisory Committee have been in virtually unanimous agreement with the parts of the proposed rules dealing with testing procedures, certification process requirements, laboratory accreditation and labeling. The Department and Advisory Committee had different views on the second stage of the emission standard.

4. Extensive hearings were held on the proposed rules throughout the state during the first week in May. Approximately 112 people testified or submitted testimony, some on behalf of major organizations.

5. The major issue raised in the hearing process came from the woodstove industry which challenged the need and achievability of the second stage of the emission standard which would represent approximately an 80% reduction in particulate emissions in comparison to conventional stoves.

6. The Department has extensively analyzed the information submitted by the woodstove industry in support of their concern about the second stage standard. The Department concludes that issues raised about the uncertainty in airshed models, emission rates of baseline stoves, and realism of test fuel density have no merit. The Department finds that the issues of downward adjustments to population projections used to project future wood use and performance of production model catalyst stoves have some merit.

7. Reassessment of airshed needs based on downward revised population projections of about 25% indicate woodstove certification emission reduction needs should be revised from the original 75 to 80% range in the Portland and Medford airsheds to a 72 to 78% range.

8. Woodstove industry testimony indicated that the Department had erroneously based its belief that catalyst stoves could meet a 3 gram/hr (80% reduction) standard on a prototype stove with a now obsolete catalyst. Recent Department tests of three production model stoves using the best available technology and newly designed catalysts still indicate attainment of a 3 gram/hr standard but 2 of the 3 stoves just barely attained compliance. Statistical analysis of the variability in these stoves' emission performances indicate a standard of 4 grams per hour would be necessary to insure confidence that most of these stove designs incorporating this technology would comply.

9. Considering that slightly less airshed reductions are needed than originally thought due to recent downward revised population growth projections and that best-available-technology, production model catalyst-stoves have slightly higher emission rates than the prototype stove originally tested by the Department, the Department believes a stronger case can be made to support a 9/4 emission standard than a 7/3 emission standard. A 9/4 emission standard should provide at least a 70-74% reduction in woodstove emissions. Such reductions would also support Department legislative testimony which indicated a 68-75% reduction was achievable with available technology.

10. The Department believes dual Condar particulate sampling technique can be recognized as equivalent to Oregon Method 7 with minimally more equivalency testing.

11. The Department believes that a two emission test option with a maximum heat output efficiency test should be allowed in lieu of 4 tests to reduce testing costs only in instances where prior notice is given to the Department and where small sales volumes of stoves are expected, such as in the case of specialty stoves. Such tests would be limited to Oregon Method 7 measurement because of increased inaccuracies of the Condar sampling techniques with less than four tests. Should this policy be abused, further rule changes would be recommended to insure that the overall airshed benefits of full performance labelling are not lost.

12. The Department believes future Woodstove Advisory Committee activities should be limited to the legislative intent of aiding and advising the Commission on future rules or rule changes that may be proposed by the Department.

13. Other issues raised by testimony do not warrant modifications to the proposed rules with the exception of clarification of sales of non-certified stoves between Oregon manufacturers and dealers and to non-Oregon businesses or residences and minor revisions to test instrument specifications.

DIRECTOR'S RECOMMENDATION

Based on the Summation, the Director recommends that the Commission adopt the revised proposed rules OAR 340-21-100 through -166 in Attachment 5 as an amendment to the State Implementation Plan.

Fred Hansen

Attachments:
1. Hearings Officers' Reports & Supporting Written Testimony
2. Summary of Written Testimony Submitted as Part of Hearing Record and Actual Written Testimony Received.
3. Written Testimony Received After Close of Hearing Record
4. Draft Statement of Need For Rulemaking and Land Use Consistency Statement
5. Proposed Revisions to Draft Rules OAR 340-21-100 Through -166

AA4422
J.F. KOWALCZYK:a
229-6459
May 17, 1984

Attachment 1

VICTOR ATIYEH
GOVERNOR

Environmental Quality Commission

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May 17, 1984

MEMORANDUM

To: Environmental Quality Commission

From: Linda K. Zucker - Portland
Richard J. Nichols - Bend
John E. Borden - Eugene
Larry L. Jack - Medford
Steven F. Gardels - Pendleton

Subject: Summary of Testimony at the Public Hearings Concerning Proposed Woodstove Certification Program Rules.

As announced, afternoon and evening hearings on proposed woodstove certification rules were conducted on May 1 - 3, 1984, by agency staff. A summary of all testimony and copies of written material submitted to complement oral testimony follow.

Part A - Portland
Part B - Bend
Part C - Eugene
Part D - Medford
Part E - Pendleton

PORTLAND

May 1, 1984 - Afternoon

Graig Spolek described the composition of the Woodstove Advisory Committee and its mission and mode of operation. Committee members were well-informed on the technical issues related to the mission and extensively discussed the social and economic implications of the committee effort. From the outset, committee members were concerned about the limited data base and test conditions used. However, both DEQ and the committee used the same data. Consequently, their differing recommendations arise from differences in interpretation. DEQ incorporated committee recommendations on testing procedure, performance grading, and the concept of a staged standard. This shows DEQ's basic appreciation of the committee's credibility. DEQ's rejection of the committee's recommended 9/4 standard is inconsistent and mistaken. The advisory committee's recommendation should be adopted.

Doug Anderson of Underwriters Laboratory, addressed issues relating to aspects of laboratory accredidation and product certification. The essential functions of a product certification program are initial testing and examination to determine compliance with applicable requirements, a follow up program, a system of controlled labeling and marking, and procedures for corrective action in case of noncompliance. Prototype testing should be subject to initial production inspections at the factory by qualified testing laboratory personnel. An advantage is a reduced likelihood of product recall. A testing laboratory procedure comparable to the one used by the Oregon Department of Commerce is preferrable to the proposed procedure in the woodstove regulations. (See OAR 814-22-160.)

Gerald Griswold of Anchor Tools & Woodstoves, Inc., believes that DEQ has abandoned a responsible education program for a program of unrealisticly restrictive regulation. Implementation of a standard excluding all but one type of unproven technology (catalytics) is irrational and counterproductive of reducing emissions from woodburning stoves. DEQ's data development process was faulty and conjectural, based on DEQ's use of a very small stove designed with midrange heating. The Medford airshed model is suspect for failure to separate the contribution of woodstove emissions from those of other sources. If the Medford airshed is used the Medford wood supply (65 percent hardwood, 35 percent fir) should be used. Because Medford is the worst case airshed in the state, testing should be consistent with the needs of the Medford airshed. In short, DEQ should use a "real world" model of home woodburning conditions and homeowner burning habits. The regulations should be limited to the exceedence airshed. The particulate contribution from recreational fireplaces and wood furnaces should be considered in the airshed analysis. Anchor Tools & Woodstoves, Inc. believes that DEQ has subverted the legislative intent in an effort to create a self-serving bureaucratic boondoggle. The proposed testing fees are too high. The Woodheating Alliance comments and testimony are supported.

Richard Blackburn of A. S. Yotul and Yotul USA urges the Environmental Quality Commission to review and adopt the technical arguments presented by the Woodheating Alliance. Failure to do so will result in destruction of the woodstove industry. Yotul has found Oregon a fruitful market and has responded by being responsible and supportive of sound regulations. Their negative reaction to the proposed standard is not the reaction of a company unwilling to accept regulation but is an effort to achieve a rational test methodology and a supportable standard.

Daniel Melcon is a self-employed independent sales representative in the woodstove industry and a co-owner of a retail stove shop and chimney sweeping company. He is involved in trade associations and writes for a variety of woodstove industry publications. The interim standard of 15/6 will decimate the woodstove industry by eliminating 95 to 98 percent of the models available in stores today. Few, if any, manufacturers will spend the research and testing monies to develop a stove for an interim standard. No noncatalytic technology is anticipated which will allow manufacture of marketable stoves able to meet a 7 or 9 standard. The standard's undue stringency will encourage circumvention of the law by bootlegging stoves from other states or buying underground stoves. The traveling baseline (average level of emissions for stoves in the field) was originally set at 40 grams per hour and now has dropped to 30 grams per hour. If the baseline is 30, the interim standard will only produce a 50 percent reduction in emissions, but if a higher baseline is used the reduction will be greater. An 80 percent reduction in emissions is now postulated by DEQ staff although, during the legislative process, a 68 to 75 percent was used. Mr. Melcon believes that air quality may be improving because firewood consumption has been decreasing. DEQ should educate the public to induce voluntary air quality improvement efforts. He urges a program that is reasonable, feasible, and technologically achievable.

R. Bruce Snyder appeared on behalf of the Associated Oregon Industries Air Quality Committee, one of the organizations which supported legislation to establish emission performance standards for woodstoves. He believes that industrial, commercial, and residential users of the airshed should share the obligation to keep it clean. Particulate emissions from residential wood combustion exceed the amount of particulate emitted from industry in the Portland area and about equal the amount emitted from grass burning in the Willamette Valley. Continued exceedence of air quality standards can mean fewer jobs due to resulting industrial growth limitations. Presently, Portland, Eugene-Springfield, and the Medford-Ashland areas are in a nonattainment status for particulates and other areas verge on nonattainment. If nonattainment exists for a particular pollutant, new or expanded industrial facilities must offset proposed new emissions with reductions from existing emissions. Offset requirements make industrial expansion difficult as potential offsets are scarce. AOI urges a standard based on available technology with significantly reduced emissions which will attract current woodstove owners to replace older, inefficient models.

Michael Sciacca is Technical Director of the Woodheating Alliance, which is the principle trade association for manufacturers, distributors, retailers, testing laboratories, and others directly involved in the manufacture, sale, and testing of wood fueled appliances, including the woodheating stoves which are the subject of the proposed rules. He stated that although the proposed woodstove emission standards appear to be rational and defensible, they are founded on a very tenuous data base. The proposed standards depend on a series of assumptions which are unsupported at best, and questionable at worst. There is not enough data at present to permit WHA to be comfortable with the DEQ proposal. The industry wants a woodstove certification program with which it can grow and develop and serve the energy needs of the public. Mr. Sciacca believes there is little or no verifiable connections between the ambient atmospheric loading of particulates contributed by woodstoves, and the DEQ recommended reductions in emission rates from woodstoves. The legislation that prompted the proposed regulations was based on an anticipated reduction of 68 to 75 percent of ambient woodstove generated particulate, not 80 percent. WHA believes that DEQ's assumptions significantly and erroneously underestimate the particulate emission rates from existing woodstoves. Because DEQ has proposed an 80 percent reduction from what it assumes to be the existing emission rates, it has come up with proposed rates which are far more stringent than are necessary to achieve the desired ambient reductions. For example, DEQ has assumed, on the basis of a single set of test data under some questionable conditions, that the average woodstove in Oregon emits at the rate of 30 to 34 grams per hour for 12 hours each day for six months of each year. Industry data suggests that woodstoves actually emit in the range of 50 to 60 grams per hour under shorter time spans and with heavier fire box loadings. WHA suggests that a 15/6 grams per hour rate will actually achieve a 75 percent reduction. This is the rate it urges the EQC to adopt effective in 1986. Further, the Commission should leave open the question of additional reductions in 1988 or thereafter. This will permit development of rational and verifiable data. WHA offers a pledge to cooperate with the DEQ in the development of the data. Further, WHA suggests that (1) the proposed certification procedures should be revised to reflect more realistically the actual conditions under which woodstoves are operated and the fuels which are actually burned in the home; (2) the proposed rules should contain a provision under which a manufacturer can declare certain information in its application to be proprietary and confidential so as to protect its design and trade secrets from its competitors; (3) independent review of design modifications by DEQ, in addition to laboratory certification, is duplicative and wasteful, and should be unnecessary; (4) recertification of an approved woodstove design at five-year (or any other periodic) intervals is unnecessary once the stove has been certified and where no modifications have been proposed; and (5) the Condar Particulate Emission Method should be adopted as being superior to the proposed Oregon Method Seven.

John Powell represents the Wood Energy Institute-West (WEI-West), an association comprised of woodstove industry members including retailers, distributors and manufacturers of woodstoves. Many woodstove industry members supported passage of woodstove legislation, acknowledging the need to improve air quality and agreeing that a reduction of emissions from woodstoves would have to be a part of that air quality improvement.

Nonetheless, the group opposes the proposed rules as establishing unreasonable emission standards. In testimony before the 1983 Legislature, DEQ consistently testified that statewide woodstove certification would reduce particulate emissions by 68 to 75 percent by the year 2000. The proposed rules insist on a reduction of 80 percent. The Legislature was assured that the technology to meet proposed certification standards would be currently available and on the market. The proposed 7/3 standard is technology forcing but provides no realistic prospect of achievement. The Legislature accepted assurances that many of the clean burning stoves on the market would meet the standard. Test results indicate that the proposed standard eliminates most existing woodstoves by 1986 and all but a prototype of a stove with a combustor by 1988. No noncatalytic stove meets the proposed 7 grams per hour standard and only 1 prototype with a catalyst approaches the 3 grams per hour standard. The DEQ proposal is based on a phased standard, implying the industry will have time to meet the final standard. However, the 1986 standard eliminates all but the small noncatalytic stoves and some catalytic stoves. The proposed rules direct the woodstove industry to a catalytic technology. The elimination of noncatalytic technology is not good for consumers or air quality. The Wood Energy Institute West questions the advisability of depending on user replacement of combustors since it will require a substantial cash outlay and the removal and installation of new combustors. Catalytic technology in woodstoves is relatively new and subject to maintenance problems. The Commission should understand and recognize the value of wood energy as an alternative energy resource. Costs of providing home heating are escalating. Wood provides a viable alternative with diminished cost. The WEI-West believes it is possible to set emission standards which will substantially reduce particulate emissions from woodstoves while avoiding the devastation the proposed rules will cause industry and consumers.

Roger Rook, attorney for Heating Energy Systems, Inc., a local woodstove manufacturer, believes that a 7/3 standard will limit available woodstoves to those with catalytic converters. The catalytic converter is not practical. It will not be used as designed and will stop functioning eventually, will need to be repaired or replaced, and will result in an overall long range worsening of air quality. Heat Energy Systems, Inc. accepts a 15/6 standard but fears that the 7/3 standard will be a death blow to the woodstove industry.

Robert J. Lonzway of Northwest Energy Wholesale traces his Oregon origin to 19th century ancestors and served as a proponent of the Oregon spirit of voluntary cooperation for the public good. He accused the agency of creating a bureaucratic red tape quagmire and of deception in abandoning the advisory committee recommendations.

Tim Nissen, owner of Willamette Woodstoves, opened his woodstove specialty store after the passage of HB2235 authorizing DEQ regulation of woodstoves. He assumed that the woodstove emission standard would be reasonable and now believes he was wrong. He states that DEQ's claim that an 80 percent reduction in woodstove emissions is required to meet federal clean air standards in the Portland and Medford airsheds is based on an air quality model that contains naive and erroneous assumptions about consumer behavior, supply and demand economics, and growth. There is no evidence that airshed capacity is limiting Oregon's economic growth, or that reductions in particulate violations will encourage an influx of industry. A very restrictive emission standard will sharply reduce available woodstove models. Without a variety of products, the hardware and building supply places and specialty stores which sell woodstoves will no longer find the products profitable. The proposed 1986 standard comes close to outlawing woodstoves and the 1988 standard actually does constitute an effective ban. Mr. Nissen's business tried to see the woodstove bill as a marketing opportunity, not as a problem. However, although he carries the cleanest burning stoves available, he has sold a negligible number of these products because they are far more costly but only slightly more efficient than other models. The woodstove industry offers good employment in Oregon directly to woodstove sellers and indirectly to wood suppliers, masons, installers and chimney sweeps. Salem complies with federal clean air standards, yet the woodstove regulations affect the Salem area suppliers. The proposed emissions standard is based on best case assumptions about stove sales and technological development while it is based on worst case assumptions about the economic rationality of the woodburning public. A test method that does not discriminate against conventional stoves is needed and an emission standard that will favorably impact air quality while not stifling development of a viable Oregon industry is essential.

Joseph Weller, State Program Director, Oregon Lung Association, urges a single stage 7/3 standard. The goal of a woodstove emission standard should be to bring air quality into compliance with federal clean air standards. Economic and political concerns should not be a consideration in the agency's recommendation. If after good faith efforts, the woodstove industry cannot meet a 7/3 standard by 1986, the Commission could relent. If DEQ assumptions about stove replacement and maintenance, burning practices, and stove purchases are overly optimistic, even a 7/3 standard may not ensure necessary airshed improvements.

John A. Charles, Executive Director of the Oregon Environmental Council (OEC), urges adoption of a single-stage 3 grams per hour standard for all stoves effective July 1, 1986. Testing shows that technology to meet this standard exists today. An 80 percent reduction in emissions from residential woodstoves is the minimum reduction necessary to meet Oregon's total suspended particulate ambient air standard.

A two-stage standard is unsatisfactory because it will delay the particulate reduction program; the second phase may never be implemented (as was the case with some standards for aluminum plants); and a phase-in program will put added burden on all other sources of particulate in the nonattainment airsheds.

A single standard should apply to catalytic and noncatalytic stoves as sub-optimal particulate levels are too likely to occur in noncatalytic stoves after degradation of the equipment.

OEC believes the agency must conform to the wording of the statute authorizing woodstove regulation without concern for the legislative history of the unambiguous statute. As written, the statute does not require the Commission to implement the statute in a way that would keep both catalytic and noncatalytic technologies economically viable.

Keith Cochran served on the Woodstove Advisory Committee. He reports that the committee was required to act under pressuring time constraints and eventually proposed 15/6 and 9/4 standards in an effort to reach a unanimous posture. He expressed his belief that DEQ staff had improperly manipulated the Woodstove Advisory Committee's operation and improperly screened its access to information. Mr. Cochran supports the Woodheating Alliance position because he feels too many questions remain unanswered. He questions whether the testing methodology, procedures, and data relied on by DEQ are valid and whether the procedure is workable. Mr. Cochran provided a compilation of test data from which he infers that the data base used by DEQ in developing the recommended standards was based on a single Blaze King prototype. He recommends delay in establishing a standard until air studies prove the amount of reduction required and until the industry is better able to control emissions. Wood heating helps conserve nonrenewable resources. Current Oregon business should not be destroyed to make room for new industry.

Charles Schade, M.D. served as a medical advisor to the Woodstove Advisory Committee. He supports the 7/3 standard proposed by DEQ staff. Protection of public health is the essential purpose of air quality laws. He believes it is unfortunate but sometimes unavoidable that private industry is regulated out of business in a necessary effort to achieve that goal.

PORTLAND

May 1, 1984 - Evening

Lois Renwick, owner of Irons In The Fire, a specialty retail woodstove shop, located in Portland, Oregon, purchased her business almost four years ago. She believes the proposed woodstove standard will curb product selection. She will cease operating her store if she cannot operate according to a high business standard of service. The public will lose the benefits of free literature, counseling on stove selection, and advice on safety and installation. Oregon will be viewed as a state which discourages and dismembers small businesses because of government regulation.

Bette Hume is the president of Klickitat Enterprises, Inc., an Oregon corporation that distributes Kent Heating products in the United States. She served as a member of the Oregon Woodstove Advisory Committee. An early supporter of woodstove legislation, she relied on Department assurances to the legislature and at committee meetings that the regulations to be proposed and promulgated by the Commission would be balanced, providing for the improvement of the Oregon airshed, while maintaining a reasonable standard that woodstove manufacturers could meet. During the legislative hearings, Department proposed a goal of 65 to 75 percent emissions reduction. Currently, the Department seeks an 80 percent emissions reduction. The data base on which the Department relied in proposing a two-stage 15/6 and 7/3 standard appears unreliable. The second stage standard will have a seriously chilling effect on the woodstove industry, will eliminate virtually all noncatalytic woodstoves using existing technology from the Oregon market, will increase the cost to consumers of woodheating, and will encourage purchase of nonconforming woodstoves from outlets in other states. Ms. Hume urges the Commission to adopt a 15/6 standard effective July 1, 1986 and to defer promulgation of any standard for 1988 until additional data has been accumulated and examined.

Bill Smith is a consumer, user of woodstoves, and a member of the woodstove industry. He believes the woodstove industry has helped the United States move toward energy independence. He believes auto emissions should be addressed in Medford and Eugene before woodstove emissions are regulated. He notes that fireplaces are used as garbage incinerators yet they are not regulated. Oregon is 47th nationally in hospitality to industry. Oregon is the woodstove capital and the industry should not be discouraged. The proposed regulations will lead to out-of-state stove purchases. Oregon may become a national park where people will come to listen to trees grow. To avoid this, jobs, business, and commerce must be the state's top priorities.

Paul B. Stegmeier, consultant, lecturer and writer, credits his work for raising the consciousness and improving the focus of the woodheating industry toward safer, cleaner, more responsible development of products and practice related to the proper use of woodheating systems. He is concerned that the goal of providing cleaner air for Oregon through improved products will be jeopardized by an unrealistic and excessively stringent proposed emission standard. He believes that many gaps exist in the chain of assumptions and proof necessary to objectively set in motion the machinery to control and regulate future emissions from woodstoves. The 7/3 standard may discourage development of the woodstove product after 1988. Consumers will be reluctant to give up their old stoves in favor of the more repair-prone new stoves. As the choice of complying products is reduced, the number of stove dealers will decrease, leaving fewer knowledgeable dealers available to serve the public in providing education and advice on safety and clean woodheating. The 15/6 grams per hour standard for 1986 will provide at least a 50 percent reduction in emissions from woodburning appliances. It will allow several technologies to be used in meeting the clean air goal. It will afford a broader base of consumer choice and support a more viable marketplace encouraging manufacturers to shoot for an attainable target.

Robin Fellenger of All-Ways Warm Co., believes that the proposed regulations will put Oregon woodstove dealers out of business. The proposed standards will funnel business to out-of-state suppliers and marketers of mail order and homemade stoves and encourage consumers to hold on to their older, poorly designed woodstoves. The regulations do not ensure education of woodstove users, although there seems to be consensus within the industry that as consumers are educated, they will gradually and voluntarily replace their stoves with cleaner burning, more efficient models. The regulations fail to provide for regulation and testing of the fuel used in woodstoves. Rather than dictating the standards, DEQ should cooperate with the industry and encourage voluntary improvement of stoves and their use.

Kurt Rumens is president of Lopi International, Ltd., as well as a member of the Board of Directors of the Woodstove Heating Alliance. He provides testimony on behalf of Lopi. When the woodstove emissions reduction program was initiated, Lopi directed its engineering staff to take a responsible position to comply with or surpass whatever standards the DEQ proposed. In March, 1983, in a series of tests conducted by OMNI Environmental Services, Lopi surpassed the then proposed DEQ standard (noncatalytic). The Lopi product has since been used by the DEQ in legislative hearings as one of the twelve products that would comply. Lopi has also contributed and invested technological advice and funds to verify emissions reduction efforts. Lopi supports the Woodstove Heating Alliance approach and will not endorse or continue to invest time or funds "to comply with what clearly has evolved from a reasonable approach, to a combination of misrepresented figures and manipulated data by the DEQ that will indeed eliminate the opportunity for the Oregon homeowner to purchase a new alternative energy appliance after July, 1988."

BEND

May 2, 1984

Overview

The Department held two separate hearings in Bend. One hearing was held in the afternoon and another in the evening. Each hearing was conducted in two parts: 1) A question and answer period followed by; 2) A public testifying period. This summary not only includes information given during the testifying period but also includes comments gleaned from discussion during the question and answer period. The summary combines the testimony from both hearings.

Testimony

The first person to testify was Ms. Gertrude Goldsmith who represented the Bend Chamber of Commerce. She read from a written statement which was submitted and is included with this report. The Chamber of Commerce supports the woodstove rules based upon the need for clean air. Their statement assumes that the rules will not affect the economy.

The second person to testify was Mr. Dave McCowen, OSU Energy Extension Service. Mr. McCowen believes people are looking for clean stoves because they are growing more sensitive to woodstove smoke. Dealers should take advantage of this. He feels the Department should provide information to manufacturers showing design considerations for lowering emissions from stoves. He likes the efficiency labeling on woodstoves. He believes the woodstove emission standards will benefit Oregon stove manufacturers because they will be a step ahead of the competition.

Mr. McCowen favors Bend being included in the area required to have woodstove certification. He has added a catalytic combustor to his 1934 furnace and is pleased with its performance. He had the following criticisms:

a. Forced air furnaces should not be exempted.

b. The Department should weight the emission testing to the lowfire segment to the test.

c. He prefers setting emission standards based on grams of emission/BTU as opposed to grams/hour.

d. He is concerned about consumers overriding the low setting stop on stoves.

e. DEQ's estimate of catalyst replacement is too high.

f. He supports clean air. The Department should not allow pollutant reductions to be refilled by industry.

Finally, Mr. McCowen presented a picture taken in Bend showing the impact of woodstove smoke. The picture is attached.

The third testifier was Mr. Bob Robinson who favored woodstove certification. He wants to maintain clean air in order to maintain a high quality of life. He is concerned about health hazards associated with woodstove smoke. He believes we are approaching the capacity of Bend's airshed. He is also concerned about future wood shortages which could be helped by more efficient stoves. He does not believe added costs will curtail the woodstove market.

The fourth testifier was Mr. Don Ring. He supports woodstove regulations for improving clean air. He does not think the rank and file appreciate the impact of the strict standards, which he believes are too tight. The Department should not adopt a standard without the knowledge that they can be achieved. The Department should wait for manufacturers to develop technology before setting a standard. Mr. Ring was afraid that if too strict standards were established, the rules would be circumvented by garage-styled manufacturers or out-of-state sales. Finally, Mr. Ring was concerned about the reliability of catalytic combustors and the belief that these units will not be properly operated or maintained. The Department should set reasonable and realistic standards so that noncatalytic stoves can be used.

The fifth and last testifier was Mr. Gerald McCormack. He stated that the woodstove smoke problem was not a toxicity problem but rather an aesthetic nuisance. Consequently, the Department could give more time to meet woodstove standards. A rapid implementation of woodstove standards will disadvantage the small guys. The small guys will be unable to afford the expensive research and development costs.

Mr. McCormack is afraid the technical direction of the Department seems to emphasize catalytic combustors. Catalytics have problems and the Department should not eliminate noncatalytic stoves.

Mr. McCormack is also concerned about expensive duplication in woodstove testing. Manufacturers of woodstoves tested by accredited laboratories should not have to pay fees to have the Department review the source test results. Work from accredited laboratories should stand.

Mr. McCormack believes woodstoves have helped the economy by reducing demand on foreign fuels. He believes that stoves should be cleaned up but that the upgrade should be more gradual. Otherwise, tight standards will shrink the available inventory to a few catalytic stoves and force people to install bootlegged, noncertified stoves.

The following points were made during the question and answer period:

a. There was concern about smoke from slash and field burning. Is there similar concern about these sources of smoke?

b. There was concern about allowing industry to use capacity in airsheds made available by clean burning woodstoves.

c. There was concern about the economic impact caused by the strict standards. Some feared that the cost of buying such stoves may be prohibitively expensive. If the woodstove cost goes up, folks will switch to alternative energy which will cause the costs of these fuels to rise.

d. Some thought the $1,600 fee for DEQ to review testing results was duplication of costs. DEQ should let accredited laboratory results stand.

e. The Department should adopt reasonable and realistic standards. The Department should slow down implementing these standards to reduce research and development costs.

f. Many of the stove dealers were highly concerned that there was no noncatalytic stove available that can meet the 1988 standards.

g. There was much conern about the reliability and performance problems with the catalytic combustors. Some wondered if they combustors would be replaced after they were spent.

h. Many were concerned about the strict standards restricting the available stoves to a very few models. This will encourage out-of-state sales, backyard fabrication and bootlegging.

EUGENE

May 3, 1984

Overview

The Department held two separate hearings in Eugene on May 3, 1984 to gather public testimony on proposed Woodstove Certification Rules (OAR 340-21-100 through OAR 340-21-166). The hearings began at 2pm and 7pm. The following summary combines testimony received at both hearings.

Testimony

Ron Crasilneck, representing National Steelcrafters of Oregon, Eugene, spoke first. He indicated his company manufacturers woodstoves, has a retail store in Eugene and markets stoves in 6 western states. He advised the EQC to not believe all facts presented by the Department, as he didn't believe everything was true. He thought questions in surveys done by the Department dealing with how much more people would be willing to pay for clean stoves were too simplistic. He thought airshed models might be flawed. He felt a 15 gram/hour standard could give the needed 80 percent reduction. If a mistake were made in setting the emission standard and it turned out too loose, he thought air quality would improve anyway, due to naturally improved products. If the standard were to tight, he felt the industry would be strangled.

He felt there was no evidence available that any practical, reliable stove can be built to meet a 7/3 or 9/4 standard. He felt only a first stage standard should be adopted now and that the Woodstove Advisory Committee should reconvene in January 1987 to study whether a stricter standard should be adopted. Mr. Crasilneck also felt there may not be enough labs to do the testing. A copy of Mr. Crasilneck's notes regarding his testimony are attached.

Mr. Robert Chapman representing Sweet Home Stove Works, Sweet Home, Oregon, spoke next. He read a prepared statement into the record which is attached. In summary, Mr. Chapman pointed out that he attended all the Woodstove Advisory Committee meetings. He felt the first stage 15/6 emission standard was a reasonable recommendation. He felt more information was needed before a second stage standard is adopted.

Brian Vik representing Fisher Century Corporation, Eugene, Oregon, read a prepared statement into the record which is attached. In summary, Mr. Vik pointed out that he followed the woodstove legislation intently as he represented the Wood Energy Association of Oregon during the 1983 legislative session. He indicated support of the program in spirit but he took violent exception to the proposed rules. He felt the proposed rules violate the spirit of representation made to the 1983 legislature and that they will unreasonably injure, if not eliminate the woodstove industry in Oregon. In regard to the emission standard, he felt the DEQ was going beyond the 65-75 percent reduction portrayed to the legislature. He felt technology was not available to meet the 7/3 standard. He felt catalytic combustors replacement should not be relied upon. His main final point was that he supported the National Wood Heating Alliance testimony on proposed rules.

Don Arkell, Director of the Lane Regional Air Pollution Authority, read a prepared statement into the record which is attached. In summary, Mr. Arkell notes studies done by the Authority which identified air pollution problems related to residential wood burning. He noted the authority supported HB2235. Mr. Arkell indicated that the Authorities Board of Directors and Advisory Committee came to a consensus on 3 areas related to the proposed rules. They were: 1) that an effective public education program must accompany the certification program which includes information on the economic and safety benefits of catalysts; 2) that the Woodstove Advisory Committee life should be extended and that it should periodically review the program and report to the Commission; and 3) that the value of a financial incentive should not be forgotten in relation to the possibility of accelerating woodstove pollution cleanup.

Mr. E. Braaten, a Portland resident, indicated he felt DEQ should have evaluated emissions from woodstoves using different wood types. He also felt we should investigate the possibility of cleaning up smoke with water sprays in the stack.

Luata VanderVeen, Business Manager for Innerwarmth, Eugene, read a prepared statement into the record which is attached. In summary, Ms. VanderVeen believes DEQ may be asking people to take a risk with catalytic technology. Specifically, she was concerned about secondary pollutants forming in catalysts, like hydrogen cyanide and ammonia. She felt more testing of catalytic converters was needed.

Edward Deardorff opposed the proposed rules on the basis of being another bureaucratic action. He was opposed to the increased cost of woodburning that will result from the program and didn't feel the air would be cleaned up.

Dan Solitz supported the proposed rules. He did feel they may fall short of what the legislature required. He wanted to be sure the program would result in a net improvement in air quality.

Dan Melcon, an independent woodstove sales representative indicated a survey had been done at considerable expense to quantify woodstove use and other factors. He indicated the results would be submitted at a later time. A copy of the survey questionnaire was submitted for the record and is attached.

John Bergland indicated he didnt see an education program in the proposed rules. He felt educating was very important and suggested that education information be put on the labels covering such things as burning hot and burning seasoned wood.

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MEDFORD
May 3, 1984

Overview

A total of ten people testified at the afternoon and evening hearings in Medford on May 3, 1984. Nine persons primarily opposed the Department's proposed action and one person primarily favored the proposed action. The major reasons for opposition were concern about the increased cost to consumers and woodstove manufacturers and concern that the second phase standard (1988) was too stringent.

Testimony

Jr. Milligan is a manufacturer (Sun Fire Woodstoves) of noncatalytic woodstoves in the Medford area. He agrees that some woodstove certification program is needed and believes that the first phase standard is realistic, but he believes that the second phase standard would put his company out of business. Mr. Milligan estimates that the proposed woodstove certification program would cost his company about $50,000 over the next three years. He is opposed to the $1,600 certification fee to DEQ; he recommends that a surtax be charged at the retail level instead of the certification fee on the manufacturers. Mr. Milligan is also concerned about the proposed laboratory accreditation procedures; he does not believe that it is appropriate to decertify woodstoves if a laboratory loses its accreditation. His written testimony is attached.

Don Fitzgerald is opposed to the strictness of the proposed rules for a woodstove certification program. He believes that other ways to reduce woodstove emissions (more education and voluntary measures) are better.

Charlie Mapel believes that EPA and DEQ are coming out to strong, especially in Southern Oregon. He points out that wood heating is an important part of the local energy picture. Mr. Mapel believes that the emission reduction requirements in the proposed rules are too strict.

Kathy Gordon represented the League of Women Voters of the Rogue Valley. She primarily favors the Department's proposed woodstove certification program. Mrs. Gordon supports the concept of cleaner burning woodstoves but questions the ability of woodstove manufacturers to meet the second phase standard proposed by the Department. Her written testimony is attached.

Paul Runquist is a woodstove manufacturer in Ashland and a member of the Oregon Woodstove Advisory Committee. Mr. Runquist is concerned about the assumptions and uncertainties upon which the proposed emission standards are based. He believes that the first phase standard is reasonable but he is opposed to the second phase standard. He is concerned that a too stringent second phase standard would result in less air quality benefit than a less stringent standard. He believes that the proposed second phase standard is not the optimum since it would discourage replacement of existing woodstoves with cleaner units and would encourage the bootlegging of non-certified woodstoves. His written testimony is attached.

David R. Jencks is affiliated with Orley's Manufacturing Company, a woodstove manufacturer in the Medford area. He is opposed to the proposed woodstove emissions standards. Mr. Jencks believes in clean air and believes that a standard is needed, but he is concerned that the proposed standard is too rigid and technology-forcing. He doesn't believe that catalysts will be maintained or that stoves will be replaced as fast as the Department believes. Mr. Jencks points out that the woodstove certification program needs woodstove manufacturers to make it work; he believes that if the Department comes out with workable standards, then the manufacturers would go forward with it.

Randy Howerton is affiliated with the Cascade Block Plant in Medford. He is opposed to the proposed second phase emission standard. He is not aware of any woodstove marketed at this time that would meet the proposed 1988 standard of 7/3 grams per hour. Mr. Howerton believes that a too stringent standard would encourage the sale of noncertified woodstoves and would have a reverse affect on air quality. He supports the first phase standard and supports the comments and recommendations of the Wood Heating Alliance and Wood Energy Institute West.

Howard A. Cusic is opposed to the Department's proposed action. He is concerned about fireplaces and backyard burn barrels which are not addressed in the proposed rules.

Jim Sevcik spoke as a concerned citizen and a woodstove user. He believes that the Department's proposed rules would put the cost of woodstoves out of the reach of consumers. He believes that more reasonable standards are needed.

Philip DaCosta believes that woodstoves are necessary due to the high cost of other fuels. He is concerned about the possible effects of the proposed rules on home heating costs.

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Jr. Milligan

SunFire
by RAINBOW RESEARCH, LTD.

May 3, 1984

Woodstove Manufacturers
vs
DEQ - House Bill HB2235

Based upon 7½ years of prior experience in the woodstove manufacturing industry and in all phases of woodstove marketing, the manufacturer of SunFire stoves began in 1980. From its inception Sun Fire woodstoves has been at the forefront of continuous state of the art engineering and development.

EMISSION STANDARDS

The longevity and success of any woodstove manufacturing company is directly related to the market-proven heating efficiency and cost effectiveness of its product. And because heating efficiency by its nature effects air pollution emissions, it is the conviction of SunFire management that we can now meet the 15 gram per hour emission limit for conventional or non-catalytic woodstoves. In fact we believe that our stove achieved this capability some few years ago and indeed has achieved an even better capability today. In the public interest, as well as that of my company, we congratulate the EPA and its departments for a pragmatic and realistic 15 gram standard for conventional woodstoves.

It will be obvious to knowledgeable engineers that once a conventional woodstove achieves the 15 gram standard its performance over its lifetime remains constant subject only to gross abuse by its operator. Constancy is not the case however with catalytic equipped stoves whose converters deteriorate with use and therefor perform over a period of time with diminished efficiency and increasing pollution emissions. This has well been taken into account with the acknowledgement that a 6 gram emission catalytic will escalate to 15 gram emissions over the life of the ~~stove~~ combuster. The 15 gram figure is, however, speculative and could rise dependent upon the catalytic converter replacement practice of the stove operator.

4820 Crater Lake Ave., Medford, Oregon 97504, Phone (503) 772-3094

Neverless, we would not at this point argue the case for a catalytic equipped stove emission standard. We do believe that a great deal more home use and data recording is required to arrive at pragmatic solutions beyond the 15/6 proposal as now applied to the differing stove types.

It is our hope, indeed our insistance, that a strong and practical distinction be drawn between conventional stoves and those equipped with catalytic devices and that these distinctions be taken into most serious account before arriving at any 1988 standard below that of the 1986 standard for conventional stoves.

In its attempt to make a case for lowering the 15 gram standard DEQ has led itself astray. It cites a $75.00 discount store stove with a 12 gram emission performance. That may be found true of any non-airtight woodstove. But because such stoves are not only fuel-cost prohibitive but require the inconvenience of almost hourly refueling, they have all but disappeared from the market. In short, such testing as that cited is of a most highly deceptive nature and constitutes an apples and oranges scenario. It is just such a scenario that we urge be avoided in fixing 1988 emission standards for conventional woodstoves as compared with catalytic equipped stoves.

CERTIFICATION FEES

The proposed manufacturer's certification fees bear ill omen for the woodstove industry in Oregon. The $1600. first certification fee with its subsequent $800. fee for additional models is discriminatory against manufacturers and ducks the issue of increased cost to consumers. Worse, however, would be the consequences to Oregon woodstove exporters who do a $100. million interstate business. Based upon earlier experience a reasonable assumption may be drawn that other states will save time, trouble and money by following Oregon's lead in this as well as other air quality matters. Such is the esteem for Oregon held in other capitals. No especial bookkeeping skill is required to discover that a repetition of such fees imposed state by state upon Oregon, stove exporters would preclude them from out-of-state markets. To assess the loss in jobs and gross state product might however require a computer.

The E.P.A. has in the past taken courageous steps. It could further burnish its image in this instance by taking another. To cover D.E.Q. administrative costs and more equitably distribute the burden of paper work a sur-tax at the retail level should be given serious consideration. In the last analysis, E.P.A. is performing a public service by imposing woodstove emission standards. It is something less than a free enterprise proposal that the woodstove industry should, in this case, pay a public service administrative tab.

LABORATORY ACCREDITATION

It is of course essential that D.E.Q. establish, implement and monitor testing laboratory accreditation regulations. It does not follow that manufacturers should bear the penalty of forbidden sales for laboratory violations. Such a position would presuppose conspiracy between laboratory and manufacturer to circumvent the law. We do not believe it is D.E.Q.'s intention to make such a supposition. Nevertheless, to penalize manufacturer's for laboratory violation is to put the cart before the horse and charge the manufacturer for hitching it up wrong. We believe D.E.Q. can do better than that.

Kathy Gordon

PUBLIC HEARING BEFORE THE OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY MAY 3, 1984

WOODSTOVE CERTIFICATION PROGRAM

While Jackson County continues to exceed the health standards for carbon monoxide and particulate pollutants, the League of Women Voters of the Rogue Valley continues its efforts for cleaner, healthier air. This testimony addresses the woodstove certification program being presented by the Oregon Department of Environmental Quality.

Over the past several years, the use of woodstoves, as the primary source of heating homes, has increased substantially. With the continued air quality improvement gained from industrial controls, emissions from woodstoves has become the largest source of particulate air pollution. Also, while automobiles continue to be the greatest source of carbon monoxide pollution, the next highest contributor is woodstoves. Another important fact concerns the size of the particulates found in woodstove smoke, which are the smallest kind, or respirable particulates, which pose the greatest threat to one's health. A program to control emissions from woodstoves is certainly in order.

Most of the proposed rules governing woodstove certification seem reasonable. We support the dual implementation approach as a fair plan to give the manufacturers enough time to produce cleaner burning woodstoves. The first emission standard of 15/6 grams (of smoke) per hour to begin in 1986 is acceptable to us.

The League of Women Voters believes very strongly that citizen involvement is an important part of the decision-making process. Citizen cooperation with industry is necessary for making rules which are prudent and reasonable for all represented parties. We support continued research and progress for designing cleaner-burning woodstoves; however we question whether the woodstove manufacturers will be able to produce woodstoves capable of meeting the second stage, or 7/3 grams (of smoke) per hour, emission standard as proposed by the DEQ.

(back)

To:Environmental Quality Commission 5/3/84

From: Paul W. Runquist, Member, Woodstove Advisory Committee

Pwk

Re: Woodstove Certification Program

As I am sure you are aware, I have been involved with the concept and development of the woodstove certification program since 1980 and supported the need for improved appliances in the legislature and in the development of the clean burning Genesis.

Throughout the meetings of the Advisory Committee we asked a recurring question:

Where's the data?

Questions concerning ...how people use stoves in the field
...how many do and when?
...what proportion of the problem is identifiable as woodstove contributed?
...the adequacy of test methods and procedures
...what can technology supply

and most important,
...will the public make it work?

I attach a list of more than 20 areas of assumption I have itemized and used in the recommendations at hand.

With this level of uncertainty, and in consideration of the available data the Woodstove Advisory Committee could not agree with an extreme standard until these and other questions could be answered.

The simple thought process is this:
If we need particulates reduced by 30% in the Rogue Valley, stoves must emit 80% less. That's fine if it can be done ... and people will buy it.

Unfortunately, if people do not REPLACE their dirty stove the air won't be any cleaner. If the proposed standards are implemented, consider:

NO production stoves are known to meet the proposed 1988 standard

Stove prices will increase 50-100%

Only catalyst stoves which require replacement every few years would possibly be salable and if they are not replaced they are no better than the stoves currently in use.

Bootlegging, blackmarket, and home-made stoves and the safety problems they create will be encouraged.

And yes, the industry in Oregon will close up and along with it the research necessary to improve the technology.
I for one am closing my business.

So why not choose the lowest possible numbers?

The answer is simple:

We won't clean up the Rogue Valley if there are no clean stoves to replace the dirty ones.
(The recent I & M vote by the public of 75% AGAINST should illustrate that degradable catalysts are no solution by themselves. Will 75% not maintain them? My experience virtually guarantees that they will NOT ... especially when people must pay to replace them.) (Catalysts would average near 20 grams/hour!!)

The Advisory Committee could not accept the simple DEQ calculation simply because the data does not exist for a responsible decision. Technological diversity as promoted to the legislature recommends a 15 gram/hour standard. That is as much as we can safely recommend now - not the 7 gram/hour that DEQ calculates.

The OPTIMUM must be sought and the public will determine what that is.

The new test method which is known to be unrealistic
The lack of FIELD data on old and new stoves
and
The uncertainty that people will REPLACE

...demand caution.

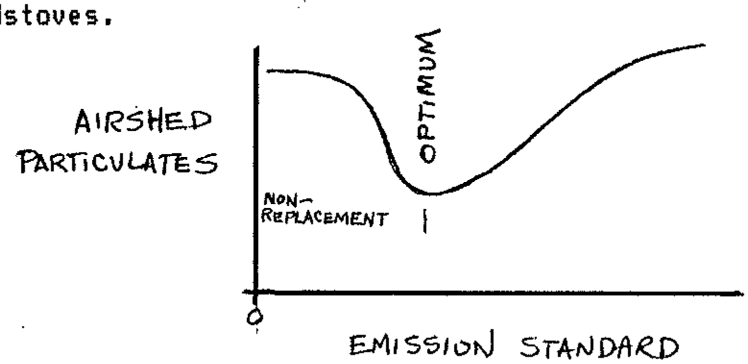
The optimum is not zero
The optimum is not a BAN of woodstoves

Only when the data is available can we make a responsible decision that will improve air quality.

We all want clean air. I've worked 10 years for it.
A 15/6 standard in '86 is all that we can be sure of now.
Cutting emissions by more than half is a major technological step, and all of those will be necessary to tempt the public to replace.

ONE stove won't work ... unless you want to ban the solution:

Affordable clean woodstoves.



Paul W. Runquist, 4/84

ASSUMPTIONS and UNCERTAINTIES
in
DEQ WOODSTOVE CERTIFICATION RECOMMENDATIONS

Weighting of woodstove usage and burn rate matches that of weather data.
The bell curve used here indicates that stoves are operated above 20,000 BTU/hr almost never and that stoves are operated continuously starting October 1 and go out April 30. Survey data indicates a substatial batch heating tendency rather than continuous.

What is the actual down-time of stoves in use?

Correlation with real world fuel types.
Survey data indicates that hardwoods may be the more dominant fuel in use. The emissions of hardwoods are known to be lower than Douglas fir.

What was the actual number of stoves in use in 1980 when characterization studies were performed?
There is apparently some contradiction here between what DEQ has used and what ODOE has recorded.

The accuracy of fingerprint distributions of other sources.
Is a different fingerprint derived from the use of different samplers? (e.g. ambient air samplers, MM5, dilution samplers...)

How does sampling instrumentation relate to environmental impact? Are dirty stoves and clean stoves measured in the same relationship by all methods?

What actual contributions attributed to woodstoves were actually caused by other sources such as fireplaces during the fingerprint period and is this relationship still true?

Were the ambient air samplers appropriately placed and weighted in importance?

Is it fair and/or possible for woodstoves to over-compensate for the contributions of other sources.

What are the emissions of the predominate species "used in the field" in 1980 when tested under the suggested test protocol and what are they under protocol corrected for field use factors? (Baseline)

Is an 80% reduction an accurate statement of need for reductions in view of:
Improved air quality in airsheds since 1980.
Impending re-evaluation of standards by EPA which would relieve pressure to seek a ban of woodstoves.

Are the projections of growth in the use of woodstoves accurate and how are they influenced by a standard which discourages or eliminates their sale?

What is the catalyst lifetime in the field?

What will the catalyst replacement rate be in the field?

What will be the effectiveness of catalysts in the home (lit off or not)?

What is the fair and proper relationship between the field performance of catalytics and non-catalytics "in the field" and do the proposed standards reflect this?

The precision of the method is assumed to be more important than accuracy. The test protocol is assumed to relate to field use. The fuel characteristics and the excessive coals base have little or no relation to field use conditions.

It is assumed that manufacturers will design their appliances around cordwood instead of 2x4's to meet the emmission standards despite the lack of correlation this may have with field performance.

The impact on small business has not been adequately considered as required by Oregon statute.

The DEQ assumes that "any" standard is achievable in a practical appliance.

The lowest standard numbers are assumed to generate the greatest air quality improvements despite the fact that counteracting forces develop below a optimum standard:

* It is assumed that the public will accept any cost impact resulting from a ban or any market regulation which greatly inflates the price or eliminates selection. It is likely that:
  - Bootlegging will be stimulated.
  - Offensive stoves will be retained longer aggravating a fire safety problem due to non-replacement.
  - The public will be unconscious of the failure of catalytics and will not place economic priority on replacement above food and fuel etc.

* Technological diversity which assures active research progress is destroyed by technological mandate or a ban ..thus further delaying development of appropriate solutions.

"The DEQ assumes that the woodstove industry is unconcerned with air quality and will resist product improvement. Some may have done so, however, most are actively seeking to unlock practical solutions to a difficult yet crucial problem of utilization of renewable solid fuel. The alternatives are equally unkind in environmental impact.

The utilization of these fuels is ultimately essential".

PWR

PENDLETON
May 3, 1984

Overview

The Department held two separate public hearings in Pendleton. One hearing was held at 2:00 p.m. and another at 7:00 p.m. The hearings were held at the Blue Mountain Community College Morrow Lecture Hall. Each hearing was conducted by a Hearings Officer, Steve Gardels, Manager of the DEQ Eastern Region. Two members of the DEQ Air Quality staff were present at each hearing to make an introductory statement explaining the development of the rules, and to answer questions from those citizens in attendance. The two DEQ staff members were Barbara Tombleson and Philip Ralston.

Materials made available to the public at the hearings included: the complete proposed rule package (3/16/84), two fact sheets summarizing the program, and the Notice of Public Hearing (3/20/84).

Each hearing was conducted in two parts: 1) A public testifying period followed by, 2) A question and answer period. No one wished to testify at the 2:00 p.m. hearing, thus this summary only includes testimony offered during the 7:00 p.m. hearing. However, a 1-1/2 hour question and answer session developed during the afternoon session after the formal testimony period ended. Throughout the question and answer period, the Hearings Officer offered to reopen the hearing to accept testimony from anyone. All offers were declined by the seven people in attendance.

Ten people testified at the 7:00 p.m. hearing; seven people testified as "primarily in favor of the Department's proposed action", and three citizens testified as "primarily opposed". A summary of the oral testimony follows. Written testimony, when offered to complement or clarify oral testimony, has been photocopied and attached to this report.

Testimony

Mr. Robert Landauer, Jr., Umatilla, OR, is opposed to the program. He feels the DEQ is the real problem; its overrunning us, overriding us, and controlling us where it shouldn't. He added the state doesn't want us to burn wood, coal, or oil, but does want us to use natural gas and electricity. He feels that kind of control is taking free enterprise away from us and limiting our choice of fuels. In turn, he said, his fuel prices will go up. He offered a personal example of his heating cost increase: during the winter, he switched from electricity at $140/month to wood at $70/month. He feels the whole program "is a big joke." He added that he has smoked for 40 years and the State of Oregon didn't tell him anything about health risks, but did tax him on cigarettes.

Dr. Donald Guenther, Pendleton, OR, is primarily in favor of the proposed action, but believes a strong public education program is at least as important as regulatory efforts. Dr. Guenther has practiced pediatrics in Pendleton during the last ten years. He has subjectively linked increased amounts of woodsmoke in the atmosphere with an increase in the number of children with respiratory diseases; and linked an increase in the severity of the diseases with the increased concentrations of the smoke. Dr.

Guenther then cited two cases from his clinical practice that illustrate his impressions. From a medical point of view, he believes there is ample justification to reduce woodsmoke emissions in Pendleton. He also believes that the economic benefits of heating with wood are less advantageous than commonly believed. Therefore, Dr. Guenther feels, the DEQ should put as much effort into educating the public about the real cost of woodburning as is being put into restrictive regulations. (Written testimony is attached).

Mr. David J. Kilmer, Milton-Freewater, OR, owns and operates Farm Boy Sales, a woodburning appliance retail shop. Mr. Kilmer is primarily opposed to the proposed rules, although he agrees with the basic intent of the law to clean up the airshed. He feels the DEQ is ignoring the wood heating industry's emission research data. He feels the proposed standards are unrealistic and unattainable and will result in the loss of hundreds of jobs, including the loss of small retailers like himself. He also feels proper stove operation is more important than stove design or technology in reducing emissions. Mr. Kilmer questions the accuracy of the figures describing woodstove emissions in the air because he doesn't think the DEQ's figures describing the number of stoves in use and sold annually are accurate. He believes other sources of air pollution should be controlled. He feels test costs are too high, 80% net cleanup cannot be achieved because inefficient and unsafe home-made stoves will be used, and that industry needs some realistic and attainable goals. (Written testimony is attached).

Mr. Alfred Nelson, Jr., Pendleton, OR, is in favor of the proposed program, but feels that the problem should have been addressed sooner. He is a retired farmer that moved to Pendleton in the fall of 1983. He said he wouldn't have moved there if he'd known it was so smoky in the winter. He has a woodstove in his home, but burned it only 3 times this past winter until he decided burning was the wrong thing to do. Smoky air also comes into his house through the furnace air intake. He and his wife left Pendleton for a week this past winter to get out of the smoke. He states his major concern being that the attention to the problem is five years too late, "like locking the barn door after the horse is stolen." He is in favor of catalyst equipped stoves because he's heard they're cleaner, cheaper, and safer. Mr. Nelson believes the "quality of life is as important as anything."

Dr. George Nelson, Pendleton, OR, is in favor of the proposed program. He has practiced internal medicine for the last 9-1/2 years in Pendleton. He says he has seen a decrease in the air quality in Pendleton over the past 9-1/2 years. He believes the common use of woodstoves during the period has been "accompanied by air that is almost easier to cut than it is to breathe." This, he says, is not a laughing matter to many people. Dr. Nelson believes that "air quality is a common resource affected by the actions of all of us", unlike cigarette smoking that generally affects mostly the smoker. He cited a study conducted in Missoula, Montana that showed a decrease in the lung function of healthy children as exposure to woodsmoke increased. The lung function improved as air quality improved. Locally, he said people with pre-existing lung conditions find it difficult to breathe during the cold winter months when smoke concentrations are high, but when they follow his suggestion to leave town during smoky periods, they experience a dramatic clearing of pulmonary problems. Dr. Nelson's greatest concern is the long-term health affect that may not be seen until 20-30 years from now because of lag-time in developing symptoms. He suggests that woodsmoke is contributing significantly to increased health care costs.

Mr. Charles W. Jones, La Grande, OR, is in favor of the proposed regulation and would support a nation-wide regulation. He owns a woodstove but is appalled by the woodstove smoke in La Grande, and especially by the increase in the last 6-8 years. Mr. Jones cited how woodstove smoke effects him: he has changed his pattern of walking from work, he now walks to and from work during hours when woodsmoke is less dense; he is not able to open windows in his home during the winter, he smells like smoke after walking outdoors; and the visibilty is obscured. Economically, he gives more consideration to the long-term health affects of his family than to short-term fuel savings. He is in favor of statewide and national regulations controlling woodstove smoke, believing that everyone should share in the solution. He is scared of the long-term health effects (30-40 years) if nothing is done now. As an example, he cited the rapid destruction of the Black Forest (Germany) by air pollution as a problem that wasn't foreseen; but the problem became obvious only after rapid and dramatic symptoms appeared.

Ms. Chloe Larvik, La Grande, OR, approves of the proposed regulation, but feels they are only a small step toward solving the problem. She says the air quality problem in La Grande is very bad, especially in the fall when field burning, slash burning and woodsmoke combine with air inversions. She cited visibility obstruction, breathing difficulties, and respiratory illness amongst children during the winter months as results of the high concentration of woodsmoke in La Grande. She fears for the children if the problem of woodsmoke is not controlled now. Ms. Larvik believes this regulation is a very small step that will take many years to show its effect. But she does feel this regulation will provide some guidance for the social responsibility we must face.

Ms. Priscilla Coe, La Grande, OR, testified in favor of strict woodstove regulations as an individual citizen and as a representative of the Grande Ronde Resource Council. Ms. Coe does not own a car and "gets around town by the use of my lungs." She adds that since it is difficult enough to breathe the air in La Grande during the cold winter months, and contend with the auto exhaust, she doesn't need to breathe the woodsmoke too. She cited the "tragedy of the commons" as a reason to regulate woodstove smoke. In other words, she said, she has learned that the "marketplace doesn't take care of our environment very often." She stated that the woodsmoke causes her clothes to smell after being outside in the winter. Ms. Coe reiterated that she is in favor of more strict regulations and "hopes they'll be as tough as we can get them."

Mr. Ron Larvik, La Grande, OR, testified in favor of regulating woodstoves, but feels the proposed standard is not tough enough or quick enough. regulations. Mr. Larvik says he has heard woodsmoke is a problem mostly in Western Oregon as opposed to Eastern Oregon. He believes the DEQ reports identifying Pendleton and La Grande as having the second and third worst air in the state respectively. He believes the problem in La Grande is due more to woodsmoke than dust. He feels the proposed standard is not tough enough or quick enough because many of the stoves sold now are sold on the basis of being airtight and lasting 25 years. That means, he says, many of the stoves sold now will be smoking away for the next 25 years. He believes to wait four more years before we have clean stoves is too long.

Mr. Robert Teichart, Lewiston, Idaho, is opposed to the proposed regulations, not because of its intent, but because of serious gaps he sees in the regulations. He is a woodstove manufacturer. Mr. Teichert believes that the DEQ claim that these regulations will provide room for economic growth and development is erroneous because the law allows bootlegging of stoves across borders. He states that heavy industry (Potlatch Corporation in Lewiston) burns more wood in its boilers than all of the firewood burned in Lewiston homes. He feels that the law is not totally wrong, but has serious gaps in it. For example, large wood-chip burning industries need to be controlled. He encourages the DEQ to educate people in proper burning techniques. He believes proper operation of a stove is more important than proper design. He also feels that high cost stoves will result from this regulation and that will encourage the use of inefficient and unsafe home-made woodstoves. That, he believes, will result in improper installation and more housefires. He states that the second-stage of the standard is too tight and the DEQ should listen to the industry when setting the standard. The DEQ should also look toward controlling all pollutant sources, not just woodstoves.

Phil Ralston
5/8/84
229-5181

Written Testimony

The Department received 50 letters postmarked on or before May 4, 1984, which was the close of the hearing record. Since then we have received approximately 5 letters, which are also included for your information.

Sixteen of the letters received by the close of the record were from Oregon woodstove manufacturers and retailers; 6 were from out-of-state manufacturers and retailers; and 8 were from other woodstove related businesses: primarily catalyst manufacturers and testing laboratories. An industry association, the national Wood Heating Alliance, and a trade journal, Wood 'n Energy, submitted comments. Also, 16 individuals and 4 community groups submitted testimony.

Most of the woodstove industry's comments criticized the proposed second stage of the standard as being too restrictive. They stated the standard will: reduce or even eliminate stove selection; raise prices; force consumers to buy homemade or out-of-state stoves; drive the woodstove business out of Oregon; chill research on noncatalyst technology; and create a catalytic mandate. Several said no known technology can meet the standard. Wood 'n Energy submitted a survey showing manufacturers' concerns about the catalyst technology.

Several industry representatives recommended the EQC delay adoption of a 1988 standard until monitoring shows reductions are needed beyond the 1986 standard. One manufacturer, Martenson Industries of Canby, says it believes it already has catalyst stoves able to meet the 1988 standard.

Industry representatives also questioned the validity of DEQ's modeling assumptions and criticized basing the standard on Medford's airshed, which is assumed to be the worst case in Oregon. Some commented that DEQ's population projections for Medford are incorrect, meaning less woodsmoke reduction is needed.

Other industry recommendations included:

- Changing the test method to better reflect real-life operating conditions;
- Substituting the less expensive Condar Test Method for Oregon Method 7;
- Allowing some information to remain proprietary;
- Having testing laboratories, rather than DEQ, review design plans and modifications;
- Having testing laboratories, rather than DEQ, certify stoves;
- Allowing manufacturers and/or retailers one year to have stoves recertified if the laboratory loses its accreditation;
- Changing the catalyst warranty from two-year full replacement to five-year pro-rated;
- Eliminating the requirement that stoves be retested every five years.

Concern was also expressed that the rules will prohibit the manufacture and sale of Oregon stoves intended for out-of-state purchase. One manufacturer said the certification fee schedule places a proportionately heavier burden on small manufacturers. Others criticized the Department for not regulating fireplaces and woodfired furnaces.

A Montana testing laboratory (#43) provided suggestions for changes to laboratory procedures. Attorneys representing the Wood Heating Alliance (#10) and Klickitat Enterprises (#11) submitted detailed anaylses of the rules and suggested changes to the rule language.

Condar Company (#49)(a designeer and manufacturer of catalytic combustor units presently used in the cleanest woodstoves tested by the Department, and developer of the Condar Emission System of testing woodstove emissions and efficiency) submitted detailed documentation supporting: 1) The use of the Condar Emission System as an alternative to Method 7; and 2) The use of the Condar for efficiency determinations as equivalent to stack loss and calorimeter room methods. Condar Company suggests the use of its test methods will provide test results at a savings of $4000 per stove, compared to Method 7 costs.

The Condar Company suggests the Department's proposed second-stage standard for catalytic-equipped stoves (3 grms/hour) is "technology forcing" and is too stringent, thus causing serious obstacles to an effective program. The Condar Company offers a 5 grms/hour standard as one that would allow the use of "best practical technology" by manufacturers developing cleaner stoves.

Corning (a manufacturer of catalysts) and one manufacturer recommended the EQC adopt the same standard for both catalyst and noncatalyst stoves.

The Department received letters from the Sierra Club, the League of Women Voters of Oregon, and the League of Women Voters of Central Lane County saying the EQC should adopt the strictest possible standard in 1986. They said there is a danger the second phase would never occur, that we need the greater cleanup now, and that the technology is available.

The Sierra Club, as well as some industry persons, commented that because testing costs are expected to be quite expensive, fewer tests should be required.

The Department received 21 letters from individuals who are concerned about the health effects of woodsmoke and who encourage the Department to regulate woodstoves. Some criticized the Department for not being strict enough or for not regulating existing stoves. Thirty-one individuals criticized the program as being too restrictive and for forcing them to potentially buy homemade or out-of-state stoves.

One local government, the City of Union, asked that it be exempted from the rules.

Attachment 5

(DRAFT RULES)

WOODSTOVE CERTIFICATION
Chapter 340, Division 21, Sections 100-166

WOODSTOVE CERTIFICATION
Chapter 340, Division 21, Sections 100-166

Definitions

340-21-100 Unless otherwise required by context, as used in this Division:

(1) "Accredited" means a woodstove testing laboratory holds a valid certificate of accreditation issued by the Department.

(2) "Audit test" means a test used by the Department to verify a laboratory's certification test results.

(3) "Catalyst-equipped" means a woodstove with a catalytic combustor that is an integral component of the design and manufacture of a woodstove.

(4) "Certify" means the Department has acknowledged in writing that a woodstove meets Department emission standards when tested by an independent laboratory according to Department test procedures.

(5) "Consumer" means any person who buys a woodstove for their direct use in heating their home or place of business.

(6) "Dealer" means any person engaged in selling woodstoves to retailers or other dealers.

[(5)] (7) "Fixed air supply" means an air supply system on a woodstove which has no adjustable or controllable air inlets.

[(6)] (8) "Heat output" means the heat output (Btu/hour) of a woodstove during one test run, measured under test conditions prescribed by OAR 340-21-130.

[(7)] (9) "Informal Departmental conference" means a meeting of a manufacturer, dealer, retailer, or laboratory representative and a representative of the Department to discuss certification or accreditation denial or revocation, or civil penalties. An informal Departmental conference is not part of a judicial process or the formal hearing process as described in Oregon Administrative Rules Chapter 340, Division 11.

(10 "Manufacturer" means any party that constructs a woodstove or parts for woodstoves.

[(8)] (11) "New Woodstove" means any woodstove that has not been sold, bargained, exchanged, given away or has not had its ownership transferred from the person who first acquired the woodstove from the manufacturer's dealer or agency, and has not been so used to have become what is commonly known as "second hand" within the ordinary meaning of that term.

[(9)] (12) "Overall efficiency (%) over the range of heat outputs tested" means the weighted average combustion efficiency (%) multiplied by the weighted average heat transfer efficiency (%) measured under test conditions (range of heat outputs) and calculated according to specific procedures prescribed by OAR 340-21-120(5). This definition is applicable to the Stack Loss Methodology. For the Calorimeter Room Method, the weighted average overall efficiency means the useful heat output released to the room, divided by the total heat potential of the fuel consumed.

(13) "Retailer" means any party engaged in the sale of woodstoves directly to the consumer.

[(10)] (14) "Smoke emission rate (grams/hour) over the range of heat outputs tested" means the weighted average particulate emissions (grams/hour) that are produced by a woodstove under test conditions (range of heat outputs) specified in OAR 340-21-130 and calculated according to procedures specified in OAR 340-21-120(5).

[(11)] (15) "Weighted average" means the weighted average of the test results to the distribution of home heating needs in Oregon. (Refer to OAR 340-211-20(5)).

[(12)] (16) "Woodstove" means a wood fired appliance with a closed fire chamber which maintains an air-to-fuel ratio of less than 30 during the burning of 90 percent or more of the fuel mass consumed in the low firing cycle. The low firing cycle means less than or equal to 25 percent of the maximum burn rate achieved with doors closed or the minimum burn achievable, whichever is greater.

340-21-110(1) On and after July 1, 1986, a person shall not advertise to sell, offer to sell, or sell a new woodstove in the State of Oregon unless:

(a) The woodstove has been tested to determine its emission performance and heating efficiency in accordance with criteria and procedures specified in OAR 340-21-130; and

(b) The woodstove is certified by the Department in accordance with procedures in OAR 340-21-140 as meeting the emission performance standards specified in OAR 340-21-120; and

(c) The woodstove is labelled for emission performance and heating efficiency as specified in OAR 340-21-150.

(2) Oregon manufacturers and dealers of new woodstoves may, in the State of Oregon, manufacture, advertise to sell, offer to sell, or sell a new woodstove that has not been certified by the Department to the following persons or parties only:

(a) In-state manufacturers and dealers, and

(b) Out-of-state manufacturers, dealers, and retailers.

[(2)] (3) No manufacturer or dealer shall alter either the permanent or removable label in any way from the label approved by the Department pursuant to OAR 340-21-156.

[(3)] (4) Violators of any of the above rules may be subject to civil penalties pursuant to OAR Chapter 340, Division 11 and 12 or other remedies prescribed by rule or [order.] statute.

Exemptions

340-21-115 (1) Wood-fired appliances that are not suitable for heating equipment in or used in connection with residences or commercial installations are excluded from 340-21-110. For example, portable camping stoves.

(2) Wood-fired forced air furnaces that primarily heat living space or water through indirect heat transfer using forced air duct work or pressurized water systems are excluded from 340-21-110.

Emission Performance Standards and Certification

340-21-120 (1) New woodstoves with minimum "heat output" of less than 40,000 Btu/hr advertised for sale, offered for sale, or sold in the State of Oregon within the period July 1, 1986 to June 30, 1988, shall not exceed the following weighted average particulate emission standards when tested to procedures in OAR 340-21-130.

(a) 15 grams per hour for a non-catalytic woodstove, or

(b) 6 grams per hour for a catalyst-equipped woodstove.

(2) New woodstoves with minimum "heat output" of less than 40,000 Btu/hr advertised for sale, offered for sale, or sold in the State of Oregon on or after July 1, 1988 shall not exceed the following weighted average particulate emission standard when tested and measured according to test procedures in OAR 340-21-130.

(a) [7] <u>9</u> grams per hour for a non-catalytic woodstove or

(b) [3] <u>4</u> grams per hour for a catalyst-equipped woodstove.

(3) New woodstoves with a minimum "heat output" of greater than 40,000 Btu per hour, advertised for sale, offered for sale, or sold in the State of Oregon after July 1, 1986 shall not exceed an average particulate emission standard equal to the sum of 8.0 grams per hour plus 0.2 grams per hour for each thousand Btu per hour heat output when tested to procedures in OAR 340-21-130.

(4) The Department will certify a woodstove as meeting the applicable woodstove emission standard after July 1, 1984 in accordance with procedures in OAR 340-21-140.

(5) The weighted average particulate emission shall be calculated as follows:

$$\bar{E} = \frac{K_1E_1 + K_2E_2 + K_3E_3 \ldots + K_nE_n}{K_1 + K_2 + K_3 \ldots + K_n}$$

where: $\bar{E}$ is the weighted average particulate emission rate in grams per hour; E_1, E_2, $E_3 \ldots E_n$ are the particulate emission rates in grams per hour from test runs 1 through n in order of increasing heat output; and K_1, K_2, $K_3 \ldots K_n$ are the weighting factors for test runs 1 through n. The weighting factors (K_i) are calculated as follows:

$$K_i = P_{i+1} - P_{i-1}$$

where P_i is the cumulative probability from Table 1 for the heat output measured during each test run, $P_o = 0$, and $P_{n+1} = 1$.

Table 1
(OAR 340-21-120)

CUMULATIVE PROBABILITY FOR A GIVEN HEAT OUTPUT DEMAND BASED ON OREGON CLIMATE (POPULATION WEIGHTED*)

Heat Output (Btu/hr)	Cumulative Probability (P)	Heat Output (Btu/hr)	Cumulative Probability (P)
0	0.02640	24,600	0.97873
600	0.03071	25,200	0.98256
1,200	0.03503	25,800	0.98540
1,800	0.04130	26,400	0.98713
2,400	0.04888	27,000	0.98972
3,000	0.05863	27,600	0.99096
3,600	0.06879	28,200	0.99237
4,200	0.08122	28,800	0.99316
4,800	0.09837	29,400	0.99408
5,400	0.11586	30,000	0.99472
6,000	0.13522	30,600	0.99506
6,600	0.15803	31,200	0.99526
7,200	0.18394	31,800	0.99563
7,800	0.21615	32,400	0.99589
8,400	0.24867	33,000	0.99679
9,000	0.28798	33,600	0.99711
9,600	0.32621	34,200	0.99745
10,200	0.37040	34,800	0.99774
10,800	0.41575	35,400	0.99787
11,400	0.46226	36,000	0.99817
12,000	0.50831	36,600	0.99837
12,600	0.55778	37,200	0.99851
13,200	0.60326	37,800	0.99858
13,800	0.64770	38,400	0.99882
14,400	0.68572	39,000	0.99899
15,000	0.72483	39,600	0.99915
15,600	0.75743	40,200	0.99933
16,200	0.78883	40,800	0.99945
16,800	0.81816	41,400	0.99958
17,400	0.84386	42,000	0.99968
18,000	0.86822	42,600	0.99974
18,600	0.88951	43,200	0.99986
19,200	0.90667	43,800	0.99992
19,800	0.92228	44,400	0.99995
20,400	0.93620	45,000	0.99996
21,000	0.94720	45,600	0.99999
21,600	0.95545	46,200	1.00000
22,200	0.96158	46,800	1.00000
22,800	0.96699	47,400	1.00000
23,400	0.97151	48,000	1.00000
24,000	0.97515	> 48,000	1.00000

* Based on ambient temperature data during October through April, 1967-73 with population weighting from eight Oregon locations (Portland, Medford, Pendleton, Astoria, Burns, North Bend, Redmond, and Salem).

Testing Criteria and Procedures

340-21-130 (1) To be considered eligible for certification, a woodstove must be tested in strict conformance with criteria and procedures contained in the document Standard Method for Measuring the Emissions and Efficiencies of Residential Woodstoves dated [March 8;, 198~~3~~4], May 21, 1984, and incorporated herein by reference and on file at the Department.

(2) All testing for certification purposes shall be conducted by a stove testing laboratory accredited by the Department in accordance with procedures specified in OAR 340-21-160.

(3) The Department may permit minor changes in the testing criteria and procedures which the Department believes does not affect its accuracy with respect to compliance with the emission standard providing such changes are approved in writing by the Department prior to the actual conducting of such tests.

General Certification Procedures

340-21-140 (1) Any woodstove manufacturer, or dealer, wishing to obtain certification of a woodstove shall file an application with the Department.

(2) An application for certification must include:

(a) An appliance description which includes the woodstove model name and design number, a copy of the appliance's operating manual and a photograph of the stove.

(b) Design plans of the woodstove, identified by design number, which include overall dimensions of the appliance and all dimensions and specifications of components critical to emission control and heating efficiency performance. These components shall include combustion chamber configurations, all air inlet controls, heat exchanger design and make and model numbers of applicable purchased parts.

(c) All test data and support documentation showing that the woodstove has been tested in accordance with OAR 340-21-130 and that it meets the emission performance standard specified in OAR 340-21-120.

(d) A non-refundable certification fee, payable to the Department at the time the application is submitted to the Department, is required for each stove model seeking certification. The fee is:

- (a) \$1600.00 for a manufacturer's first model seeking certification, and
- (b) \$ 800.00 for each additional model submitted by the manufacturer.

(3) The Department will promptly review an application for certification and:

(a) Notify the applicant in writing within 30 days of receipt of the application, of any deficiencies in the application that cause the application to be incomplete.

(b) Notify the applicant within 60 days of receipt of a completed application whether certification is granted or denied pursuant to Sections 4 and 7 below.

(4) When all the preceeding requirements have been met, the Department will issue <u>or deny</u> a certification document to the manufacturer or dealer for the specified woodstove.

(5) If the Department grants certification, the certification status shall be effective for no longer than 5 years unless extended or terminated by rule or order.

(6) An application for a new document of certification shall be made by submitting a completed application including retests and fees at least 60 days prior to expiration of certification. The Department may waive the retest and fees if the applicant demonstrates the previous evidence used to certify the woodstove has not changed and remains reliable and applicable.

(7) If the Department denies certification of a woodstove, the Department will notify the manufacturer or dealer in writing of the opportunity for a hearing pursuant to OAR Chapter 340, Division 11.

Changes in Woodstove Design

340-21-145 Certification of woodstoves shall be valid for only the specific model, design, plans and specifications which were originally submitted, tested and approved for certification. Any modification to the model, design, plans or specifications shall cause the certification to be ineffective and any so modified woodstoves to be uncertified, unless prior to making such modification the certification holder submits the proposed modification to the Department for approval, and the Department approves it. The Department may approve the proposed modification if the holder demonstrates and the Department finds that the proposed modification would not affect emission performance or heating efficiency.

Labelling Requirements

340-21-150 Woodstoves which must be labelled pursuant to OAR 340-21-110 and shall have affixed to them:

(1) A permanent label, that has been previously approved by the Department in writing as to form, content and location, that shows the test emissions and heating efficiency for the range of heat outputs tested.

(2) A point-of-sale removable label that verifies certification and shows how the appliance's emission test results compare with the Oregon emission performance standard; and shows the heating efficiency and heat output range of the appliance. The label shall be affixed to the appliance at the point of sale near the front and top of the stove and remain affixed until sold and delivered to the consumer.

340-21-151 All woodstoves certified by the Department from July 1, 1984 on, shall be labelled with a permanent and a removable label.

Permanent Label

340-21-152 (1) The permanent label, or "Certified Test Performance" label, shall contain the following information:

(a) Testing laboratory

(b) Date tested

(c) Test procedure used

(d) Manufacturer of appliance

(e) Model

(f) Design number

(g) The statement: "Performance may vary from test values depending on actual home operating conditions."

(h) A graph showing:

(A) Smoke emission rates, in grams/hour, over the range of heat outputs tested.

(B) Overall efficiency over the range of heat outputs tested.

(2) The axis of the graph shall be identified as follows:

(a) Vertical axis, left side: "Smoke - grams/hour", with a scale of 0 to a maximum of 20, bottom to top.

(b) Vertical axis, right side: "Efficiency - %", with a scale of a minimum of 50 to a maximum of 90, bottom to top.

(c) Horizontal axis, bottom: "Heat Output - Btu/hour", with a scale from 0 to a maximum of 5,000 Btu/hour higher than the highest tested heat output.

(3) Curves describing emissions and efficiency at various heat outputs shall be printed on the graph, and will be developed by the Department as follows:

(a) The emissions curve will be developed by the Department by fitting the emission test data to the quadratic equation:

$$y = a_0 + a_1x + a_2x^2$$

where

y = particulate emissions (grams/hour)

x = heat output (Btu/hour)

a_0, a_1, a_2 = regression coefficients

(b) The overall efficiency curve shall be developed by the Department by fitting the efficiency test data to the quadratic equation:

$$y = a_0 + a_1x + a_2x^2$$

where

y = overall efficiency (%)

x = heat output (Btu/hour)

a_0, a_1, a_2 = regression coefficients

<u>(4) If the two test option (refer to Oregon DEQ Standard Method For Measuring The Emissions and Efficiencies of Woodstoves, Section 5.8.8, May 21, 1984) is used to test for emissions and overall efficiency, then:</u>

(a) The emissions and efficiency performance of the appliance will each be described by a line between the two test data points.

(b) The maximum heat output will be identified as a single point.

(c) The statement: "Not tested over entire heat output range of appliance" will be placed on the permanent label.

[(4)] (5) For woodstoves with a fixed air supply which have only two data points for emissions and two data points for overall efficiency the Department will:

(a) Develop the emission performance description by averaging the two emission data points and describe the performance on the graph with a single point representing the average.

(b) Develop the overall efficiency performance description by averaging the two efficiency data points and describe the performance on the graph with a single point representing the average.

[(5)] (6) The curves, lines or single points will be developed and fit on the graph by the Department and transmitted to the appliance manufacturer for printing on the label. Changes from the above criteria may be made by the Department as necessary to insure readability. Approval of the label design, layout, and location on the woodstove will be made by the Department and shall be obtained pursuant to OAR 340-21-156.

[(6)] (7) The label shall be permanently secured or fixed to the appliance so that it is visibly located on the appliance and legible, and meets the following criteria:

(a) A permanent label shall be a label that cannot be removed from the appliance without damage to the label. The label shall remain legible for the maximum expected useful life of the appliance in normal operation.

(b) A label shall be readily visible after installation. Approval of the location of the label on a woodstove will be made by the Department and shall be obtained pursuant to OAR 340-21-156. The label may be located on:

(A) Any visible exterior surface except the bottom of the appliance, or on

(B) Any interior surface of the appliance, within stove compartments, or under overlapping covers or doors, or at another interior location, if the label can be seen after installation and will remain legible for the life of the stove.

(c) A legible label shall be quickly and easily read.

(d) It shall be acceptable to combine the permanent label with another label, such as a safety label, if the design and integrity of the permanent label is not compromised, and if the combination label meets the approval of the Department.

[(7)] (8) Physical and Material Specifications

(a) The minimum dimensions of the label shall be at least 3-1/2" long by 2" wide.

(b) The graph on the label shall be at least 3" long by 1-1/2" wide; and any enlargement of the graph shall maintain a proportion represented by the length to width ratio of 2:1.

(c) The label must be made of a material that will satisfy the permanency rule (340-21-152(6)(a)). For instance, it may be made of aluminum, brass, galvanized steel, or another metal, and of a thickness that will ensure permanence of the label.

(d) The information on the label shall be applied to the label in a way that will satisfy the permanency and legibility rules (340-21-152(6)(a) and (c)). For instance, the information may be etched, silk-screened, or die-stamped onto the label.

(e) The label shall be secured to the appliance in a way that it will satisfy the permanency and visibility rules (340-21-152(6)(a) and (b)). For instance, the label may be riveted, screwed, or bolted onto the appliance.

Removable Label

340-21-154 (1) The point of sale removable label, or "Emissions and

Efficiency Performance" label, shall contain the following information:

(a) "Smoke (Ave.) ______ grams/hour", weighted average of tested values.

(b) "Efficiency (Ave.) ______%", weighted average of tested values.

(c) Summary of the applicable emissions standard.

(d) Heat output range, tested values.

(e) Manufacturer of appliance.

(f) Model of appliance.

(g) Design number of model.

(h) A statement verifying certification.

(i) The statement "Performance may vary from test values depending on actual home operating conditions."

<u>(j) If the two test option is used to test for emissions and efficiency, the statement "Not Tested Over Entire Heat Output Range of Appliance" will be placed on the removable ~~lable~~ Label.</u>

(2) The label shall be visibly located on the appliance when the appliance is available for inspection by consumers.

(3) This label may not be combined with any other label or with other information.

(4) The label shall be attached to the appliance in such a way that it can be easily removed by the consumer upon purchase. For instance, the label may be attached by adhesive, wire, or string.

Label Approval

340-21-156 (1) Permanent label

(a) The Department will provide guidance on the design of labels by supplying information that shall be placed on the label at the time certification is granted.

(b) The manufacturer or dealer shall submit to the Department:

(A) The name, phone number and address of the label manufacturer.

(B) A proof copy of the label, printed on a representative sample of the label stock, shall be submitted to the Department, if practical; if not, a sample of the label stock shall be submitted for review with a proof copy of the label. The copy shall be as representative of the intended final printed label as practical. The copy shall be actual size; and shall show the proposed label design; layout; artwork; print size, style and color; and shall show all the information required on the label, including curves or points.

(C) A drawing, diagram, or photograph that identifies the location of the permanent label on the woodstove.

(D) Information that describes or shows how the permanent label will be affixed to the woodstove. For instance, it may be a description of an adhesive type, adhesive manufacturer, and performance characteristics; or rivet type, rivet manufacturer, and performance characteristics.

(c) Within 14 days of receipt of all information required in (b), the Department will approve or deny use of the proposed label.

(2) Removable label

(a) The Department will provide the manufacturer or dealer, at the time of certification with:

(A) A copy of the standardized printed removable label, with all printing specifications, and

(B) The specific information that shall be printed in the spaces on the label by the manufacturer.

(b) The manufacturer or dealer shall submit to the Department for review:

(A) A proof copy of the proposed label with the required information printed on the labels.

(B) The method of attaching the removable label to the woodstove.

(C) The name, telephone number, and address of the label printer.

(c) Within 14 days of receipt of all the information required in (b), the Department will approve or deny use of the proposed label.

(3) The manufacturer shall submit to the Department three final printed permanent, and three final printed removable labels within 1 month of receiving the labels from the printer.

Laboratory Accreditation Requirements

340-21-160 A laboratory submitting test data pursuant to requirements in this rule shall have a valid certificate of accreditation issued by the Department. A laboratory may initiate application for an accreditation certificate by submitting written documentation to the Department that accreditation criteria contained in OAR 340-21-161 are met. In addition, the laboratory must demonstrate stove testing proficiency pursuant to OAR 340-21-162, in order to qualify for accreditation.

340-21-161 (1) All laboratories shall meet the following criteria and standards at the time of application and shall continue to meet these criteria as a condition of maintaining accreditation:

(a) The laboratory shall be an independent third-party testing organization with no organizational, managerial, or financial affiliation with any manufacturer, supplier or vendor of any woodstove covered under its testing programs. For example:

(A) The laboratory shall not be owned by any manufacturer or vendor, or own any manufacturer or vendor of woodstoves.

(B) The management of the laboratory shall not control or be controlled by any manufacturer or vendor.

(C) The laboratory shall not be engaged in the promotion or design of the woodstove being evaluated or tested.

(D) The laboratory shall have sufficient diversity of clients or activity so that the loss or award of a specific contract regarding testing would not be a determinative factor in the financial well being of the laboratory.

(E) The employment security status of the personnel of the laboratory shall be free of influence or control of any one or more manufacturers or vendors of woodstoves tested.

(b) The laboratory shall be operated in accordance with generally accepted professional and ethical business practices. For example:

(A) The laboratory shall accurately report values that reflect measured data.

(B) The laboratory shall limit certification program test work to that for which it can perform competently.

(C) The laboratory shall immediately respond and attempt to resolve every complaint contesting test results.

(c) The laboratory shall be staffed by personnel competent to perform the test procedures for which accreditation is sought, for example:

(A) The laboratory shall assure the competency of its staff through the observation or examination or both of each relevant staff member in the performance of tests, examinations, and inspections that each member is assigned to perform. The observations must be conducted at intervals not exceeding one year by one or more individuals judged qualified by the person who has technical responsibility for the operation.

(B) The laboratory shall make available the description of its training program for assuring that new or untrained staff will be able to perform tests and inspections properly and uniformly to the requisite degree of precision and accuracy.

(C) The laboratory shall maintain records, including dates of the observation or examination of performance of all personnel.

(d) The laboratory shall be equipped with the necessary instrumentation and equipment to test all appliances in accordance with the Department's test procedures.

(e) The laboratory must have in place and maintain a viable record keeping system. This means that records must be easily accessible, in some logical order and contain complete information on the subject. Records covering the following items are required and will be physically reviewed during the on-site assessment either in total or by selected sampling:

(A) Measuring equipment : [-] each instrument name and description, name of manufacturer, model, style and serial number. Specifications on range or level of precision, date and documentation of calibration, record of maintenance and frequency of calibration.

(B) Data systems : [-] samples of raw and reduced data sheets, test report format, method (manual or automated) of data recording, analysis and reporting.

(C) Staff training dates and results.

(D) Staff competency review dates and results.

(E) Equipment calibration (or verification) records shall include the following: equipment name or description; model, style, serial number; manufacturer; notation of all equipment variables requiring calibration or verification; the range of calibration/verification; the resolution of the instrument and allowable error tolerances; calibration/verification date and schedule; date and result of last calibration; identity of the laboratory individual or external service responsible for calibration; source of reference standard and traceability.

(F) Test data and reports, including emissions and efficiency calculations fully documented and all other items required by the specific test method.

(G) Sample tracking and logging records shall trace the movement of each stove through the laboratory from its receipt through all the tests performed to the final test report. Dates, condition of sample, and laboratory personnel involved should be included.

(f) The laboratory shall maintain a quality control system to help assure the accuracy and technical integrity of its work consisting of the following:

(A) The laboratory's quality control system must include a quality control manual containing written procedures and information in response to the applicable requirements of the test procedures. The procedures and information may be explicitly contained in the manual or may be referenced so that their location in the laboratory is clearly identified. The written procedures and information must be adequate to guide a testing technician and inspector in conducting the tests and inspections in accordance with the test methods and procedures required for the stove testing for which accreditation is sought.

(B) The laboratory shall have a current copy of its quality control manual or laboratory operations control manual available in the laboratory for use by laboratory personnel and shall make the manual available to the Department for review and audit.

(C) The quality control manual shall consist of general guidelines for the quality control of the laboratory's method of operation. Specific information shall be is provided for portions of individual test methods whenever specifics are needed to comply with the criteria or otherwise support the laboratory's operations.

(g) The laboratory shall maintain an emissions and efficiency computer program that produces reasonably the same results to the Department's, using a standard data set provided by the Department.

(h) Neither the laboratory owners or business affiliates shall discriminate in management or business practices against any person or business because of race, creed, color, religion, sex, age, or national origin. In addition, neither the laboratory or its owners or operators shall be certified by any association or are members of any association that discriminates by business or management practices against any person or business because of race, creed, color, religion, sex, age, or national origin.

Application for Laboratory Accreditation

340-21-162 (1) A laboratory applying for accreditation shall state in writing and demonstrate by providing documentation, that they comply with the criteria and standards in OAR 340-21-161 at the time of application, and how they will continue to meet the criteria and standards on an on-going basis.

(2) The laboratory shall notify the Department in writing within 30 calendar days should it become unable to conform to any of the criteria and standards in OAR 340-21-161.

(3) The laboratory shall demonstrate to the Department that the laboratory's emission and efficiency computer program produces reasonably the same results to the Department's, using a standard data set provided by the Department.

(4) Deficiency in the application will be identified by the Department in

writing, and must be resolved by the laboratory before further processing occurs.

(5) The application will not be considered complete for further processing until the laboratory certifies in writing that the deficiencies have been revolved. The application will be considered withdrawn if the applicant fails to certify resolution within 90 days of postmark of notification by the Department.

(6) When the application is approvable, the Department will inform the laboratory in writing and schedule an on-site laboratory inspection.

On-Site Laboratory Inspection and Stove Testing Proficiency Demonstration

340-21-163 (1) An on-site inspection will be conducted by a Department representative after all laboratory information required by OAR 340-21-161, has been provided by the laboratory, reviewed and approved by the Department. The on-site visit will be conducted when a laboratory initially applies for accreditation and when the laboratory re applies for a new certificate of accreditation . [renewal.]

(2) During the on-site inspection, the Department representative will:

(a) Observe the Stove Testing Proficiency Demonstration specified in OAR 340-21-162(3).

(b) Meet with management and supervisory personnel responsible for the testing activities for which the laboratory is seeking accreditation.

(c) Review representative samples of laboratory records. To facilitate examination of personnel competency records, the laboratory should prepare a list of names of staff members who perform the tests.

(d) Observe test demonstrations and talk with laboratory personnel to assure their understanding of the test procedures. Refer to OAR 340-21-130 and 340-21-162(3).

(e) Physically examine selected equipment and apparatus.

(f) At the conclusion of the on-site visit, the Department will discuss observations with responsible members of the laboratory management pointing out any deficiencies uncovered.

(3) In order to be accredited and as a part of each on-site laboratory inspection, each laboratory must demonstrate to the Department's representative its ability to successfully and proficiently conduct and report a woodstove emission and efficiency test. Each laboratory will be:

(a) Required to test one woodstove provided by the Department. Costs for all stove shipping, catalytic combustors, or other necessary parts will be paid by the laboratory.

(b) Required to test the stove in accordance with testing criteria and procedures specified in OAR 340-21-130.

(c) Conduct the actual emission and efficiency testing in the presence of a Department observer.

(d) Submit all test data observations and test results to the Department for technical evaluations.

Accreditation Application Deficiency, Notification and Resolution

340-21-164 (1) Any deficiencies noted during the on-site inspection and/or in the test data and test results submitted from the stove testing proficiency demonstration will be specifically identified in writing and mailed to the laboratory within 30 days of the on-site visit.

(2) The laboratory must respond in writing within 30 days of the date of postmark of the notification by the Department and provide documentation that the specified deficiencies have been corrected. All deficiencies must be corrected prior to accreditation being granted.

(3) Deficiencies noted for corrective action will be subject to thorough review and verification during subsequent on-site visits and technical evaluations.

(4) Any deficiencies in the test data and/or results may result in subsequent proficiency tests being required at the laboratory with a Department representative present.

Final Department Administrative Review and Certificate of Accreditation

340-21-165 (1) When all application material has been received, including the on-site inspection and the stove testing proficiency evaluation, and there has been time for all deficiencies to be resolved, the Department will grant or deny accreditation.

(2) Accreditation can be denied for failure to comply with or fulfill any of the criteria in OAR 340-21-161, -162, and -163.

(3) When accreditation is approved, a certificate of accreditation will be issued to the laboratory. Accreditation will be granted for a period of three years (36 months) subject to rule change or revocation for cause, pursuant to OAR 340, Division 11.

(4) A certificate of accreditation is not renewable. A holder may obtain a new certificate of accreditation by completing the application procedure in OAR Chapter 340-21-162, and demonstrates compliance with OAR [Chapter] 340-21-161 and -163.

(5) The Department may select and audit test one stove tested by the laboratory during its accredited status to verify certification test

results. Any discrepancies noted will be communicated to the laboratory by certified or registered mail. The laboratory must respond in writing within 30 days of postmark of notification and provide documentation or certification by an authorized member of the laboratory management that the specified discrepancies have been corrected or the laboratory may be subject to civil penalties or revocation of accreditation.

(6) A laboratory may voluntarily terminate its accreditation by written request at any time. The certificate of accreditation must be returned with the request.

Civil Penalties, Revocation, and Appeals

340-21-166 (1) Violation of any of these rules shall constitute cause to revoke the manufacturer or dealer's woodstove certification or laboratory's certificate of laboratory accreditation, and also may be subject to civil penalties and other remedies pursuant to rule or statute.

(2) Certification of a woodstove may be revoked if the woodstove was tested at a laboratory that was found to be in violation of accreditation criteria and rules at the time the woodstove was tested for certification.

(3) When certification or accreditation has been revoked, the holder shall return the certification or accreditation document to the Department and cease to use mention of Department certification or accreditation of the

stove model or laboratory on any of its test reports, correspondence or advertising.

(4) Stove certification and lab accreditation revocation would be handled as contested cases pursuant to OAR Chapter 340, Division 11.

APPENDIX 1

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

STANDARD METHOD FOR MEASURING THE EMISSIONS AND EFFICIENCIES OF WOODSTOVES

REVISED DRAFT

May 21, 1984

TABLE OF CONTENTS

SECTION 1: SCOPE AND PURPOSE

1.1 SCOPE

1.1.1 This document prescribes a standard method of testing woodstoves to obtain particulate emission factors based on useful heat output for appliances that produce less than 1.5 x 10^5 Btu/hr.

1.1.2 A woodstove is defined as an appliance having an air/fuel ratio by weight less than 30 during the burning of 90 percent or more of the fuel mass consumed in the low-firing cycle. The low firing cycle means less than or equal to 25 percent of the maximum burn rate achieved with doors closed or the minimum burn achievable.

1.2 PURPOSE

1.2.1 The purpose of this document is to:

a. Establish a uniform procedure for appliance operation to be used in conjunction with a standardized test method for obtaining woodstove emission and efficiency performance data.

b. Specify the types of test equipment and establish standard performance requirements for the equipment used for performing such tests.

c. Specify data required and calculations to be used.

1.3 METHOD FOR USING THIS STANDARD

1.3.1 Determine from Section 1.1.1 and 1.1.2 whether this standard is applicable for the appliance to be tested.

1.3.2 Verify that the test facility and equipment is in accordance with Sections 2 and 3.

1.3.3 Test and calculate results in accordance with Sections 5, 6, and 7.

SECTION 2: TEST FACILITY AND APPLIANCE INSTALLATION

2.1 DESCRIPTION OF TEST FACILITY

2.1.1 The testing will be conducted in an area with a height for atmospheric discharge of flue effluent at 15 ± 1 foot (4.6 ± 0.3m) above the top surface of the scale.

2.1.2 The flue exit shall freely communicate with the laboratory, that is, the area shall have essentially the same pressure such that no artificial draft is imposed on the appliance.

2.1.3 The test chamber room temperature shall be maintained between 65° F and 90° F (18° C and 32° C) during the course of any test.

2.1.4 Air velocities within 2 feet (0.6m) of the test appliance and exhaust system shall be less than 50 feet/minute (0.25 m/s) without a fire in the unit.

2.1.5 All calorimeter rooms must meet the specific criteria in the June, 1982 Standard for Testing the Heating Performance of Wood-Fired Closed Combustion Chamber Heating Appliances for accuracy verification and calibration procedures before conducting appliance performance testing.

2.2 APPLIANCE INSTALLATION FOR FREE STANDING STOVES

2.2.1 Unless specified differently by the manufacturers, the flue pipe shall be made of No. 24 gauge black steel and shall have an insulated metal solid pack type chimney above the particulate and combustion gas sample probe port locations with a minimum 1 inch (2.5 cm) solid pack material.

2.2.2 The flue shall extend to 15 ± 1 feet (4.6 ± 0.3m) above the platform scale on which the appliance is located. All flue pipe cracks or joints shall be sealed.

2.2.3 The appliance and parts shall be assembled and installed in conformance with the manufacturer's published installation instructions.

2.3 APPLIANCE INSTALLATION FOR FIREPLACE INSERTS

2.3.1 Fireplace inserts shall be installed on the platform scale with R 12 insulation applied to all surfaces not normally exposed to the room to be heated. The appliance parts and exhaust system shall be assembled and installed in conformance with the manufacturer's published installation instructions.

2.3.2 The flue pipe shall consist of an insulated metal solid pack type chimney positively connected from the appliance flue outlet, extending to the particulate and combustion gas sample probe port locations with a minimum 1 inch (2.5 cm) solid pack material.

SECTION 3: TEST EQUIPMENT AND INSTRUMENTATION

3.1 TEST EQUIPMENT SET-UP

3.1.1 The equipment to be used for emissions and efficiency testing is illustrated in Figure 3.1 and described below.

3.2 TEST FUEL WEIGHT

3.2.1 The balance used to weigh the fuel shall be accurate to ± 0.1 pound (0.05 kg).

3.2.2 The appliance to be tested shall be centrally placed on a platform scale. The scale shall have a monitor or other feature such that the weight change of the fuel loads may be continuously displayed. The scale shall be capable of reading weights to 0.1 pound (0.05 kg) and shall have a tare feature.

3.3 FLUE GAS TEMPERATURES

3.3.1 Flue gas temperatures shall be determined with a thermocouple or other temperature sensing device at a height of 8 to 9 feet (2.4 - 2.7 m) from the top surface of the scale. The temperature sensing device shall be located in the center of the flue gas stream.

3.3.2 The temperature sensor and associated display and recording equipment shall have a resolution of $1^{o}F$ ($0.5^{o}C$).

3.4 STOVE SURFACE TEMPERATURES

3.4.1 Stove surface temperatures shall be determined with a shielded temperature sensing device placed at 5 locations on the appliance's exterior surfaces. Temperature locations shall be centrally positioned on the top, two sidewall, bottom and back combustion chamber surfaces (not on heat shields) if these surfaces are exposed while testing. Surface temperature locations for unusual design shapes (spherical, etc.) shall be positioned to conform to the intent of the locations described.

3.4.2 The temperature sensing device and associated display shall have a resolution of 1°F (0.5°C).

3.5 STOVE COMBUSTION TEMPERATURES

3.5.1 Radiation shielded thermocouple(s) or other equivalent temperature sensing device(s) shall be located in the primary and secondary (if applicable) combustion chambers to measure gas temperatures at a location where direct flame impingement on the sensing device does not normally occur. If a catalytic combustor is part of the stove's combustion features, an additional thermocouple must be located in the permanent temperature monitoring part required in Section 8.4.1.

3.5.2 The temperature sensing devices and associated display shall have a resolution of 1°F (0.5°C).

3.6 FLUE GAS COMPOSITION

3.6.1 Dry flue gas composition shall be measured with continuous combustion gas analyzers to include percent by volume (dry basis) carbon monoxide, carbon dioxide, and oxygen. Samples shall be extracted at the same height as flue gas temperature measurements and withdrawn through a probe and tubing made of inert materials. The probe shall be bent into the flow of the flue gases.

3.6.2 A gas stream sample conditioner using a glass fiber filter is required in line before the analyzer. The sample conditioner shall include two impingers encased in an ice bath, one water trap and a silica gel trap in sequence.

3.6.3 Minimum performance specifications for accuracy and precision for the combustion gas analyzers and recorders include:

Drift ≤ ± 1% of full scale per 8 hours
Repeatability ± 1% of full scale
Resolution: 0.1% for CO_2 and O_2; 0.01% for CO by volume
Accuracy: ± 1% of scale

3.7 TRACER GAS DETECTOR

3.7.1 Minimum performance specifications for accuracy and precision for the tracer gas analyzer include:

Drift ≤ ±5% of full scale per 8 hours
Repeatability ± 2 percent of full scale
Accuracy ± 3% of scale

3.8 FLUE MOISTURE CONTENT DETERMINATION

3.8.1 A wet bulb-dry bulb technique shall be used to determine the water vapor present in the flue gases for on-line sampling purposes to maintain proportional sampling and appropriate weighting of enthalpy losses during burn cycle. A wet bulb temperature sensor shall be placed at the same location as the flue gas dry bulb temperature sensor. The wet bulb sensor shall consist of a thermocouple or other temperature sensing device with a cloth sock placed at the sensor end and saturated with water. The wet bulb sensor shall be placed in the center of the flue gas stream until the temperature reaches a steady state. The wet bulb temperature must be taken while the sock is saturated with water. The appropriate water vapor content is determined using psychometric charts (See Oregon Source Sampling Method 4, Appendix 1).

3.9 DRAFT

3.9.1 The draft or static pressure (in inches of water) shall be measured in the flue at a location no greater than 1 foot (30.5 cm) above the flue connector at the stove outlet.

3.10 RELATIVE HUMIDITY

3.10.1 The test facilities ambient relative humidity shall be measured and recorded prior to and at the completion of each test cycle.

3.11 DATA RECORDING INTERVALS

3.11.1 Data recording shall commence upon charging of the test fuel load and all measurements shall be recorded either manually or automatically at least at every 5 minute interval for the entire test period. In addition, appliance surface and combustion chamber temperatures are also required at every five minute interval one hour prior to the test cycle.

3.12 INSTRUMENT CALIBRATION

3.12.1 Notwithstanding any standard calibration procedures designed to assure and maintain the accuracy of standard source testing equipment, the following calibration and testing methods must be utilized on the auxiliary equipment when testing woodstoves for air emissions.

3.12.2 Continuous gas analyzer(s) calibration

Upon receipt of equipment or any time the single point audit described below fails, a multipoint calibration of the analyzer must be completed before the instrument is put into service.

a) Set up the instrument and allow it to operate for a sufficient time to stabilize as recommended by the manufacturer's published operating procedure.

b) Introduce zero gas into the instrument at the normal sample flow being careful not to pressurize the sample stream. Normally, this will be accomplished by allowing the zero gas to flow into a three port vessel at a rate of at least twice the instrument sample rate and withdrawing sample from another port on the vessel while the third port is allowed to vent to the atmosphere.

c) Introduce consecutively in the same manner as b) three certified calibration gases in artificial air noting the instrument response of each. The gases should represent approximately 20%, 50% and 80% of the instruments' full scale concentration.

d) Construct a calibration curve using the data collected in b) and c).

3.12.3 Continuous gas analyzer(s) audit

Before and after each test [and at intervals not to exceed 2 hours during the test], conduct a single point audit of the instrument as described below. <u>It is highly recommended that a single point audit of the instrument be conducted at intervals not to exceed 2 hours during the test periods.</u>

a) Disconnect the instrument sample line from the sample source at a point upstream of all sample conditioning equipment (dryers, scrubbers, etc.).

b) Being certain to avoid pressurizing the system, introduce a certified reference gas into the analyzer through all sample conditioning equipment. The sample gas should be in the range of 20% to 80% of full scale of the instrument.

c) If the instrument response to the audit gas differs by more than 5% from the calibration curve, disregard all data collected with the instrument since the last successful audit and perform a multipoint calibration.

d) Before and after each test, leak check the system by plugging the inlet and watching the sample flow rotometer.

3.12.4 Platform scale auditing

a) Upon installation of the scale, a multipoint calibration must be performed using NBS traceable weights. This function will normally be performed by the scale manufacturer. As soon as practicable after the calibration, one or more weights may be weighed for use as a calibration traceable standard weight for audit purposes. The weight should be constructed from a weight stable (non-oxidizable and non-hydroscopic) material and maintained in such a way that its weight integrity is assured.

b) Before and after each series of tests, the scale must be audited by first zeroing and then weighing at least one calibration traceable weight that corresponds to 20% to 80% of the expected charge load of the stove to be tested. If the scale does not reproduce the value of traceable weight within ± 0.4 lbs, the scale shall be recalibrated before use and void previous results.

3.12.5 Tracer gas flow measurement

a) All rotometers used in conjunction with tracer gas injection flow measurement techniques must be calibrated with the intended gas using either a calibrated volume measurement device such as a dry or wet gas meter or an accurate volume (displacement).

b) The tracer gas detector must be calibrated at the begining and end of each set of tests by introduction of a certified reference gas. The gas must be introduced through all normal gas conditioning devices and in such a way as to prevent system pressurization.

SECTION 4: TEST FUEL REQUIREMENTS

4.1 FUEL PROPERTIES

4.1.1 The test fuel shall be untreated, air dried Douglas fir lumber. Kiln dried lumber is not allowed. To insure positive identification of Douglas fir, species type is stamped D.F. on the lumber by the certified lumber grader at the mills. The oven-dried density range shall be 28.7-37.4 pounds per cubic foot (.46-0.60 gm/cm^3). The density shall be determined and reported for certification purposes.

4.1.2 The test fuel shall have a moisture content range between 16% and 20% on the wet basis (19-25% dry basis). Moisture content shall be determined by measurements made with a calibrated electrical resistance type moisture meter or other equivalent performance type meter. Note: To convert moisture meter readings from the dry basis to the wet basis: (100)(% dry reading) - (100 + % dry reading).

4.1.3 Minimum performance specifications for accuracy of the moisture meter shall be ± 3% of reading.

4.1.4 Moisture content determination per load shall be an average of a minimum of three readings for each fuel piece measured parallel to the grain of the wood on three sides (end readings excluded). If an electrical resistance type meter is used, electrode penetration shall be to a one inch depth using insulated pins. Moisture content measurements shall be made within a four hour period prior to testing, and the test fuel shall be at room temperature.

4.1.5 No wetting of previously dried wood is allowed. It is recommended that the test fuel be stored in a temperature and humidity controlled room.

4.1.6 The test fuel shall be essentially free of knots, and free of any rotted or molded areas or other defects such as pitch seams.

4.1.7 The higher heat value of the fuel shall be determined by bomb calorimetry using ASTM Method D 3286-77 or D 2015-77. A composite sample from each piece of the test charge shall be analyzed and reported for each test fuel load.

4.2 TEST FUEL PIECES

4.2.1 The dimension of each piece of fuel (flanged lumber) shall conform to the nominal measurements of 2x4 and 4x4 lumber (1-1/2 x 3-1/2 and 3-1/2 x 3-1/2 in).

4.2.2 The flanged lumber dimensions will vary according to the appliance's firebox volume as indicated below:

Usable firebox volume (ft^3)	Flanged lumber piece size (nominal inches)
≤ 1.5	2x4
1.5 ≤ 3	2x4 approximately 1/2 weight of test fuel load 4x4 approximately 1/2 weight of test fuel load
>3	4 x 4

4.2.3 Each flanged piece shall be constructed in a configuration to conform to the following requirement for spacer dimensions and spacing intervals: Spacers will be constructed from air dried Douglas fir lumber (meeting the fuel specifications in Section 4.1) 5 inches in length, 1-1/2 inches in width, and 3/4 inches in height (12.7 x 3.8 x 1.9 cm). The spacers are to be attached by uncoated ungalvanized nails or staples to the lumber flush with the ends of each piece such that a 3/4 inch (1.9 cm) extension of the spacer occurs at the width of each end of the log as illustrated in Figure 4.2-A.

4.2.4 An optional acceptable flanged fuel configuration has identical spacing intervals as indicated in 4.2.3, but with a greater spacer dimension in height as depicted in Figure 4.2-A. The optional spacer configuration must conform to the conditions specified in 4.2.3 and meet the 5 inches in length, 1-1/2 inches in width and 1-1/2 inches in height (12.7 x 3.8 x 3.8 cm).

4.2.5 The length of each piece of test fuel shall be of equal length and shall closely approximate 5/6 the length of the longest usable dimension of the firebox. (See 4.3.2)

4.2.6 Test fuel pieces shall be arranged in the firebox in conformance with the manufacturers published written instructions and in a configuration which maintains air space intervals between the logs. The fuel shall be positioned so that the flanges are flat (parallel) to the floor of the firebox, with the flanged edges in contact (abutting each other). If loading difficulties result, some fuel pieces may be placed on edge. If the usable firebox volume is between 1.5 and 3.0 ft^3, alternating the piece sizes in vertical stacking layers is required to the extent possible. For example, 2x4's shall be placed on the bottom layer in direct contact with the coal bed and 4x4's on the next layer, etc. (See Figure 4.2-B). Photo documentation of the loading configuration for each test cycle shall be provided to the DEQ for certification purposes.

4.2.7 Appliances of unusual or unconventional firebox design shall load the fuel in a configuration which maintains air space intervals between the flanged lumber and is in conformance with the manufacturers published written instructions. Any appliance that will not accommodate the loading configuration specified in 4.2.6, must obtain DEQ loading configuration approval prior to testing for certification purposes.

4.2.8 Appliances that are designed to provide continuous feed pelletized or chipped fuel must prearrange an equivalent test criteria agreement with the DEQ prior to testing for certification purposes.

4.3 LOAD SIZE

4.3.1 The initial fuel load and the test fuel charge shall be based on weight per usable firebox volume. The fuel loads shall be equivalent to seven pounds of fuel as fired per cubic foot (112 kg/m^3) of usable firebox volume $\pm$ 10 %.

4.3.2 To avoid stacking difficulties, or when a whole number of fuel pieces does not result, all piece lengths may be adjusted uniformly to remain within the specified loading density.

4.3.3 Usable firebox volume means the entire volume of the (primary) combustion chamber less any volume where firewood could not reasonably be placed, such as areas restricted by baffles or firebrick. (see Figure 4.3)

SECTION 5: APPLIANCE OPERATING PROCEDURE

5.1 PRETEST START UP

5.1.1 The pretest startup phase is designed to bring the stove up to a stabilized operating temperature that is reflective of the heat output range required for the following test cycle.

5.1.2 Pretest start up will begin with ignition of kindling from a cold start with no charcoal residue in the firebox. A layer of cold wood ashes spread to a uniform depth of up to one inch in depth (2.54 cm) on the floor of the firebox or ash pan is optional. The kindling load shall consist of between 4-8 pounds (1.8 - 3.6 kg) of finely split Douglas fir with a moisture content range up to 20% on the wet basis. Crumpled newspaper balls loaded with the kindling shall be used to help attain ignition. The air supply controls may be adjusted per the manufacturer's published instructions for the kindling start up phase.

5.1.3 After 50 - 75% of the kindling by weight has been consumed, a pretest fuel load shall be added. The pretest fuel load shall meet the same fuel species and moisture content specifications as the test load. The pretest fuel load shall consist of whole 2x4 lumber pieces, without flanges, that are no less than 1/3 the length of the test fuel. Additional fuel may be added provided it meets the above requirements and that uniform charcoalization and weight specifications are adhered to before the test cycle begins.

5.1.4 The air inlet supply setting may be set at any position desired which will maintain combustion of the pretest fuel load. It is recommended that the air inlet supply setting be set at the position necessary to achieve the lowest heat output level of the following test cycle and be set at least one hour prior to addition of the test fuel load.

5.1.5 To document stabilized appliance heat storage effects and to control heat output levels, surface temperatures shall be recorded at each 5 minute interval during the one hour prior to charging the test fuel.

5.1.6 No emissions or efficiency measurements are required during this pretest startup phase.

5.2 TEST CYCLE OPERATION

5.2.1 All stove surface temperatures shall be averaged and compared to those recorded at the beginning and the end of each test cycle. To approximate thermal equilibrium, the averaged beginning and ending test cycle stove surface temperatures must be within 125°F (51.7°C) of each other. For all appliances, a correction factor shall be made to correct for heat storage effects. The correction factor shall be 0.12 Btu/lb °F multiplied by the averaged surface temperature difference in °F obtained from the beginning and ending temperatures of each test cycle. Some stoves (e.g., high mass stoves) may require more than one pretest fuel load to stay within the required averaged temperature range at the beginning and at the end of the test cycle.

5.2.2 An appliance may be tested in one continuous testing period that encompasses discrete test cycles for each of the [four] specified heat output levels (see 5.8) provided that a one hour minimum interval between each discrete test cycle occurs. The interval between test cycles provides time to reposition the air supply adjustment to the appropriate setting, re-establish and maintain the required coal bed, and meet the surface temperature requirements for the next desired heat output level.

5.3 TEST FUEL LOADING

5.3.1 When the kindling and pretest fuel load has been consumed to leave a weight equal to 20-25 percent of the test fuel load, the test fuel load shall be charged. Manipulation of the hot coal bed prior to charging the test fuel load shall conform to the manufacturer's published written instructions. In the absence of written instructions, breaking up, raking and uniform spreading of the embers or hot coal bed is required prior to addition of the test fuel load. No manipulation or rearrangement of the test fuel load configuration is allowed during any portion of the test cycle.

5.3.2 Additional fuel may be added between the test cycle intervals, provided it meets the fuel species and moisture content specifications. Whole 2x4 lumber pieces, without flanges, no less than 1/3 the length of the test fuel may be used, provided proper re-establishment of the hot ember bed is controlled to the specified weight criteria and uniform charcoalization of the ember bed is adhered to.

5.4 AIR SUPPLY CONTROL

5.4.1 Adjustment of the primary air supply controls or holding the fuel loading door open up to the first 5 minute phase of the test cycle is allowed to insure good ignition of the test charge and catalyst if so equipped. Adjustments should be conducted per the manufacturer's published written instructions. Immediately thereafter, the primary inlet air supply control(s), either manual or automatic, shall be set to the position necessary to achieve the required heat output level. No additional adjustments of the air supply controls or opening the loading door will be allowed during the remainder of each test cycle.

5.4.2 Maximum heat output shall be achieved by operating the appliance with the primary air supply inlet controls fully open during the entire fuel load cycle unless the manufacturer's published written instructions specify that maximum heat output occurs at another setting.

5.4.3 All other heat output levels shall be achieved by operating the appliance with the primary air supply inlet control or other mechanical control device set in a predetermined position necessary to obtain average heat output levels specified in 5.8 during the entire test cycle.

5.4.4 If the primary air supply inlet control(s) cannot be adjusted to obtain variable burn rates or variable heat output levels, the appliance shall be tested at the fixed air supply setting.

5.4.5 Secondary or tertiary air supply may be adjusted one time only during each test cycle following the manufacturer's published written instructions.

5.5 TEST CYCLE COMPLETION

5.5.1 A test cycle ends when the entire weight ± 0.1 lb (.045 kg) of the test fuel load has been consumed, (i.e., when a bed of coals equal to the beginning coal bed weight remains).

5.6 BLOWERS, FANS

5.6.1 The use of blowers for heat exchange is optional. Beginning with the start of the test cycle, blower speed may be positioned at a recommended setting but no changes in setting will be allowed throughout the entire test period and the position setting shall be recorded at the time positioning occurs.

5.7 OTHER APPURTENANCES

5.7.1 Shaker grates, by-pass handles, or other appurtenances (not primary air supply controls) may be adjusted one time only during each test cycle in accordance with the manufacturer's written published instructions, and all adjustments shall be recorded.

5.8 NUMBER OF TESTS REQUIRED

5.8.1 Simultaneous emissions and efficiency tests are required during an entire test cycle within each of four discrete heat output ranges as indicated below.

Test Cycle Heat Output

(Average Btu/hr)

Category 1.	Category 2.	Category 3.	Category 4.
< 10,000	10-15,000	15-25,000	Maximum heat output

5.8.2 If the lowest sustainable burn rate produces an average heat output greater than the first category, then two tests must be conducted near the low and high end of the second category plus tests at the remaining categories. A total of four test cycles are required.

5.8.3 If the lowest sustainable burn rate produces an average heat output greater than the second category, then two tests must be conducted near the low and high end of the third category plus a test at the remaining category. A total of three test cycles are required.

5.8.4 If the lowest sustainable burn rate produces an average heat output greater than the third category, three tests must be conducted, one at the lowest sustainable burn rate, one at the maximum heat output level and one at an intermediate level between the lowest and maximum level. A total of three test cycles are required.

5.8.5 If lowest sustainable burn rate is greater than 10,000 Btu/hr then documentation shall be submitted to demonstrate the actual burn rate is the lowest sustainable. This documentation can be in the form of proof that the appliance was run at its lowest permanent air supply setting or test data that demonstrates the burn rate approaches zero (less than 0.1 kg/hr) within the area of 1 to 1.1 times the lowest sustainable burn time and when greater than 90% of the test charge has been consumed. Such test data shall be collected by following all the stove operating procedures specified in this document.

5.8.6 If an appliance has a fixed air supply setting, two replicate tests shall be conducted at the "on" firing mode setting. A total of two test cycles are required.

5.8.7 If an appliance is unable to achieve an average heat output level of 25,000 Btu/hr at its maximum heat output, four tests must be conducted. One test must be conducted at the first category, one at the second category and two tests at the third category, one conducted near the low end of the range and one at the maximum heat output. A total of four test cycles are required.

5.8.8 Two Test Option.

(a) Two tests are alowed to be used to determine emissions rather than the four tests required in 5.8.1, if one test is conducted in each of the two heat output categories indictaed below and a heat output and efficiency test is performed at the maximum heat output.

Test Cycle Heat Output
(Average Btu/hr)

Category 1	Category 2
10,000 - 13,000	13,000 - 15,000

(b) If the two test option is to be used, emissions tests shall be conducted in conformance with Oregon Source

Sampling Methods 5 & 7, as described in 6.1.1. Overall efficiency tests shall be conducted in conformance with the calorimeter room method or the stack loss method as described in 6.5. Equivalent methods of determining emission and overall efficiency may not be used.

(c) For the two test option to be considered for certification, the Department must be given notice prior to actual testing that such option has been chosen.

SECTION 6: TEST METHODOLOGY AND CALCULATIONS

6.1 EMISSION TESTING

6.1.1 Particulate emission testing shall be conducted in conformance with Oregon Source Sampling Methods 5 and 7 (Attachments 2 and 3) with the following exceptions: 1) no traverse of the flue is necessary, 2) sample extraction shall occur in the center of the flue at a height of eight to nine feet above the top surface of the scale, 3) on-line stack gas velocity and volumetric flow rate determination will be made using an alternate method (Section 6.3). Total volume and average flow rates for the test period will be calculated using a simultaneous stoichiometric carbon, hydrogen and oxygen balance method (Section 6.2.1). Sample extraction rates shall be maintained at or proportional to the flue gas velocity as determined by the measured concentration of a tracer gas injected into the stack gases to determine dilution rate and thus, total flow. Adjustments to the sampling rate will be made at each five minute interval during the entire test period.

6.2 PROCEDURES FOR DETERMINING EQUIVALENCE BETWEEN CANDIDATE METHODS AND THE REFERENCE METHOD FOR WOODSTOVE EMISSION TESTING

6.2.1 Determination of Equivalence

The test procedures outlined in this section shall be used to determine if a candidate method is equivalent to the reference method when both methods measure particulate emissions from woodstoves. Equivalence is shown for the methods when the differences between the measurements made by a candidate method and the measurements made simultaneously by the reference method are less than or equal to the precision and consistency values specified in [Table 1] below.

Specifications For Woodstove Emission Test Methods

Parameter	Units	Limits
Emission rate range	g/hr	1.0-[20.0] 45.0
Minimum number of test runs		[5] 16
Minimum number of simultaneous samples per test run		4
(Candidate method)		(2)
(Reference method)		(2)
Maximum analytical precision (individual test runs)	%	18
Maximum analytical precision (standard deviation)	%	10
Maximum difference in consistent relationship (weighted aveerage)	%	[24] 20

6.2.2 Test Conditions

The woodstove burn rate and operating cycle shall be in accordance with procedures specified by DEQ. Testing procedures and schedules shall be approved by DEQ at least 60 days prior to testing. All test measurements or samples shall be taken in such a way that both the candidate method and the reference method receive stack gas samples that are homogenous or as nearly identical as practical.

Collect simultaneous and duplicate samples of woodstove emissions with both the reference and candidate methods until at least [12] 16 quadruple samples (duplicate pairs of both candidate and reference methods) have been obtained. The 12 quadruple samples should represent [12] 16 full test runs[.] four test runs on each of four stoves. The tests on each stove shall be in each of the four heat ouput ranges specified in teh certification procedures and 5.8.1 of this document.

Calculate the emission rates as determined by the candidate and reference methods for each test run. For the reference method, calculate the average particulate emissions for each test run by averaging the results calculated from the duplicate analyses (A and B):

$$R_i\ ave = \frac{R_{iA} + R_{iB}}{2} \qquad 6.2.2.a$$

where R denotes results from the reference method and where i is the sample number. Disregard all quadruple samples for which the particulate emission rate as determined by the average of the duplicate reference method analyses falls outside the range of 1.0 to [20.0] <u>45.0</u> grams per hour (g/hr). All remaining quadruple samples must be subjected to [both of] the following tests for precision. [and consistent relationship. At least five samples (average of duplicate reference method analyses) must be within the 1.0 to 20.0 g/hr range and at least one sample within each of the 1.0 to 5.0, 5.0 to 10.0, 10.0 to 15.0, and 15.0 to 20.0 g/hr ranges for the test to be valid.]

<u>Calcualte the weighted emission rates, using the procedures specified in OAR 340-21-120(5), as determined by the candidate and reference mehtoids for each of the four woodstoves tested. for teh reference method, calculate the average weighted emission rate for each woodstove testd by aeraging the results calculated from the dulicate analysis (A and B). One woodstove weighted emission rate (average of duplicate reference method analysis) must be within each of teh following rages for the procedure to be valid: Less than 5.0 g/hr, 5.0 to 10.0 g/hr, 10.0 to 15.0 g/hr, and greater than 15.0 g/hr. All weighted emission rates must be subjected to the consistent reltaionship test (in 6.2.4 following).</u>

6.2.3 Test For Precision

Calculate the precision (P) of the analysis (in percent) for each duplicate sample and for each method, as the maximum minus the minimum divided by the average of the duplicate analyses, as follows:

$$P_{Ri} = \frac{R_i\ max - R_i\ min}{R_i\ ave} \times 100\% \qquad 6.2.2.b$$

$$P_{Ci} = \frac{C_i\ max - C_i\ min}{C_i\ ave} \times 100\% \qquad 6.2.2.c$$

where C denotes results from the candidate method, R denotes results from the reference method, and i indicates the sample number.

Calculate the standard deviation (SD) of the reference and candidate precision analyses as follows:

$$SD_R = 1.77 \times P_{R\ ave} \qquad 6.2.2.d$$
$$SD_C = 1.77 \times P_{C\ ave} \qquad 6.2.2.e$$

where $P_{r\ ave}$ is the average of the absolute values of P_{Ri}; and $P_{C\ ave}$ is the average of the absolute values of P .

If any reference method precision value (P_{Ri}) exceeds 18 percent [,] or if the standard deviation (SD_R) exceeds 10 percent, the precision of the reference method analytical procedure is out of control. Corrective action must be taken to determine the sources(s) of imprecision and the reference method determinations must be repeated, or the entire test procedure must be repeated.

The candidate method passes this test if the precision values of the candidate method (P_{Ci}) are less than or equal to 18 percent and the standard deviation (SD_C) is less than or equal to 10 percent.

6.2.4 Test For Consistent Relationship

For each of the four woodstoves tested, calculate the weighted average emission using DEQ procedure specified in OAR 340-21-120(5).

For each quadruple sample, calculate all four possible percent differences (D) between the reference and candidate methods, using all four possible combinations of the duplicate determinations (A and B) for each method, as:

$$D_{in} = \frac{C_{ij} - R_{ik}}{R_{ik}} \times 100\% \qquad 6.2.2.[d]f$$

where i is the [filter number,] woodstove medel tested and n numbers from 1 to 4 for the four possible difference combinations for the duplicate determinations for each method (j = A, B, candidate; k = A, B, reference).

If the candidate method is to innclude dual units and averaging of test results, then calculate the differences (D) between the reference and candidate methods as follows:

$$D_i = \frac{C_i - R_i}{R_i} \times 100\% \qquad 6.2.2.g$$

where i is the woodstove model tested, C is the average of the dual candidate results, and R is the average of the dual reference results.

The candidate method passes this test if the absolute values of all of the applicable differences (D) are less than or equal to [24] 20 percent.

6.2.5 Test For Equivalence

The candidate method must pass both the precision test and the consistent relationship test to qualify for designation as an equivalent method. DEQ may require dual units and precision criteria between dual units, or other conditions in the designation as an equivalent method.

6.2.6 Verification Testing

DEQ may conduct verification testing of the candidate method. If DEQ testing does not verify the precision and consistent relationship of the candidate method then the candidate method will not be approved as an equivalent method.

6.3 TRACER GAS DILUTION METHOD

6.3.1 This method is used for on-line measurement of stack gas flows during the test period. Other techniques that can provide equivalent results may be accepted, provided prior approval by DEQ has been made before testing for certification purposes commences.

a) Tracer Gas Dilution Method

A pure tracer gas (sulfur dioxide or equivalent, or approved performance gas) is metered through a calibrated rotometer for injection into the flue pipe. Injection shall be made through a stainless steel multi-perforated tube loop located inside the stack at four flue diameters downstream from the particulate and gas sampling port. A downstream diluted sample extraction probe shall be located 8 flue diameters downstream from the injection loop. The dilution sample gas stream shall be processed through a sample conditioner consisting of a combustion tube furnace, and in series, a glass fiber filter and three impingers encased in an ice bath. Impingers one and two shall be empty for water collection and the third shall contain silica gel.

The tracer gas content of the diluted gas sample stream shall be determined with an appropriate calibrated analyzer. Downstream tracer gas concentrations should not exceed 0.5% of the total flue gas volume. The tracer gas shall be as non-reactive with other flue gas constituents as possible and measurable by instrumentation capable of obtaining an accuracy of $\pm$ 1% of the instrument scale reading. Instrument calibrations shall be performed and recorded before and after each test run.

Stack gas volumetric flow rates shall be calculated using the following equations:

$$\text{Flow (cfm)} = \frac{Ir}{Dc} \times \frac{1}{60} \times \frac{Tr}{Pr \times 17.65^{*}} \qquad 6.3.1.a$$

Where: Ir = Tracer gas injection rate (ft^3/hour)

Dc = Downstream tracer gas concentration (ppm x 10^{-6})
Tr = Injection gas temperature (^{o}R) at the rotometer
Pr = Injection gas pressure (inches Hg)
* = Density specific for SO_2

Other tracer gases such as helium may be substituted for sulfur dioxide provided prior written agreement has been made with the DEQ.

6.4 STOICHIOMETRIC CARBON, HYDROGEN AND OXYGEN BALANCE METHOD

6.4.1 A carbon, hydrogen and oxygen mass balance will be used for determining overall flue gas volume--not for on-line measurements during the test period.

a) The carbon, hydrogen and oxygen balance method for volumetric flow rates is based on the following basic combustion equation and will be determined and reported for every five minute interval.

$$@[CxHyOz + pH_2O] + Tsg(1-k)(a)[O_2 + 3.785N_2 + mH_2O] \qquad 6.4.1.a$$
$$Tsg[(1-k)(dCO_2 + eCO + gO_2 + hN_2) + jH_2O + kCH_4]$$

Where @ = Dry weight of fuel burned (lbs)
x = Moles of carbon per lb of dry fuel (assumed 0.0425)
y = Moles of hydrogen per lb of dry fuel (assumed 0.073)
z = Moles of oxygen per lb of dry fuel (assumed 0.0256)
p = Moles of H_2O per lb of dry fuel
= Dry basis moisture (free and combined) - 1800
a = Mole fraction of oxygen in air supply
= Moles O_2 supplied per mole of stack gas
d = Mole fraction of CO_2 in stack gas

e = Mole fraction of CO in stack gas
g = Mole fraction of O_2 in stack gas
h = Mole fraction of N_2 in stack gas
j = Mole fraction of H_2O in stack gas
k = Mole fraction of unburned hydrocarbon in stack gas (as CH_4).
m = Mole fraction of H_2O in supply air (mole H_2O per mole of supply oxygen)
Tsg = Total moles of stack gas (dry)

b) Mass balance equations for the combustion of @ lbs of wood are as follows:

Carbon:	$x@ = Tsg\,[(1-k)(d+e)+k]$	6.4.1.b
Hydrogen:	$@(2p + y) + Tsg(1-k)(a)(2m) = Tsg(2j + 4k)$	6.4.1.c
Oxygen:	$@(p+z) + Tsg(1-k)(a)[2+m] = Tsg[(1-k)(2d + e + 2g) + j]$	6.4.1.d
Nitrogen:	$3.785\,(a) = h$	6.4.1.e

Stack gas total as measured by combustion gas analyzers:

$$1 = (d + e + g + h) \qquad 6.4.1.f$$

The stack gas composition equation can be solved for "h" which will then provide a solution for "a" in the nitrogen balance equation. The remaining unknown values for "@", "p", and "k" are determined by simultaneously solving the carbon, hydrogen, and oxygen balance equations.

c) Two calculation runs of the simultaneous equation set are performed for each set (5 minute test segment) of data collected. The first run is performed to determine an average weighted "@" for the test burn. This first run "@" is then used to determine a corrected Tsg for the second run as follows:

$$Tsg'(\text{corrected}) = Tsg\ (\text{tracer gas})\ \frac{@\ (\text{actual})}{@\ (\text{calculated first run})} \qquad 6.4.1.g$$

Where: @(actual) = Dry weight burn rate for test burn (lb/hour)

d) "Tsg" is converted to a flow rate by the following equation:

$$\text{Flow (cubic feet per minute)} = \frac{Tsg \times 386.2}{60} \qquad 6.4.1.h$$

This calculation procedure is necessary for each five minute test period segment, therefore a computer program is recommended.

6.5 EFFICIENCY TESTING AND CALCULATIONS

6.5.1 If a calorimeter room is used to measure appliance efficiency, combustion gas analyzers must be included to determine and report appliance combustion and heat transfer efficiencies for each heat output level required.

6.5.2 Efficiency values shall be determined based on the following stack loss method. The approach shall include determination for each heat output level for combustion, heat transfer, and overall efficiency.

a) Combustion Efficiency

Combustion effiencies are calculated as the percentage represented by the actual heat produced in the firebox relative to the total heat production potential for the fuel consumed. Actual heat production in the firebox is calculated as the difference between the heat of combustion of the incompletely combusted stack gas constituents (carbon monoxide and unburned hydrocarbon equivalents) and the gross caloric content of the fuel burned. The basic equation used for combustion efficiency is as follows:

$$\text{Combustion Efficiency} = \frac{Thi - Clo}{Thi} \ (x\ 100) \qquad 6.5.2.a$$

Where: Thi = Total heat content of the fuel consumed
Clo = Combustible losses out stack

b) The total heat content of the fuel consumed shall be calculated using the following equation:

$$Thi = Gcvf \times Wfc \qquad 6.5.2.b$$

Where : Gcvf = Gross caloric value of the fuel (use HHV determined from bomb calorimetry analysis)
Wfc = Weight of fuel consumed (lbs) dry weight

c) The heat content of the combustible losses are calculated using the following equation:

$$Clo = Tsg\,[(e \times Hco) + (k \times Huh)] \qquad 6.5.2.c$$

Where: Hco = Heat of combustion for carbon monoxide
= 128,000 Btu/mole
Huh = Heat of combustion for unburned hydrocarbons
= 181,000 Btu/mole (estimated)

This calculation procedure is necessary for each five minute test period segment.

d) Heat Transfer Efficiency

Heat transfer efficiencies are calculated as the percentage represented by the useful heat released to the room relative to the actual heat produced in the firebox. The useful heat released to the room (Uhr) is calculated as the difference between the actual heat produced in the firebox (Ahf or Thi-Clo), and the sensible and latent heat losses out the stack (Sllo). The basic equation for heat transfer efficiency is as follows:

$$\text{Heat Transfer Efficiency} = \frac{Uhr}{Ahf} = \frac{Ahf - Sllo}{Ahf} = \frac{(Thi - Clo) - Sllo}{(Thi - Clo)}\ (\times 100) \qquad 6.5.2.d$$

Where: Sllo = Sensible and latent heat losses
$= (To - Ti)\,[Tsg(dCpCO_2 + eCpCO + gCpO_2 + hCpN_2 + jC_pH_2O)] + (j-m)LH_2O$

Where: To = Temperature of stack gases out
Ti = Temperature of inlet air and fuel

C_pCO_2 = Specific heat of CO_2 = 9.3 Btu/mole
C_pCO = Specific heat of CO = 7.0 Btu/mole
C_pO_2 = Specific heat of O_2 = 7.1 Btu/mole
C_pN_2 = Specific heat of N_2 = 7.0 Btu/mole
C_pH_2O = Specific heat of water = 8.3 Btu/mole
LH_2O = Latent heat of evaporation of water
= 18,810 Btu/mole

This calculation procedure is necessary for each five minute test period segment.

e) Overall Efficiency

Overall average efficiency is calculated as the percentage represented by the heat released to the room relative to the total heat production potential of the fuel consumed. The overall efficiency is calculated as the product of the combustion efficiency and the heat transfer efficiency as follows:

Overall Efficiency = Combustion Efficiency x Heat Transfer Efficiency

$$= \frac{Ahf}{Thi} \times \frac{Uhr}{Ahf} = \frac{Uhr}{Thi} \qquad 6.5.2.e$$

6.5.3 A corrected flue gas moisture content for each five minute interval must be determined as follows:

Final flue moisture determination shall be made by calculating a corrected flue gas moisture content for each data interval taken during the test cycle. The average wet bulb-dry bulb moisture measurement must be weighted by the volumetric flow rate for that 5 minute interval. The correction factor which is applied to each 5 minute moisture determination is calculated as the ratio between the average wet bulb-dry bulb measurement and the Oregon Source Sampling Method 4 (Attachment 1) measurement (condensate catch) for the entire burn cycle.

6.6 EQUIVALENCE BETWEEN CANDIADATE METHODS AND THE REFERENCE METHOD FOR WOODSTOVE EFFICIENCY TESTING

6.6.1 Candidate methods for woodstove efficiency demonstrate consistent relationshi to the reference methods (stack loss) comparable to the consistent relationship between teh reference method (stack loss) and the calorimeter room method as desribed in teh DEQ's Confirmation Testing Summary, Section 18, Par C, Table 1: Comparison of Calorimeter Room Method vs. Stack Loss Method, 1984.

6.6.2 DEQ may conduct verification testing of the candidate method. If DEQ testing does not verify equivalence of the candidate method to the reference method (stack loss), then the candidate method will not be approved as an equivalent method.

SECTION 7: TEST DATA

7.1 DATA TO BE REPORTED

7.1.1 All raw and reduced test data must be included in the material sent to DEQ for appliance certification. Reduced test data shall be tabulated as indicated in Sections 7.1.2 through 7.1.10.

7.1.2 Particulate Emissions For Each Test Cycle

a) Concentration: total grains/dscf, total grams/m^3
b) Emission rate: grams/hr
c) Emission factor: grams/kg (dry fuel weight basis)
d) Emission process rate: grams/10^6 joule useful heat output
e) Front half catch: % of total
f) Total mass captured: front and back catch, mg

7.1.3 Average Efficiency Values For Each Test Cycle

a) Overall appliance efficiency %
b) Combustion efficiency %
c) Heat transfer efficiency %

7.1.4 Heat Output For Each Test Cycle

a) Btu/hr average over entire test

7.1.5 Burn Rate For Each Test Cycle

The average values (kg/hr wet and dry basis) over the entire test cycle and an hourly average over the entire test cycle at each heat output level.

7.1.6 Average Fuel Moisture Content For Each Test Cycle

a) Kindling (wet basis) %
b) Test fuel (wet basis) %

7.1.7 Air/Fuel Ratio

Mass of combustion air to the mass of fuel over 90% or more of each test cycle (lbs air/lbs fuel).

7.1.8 Average Stack Gas Composition For Each Test Cycle

a) Carbon dioxide %
b) Carbon monoxide %
c) Oxygen %
d) Excess air %
e) Moisture %

7.1.9 Average Stack Gas Flow and Draft

a) Average flow rate cfm
b) Stack flow rate dscf/min (tracer gas and CHO balance)
c) Draft, inches H_2O

7.1.10 Average Stack Gas Emission Factors and Process Rates For Each Test Cycle

a) Carbon monoxide: grams/kg, and grams/10^6 joule (measured)
b) Hydrocarbons: grams/kg, and grams/10^6 joule (calculated)

7.1.11 Average Temperatures For Each Test Cycle

a) Stack gas ºF
b) Primary combustion chamber gas ºF
c) Secondary combustion chamber gas (if applicable) ºF
d) Above catalyst gas (if applicable) ºF
e) Stove top surface ºF
f) Stove sidewall surfaces ºF
g) Stove back surface ºF
h) Stove bottom surface ºF

7.1.12 Fuel Load Weight and Burn Cycle Period (Minutes)

a) Coal bed weight, lbs

b) Test fuel load weight, lbs

c) Total burn cycle time period, minutes

SECTION 8: CATALYTIC COMPONENT CERTIFICATION REQUIREMENTS

8.1 CATALYTIC COMBUSTOR DESIGN CRITERIA

8.1.1 To insure equivalent performance of catalytic combustors used in testing versus production model stoves, a combustor model number for every catalytically equipped stove evaluated for certification shall be supplied. The model number will serve to identify catalytic combustor types by brand (manufacturer), dimensions, and design (substrate and coating material). The model number must be imprinted or inscribed on a readily visible surface (such as a metal sleeve or canned surface). This will allow DEQ field verification monitoring. Any change in combustor brand, size and design type will require retesting of the appliance with the new combustor model for performance change unless test data or sufficient information can be provided demonstrating equivalent or improved performance.

8.2 CATALYTIC COMBUSTOR AGING CRITERIA

8.2.1 [Any appliance that contains a catalytic combustor must have the combustor pre-aged before emission performance testing to a specified aging process. The aging process will consist of the catalytic combustor tested in a woodstove (specifically designed for an internal catalytic combustor) for a continuous period of 50 hours. The test fuel shall consist of Douglas fir dimensional lumber or cordwood with a moisture content range between 16-20% wet basis. The accredited testing laboratories must provide combustor temperature data and certify to the DEQ that each catalytic appliance tested for emissions and efficiency performance has met this provision.] Any appliance that contains a catlytic combustor must use a pre-aged combustor when testing for certification purposes. The combustor agin process will consist of burning Douglas Fir dimensional lunmber or cordwood with a moisture content range on the net bases of 15-25% in a woodstove specifically designed for an internal catalytic combustor. The stove must be operated at its medium burn rate with a new catalytic combustor in place and in operation for a period of 50 hours. The accredited testing laboratory must document and provide combustor temperature data, hours of aging operation and certify to the dEQ that each catalytic appliance tested for certification purposes has met this provision.

8.3 CATALYTIC COMBUSTOR LONGEVITY CRITERIA

8.3.1 All catalytic combustor manufacturers must submit to the DEQ evidence in the form of test data that each combustor design type, identified by model number, has been longevity tested for 5000 hours and document that the percent reduction in particulate emissions from the new state is no less than 70%. Three test conditions are required: 1) unused (0 hours), 2) 250 hours, and 3) 5000 hours. Testing must be performed by a DEQ accredited laboratory. In lieu of this requirement, the manufacturer may substitute a 24 month non pro-rated combustor replacement warranty.

8.4 CATALYTIC COMBUSTOR TEMPERATURE MONITORING PROVISION

8.4.1 In order to qualify for DEQ certification, catalytically equipped woodstoves must be equipped with a permanent provision to accommodate a commercially available temperature sensor which can monitor combustor gas stream temperatures within or immediately downstream (within 1.0 inch or 2.5 cm) of the combustor surface.

EXAMPLE OF TEST EQUIPMENT SET-UP

FOR FREE STANDING WOODSTOVES

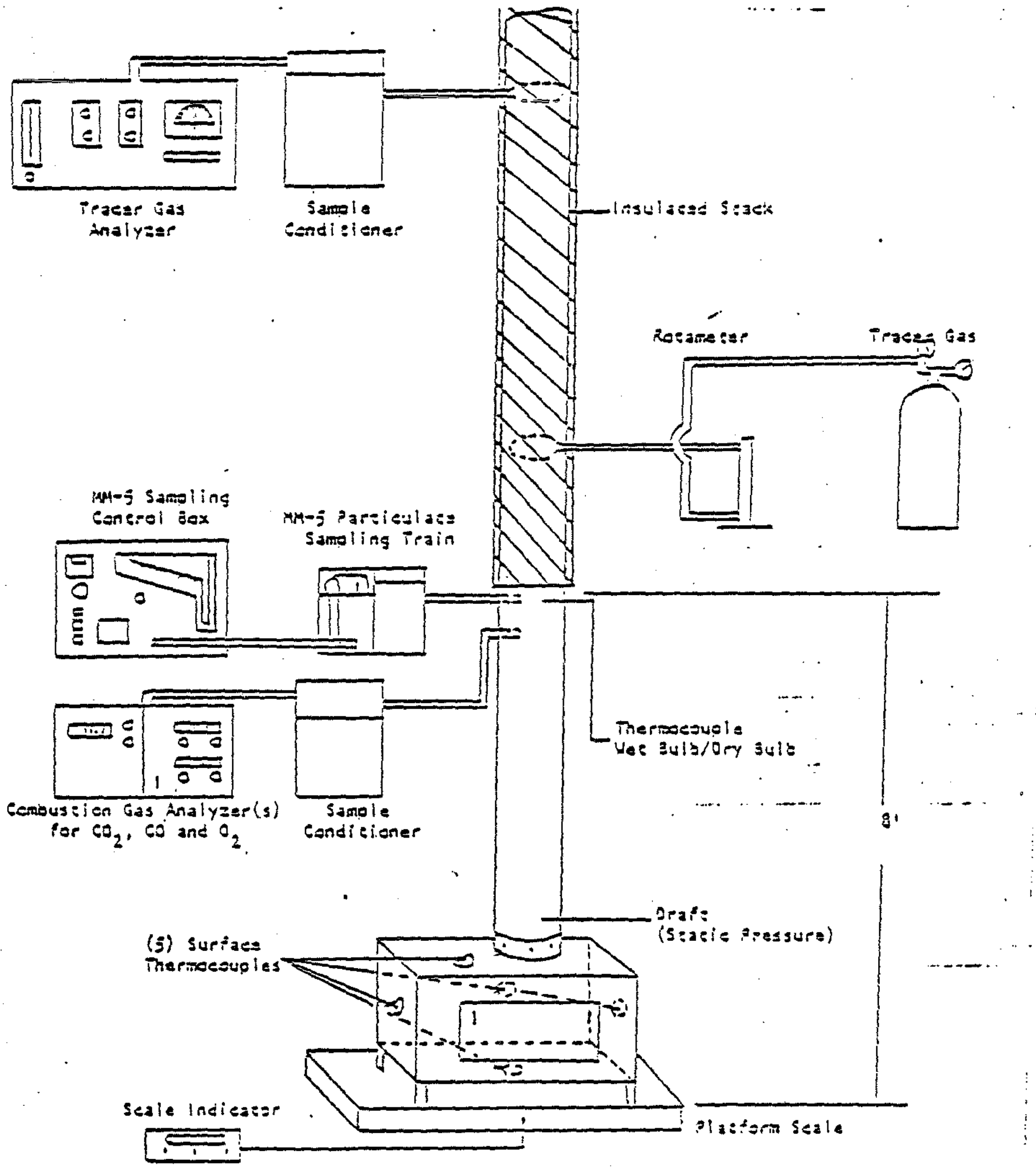
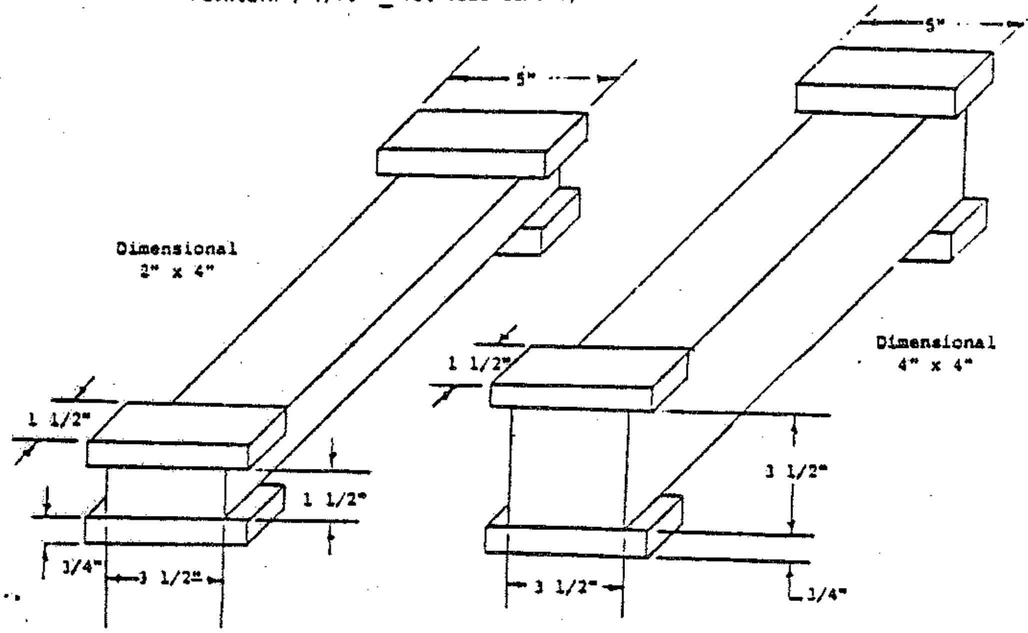


Figure 3.1

Test Fuel Size

Usable Firebox Volume (ft^3)	Size - Flanged Log (Nominal inches)
≤ 1.5	2 x 4
$> 1.5 \leq 3$	Combination: 2x4 approximately ½ weight of test fuel load; 4x4 approximately ½ weight of test fuel load
> 3	4 x 4

Maintain 7 #/ft^3 $\pm$ 10% load density



Scale 1/4" = 1"

* Length will vary depending on length of firebox

Alternative Flange Configuration

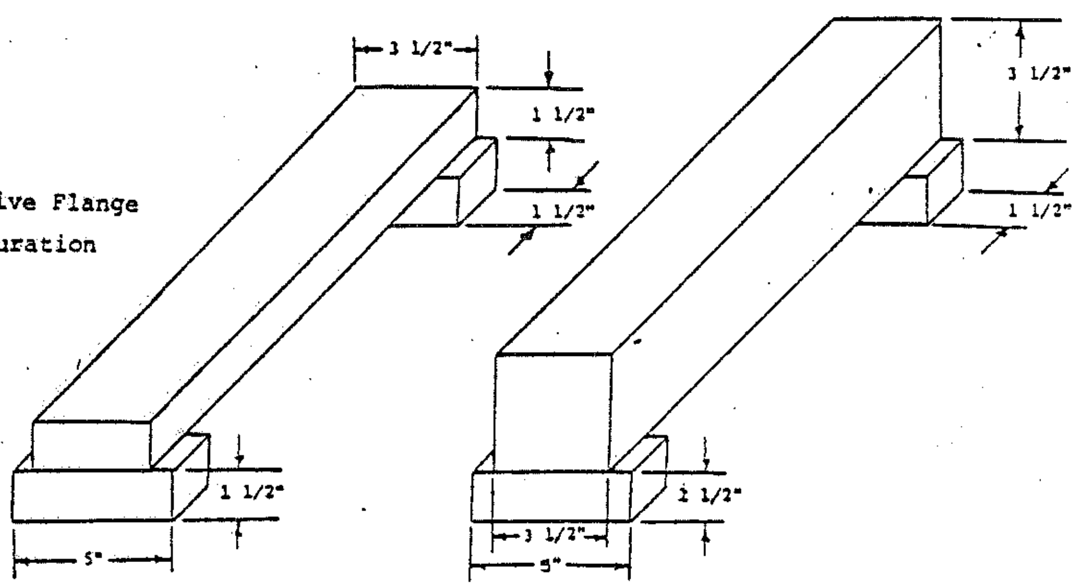
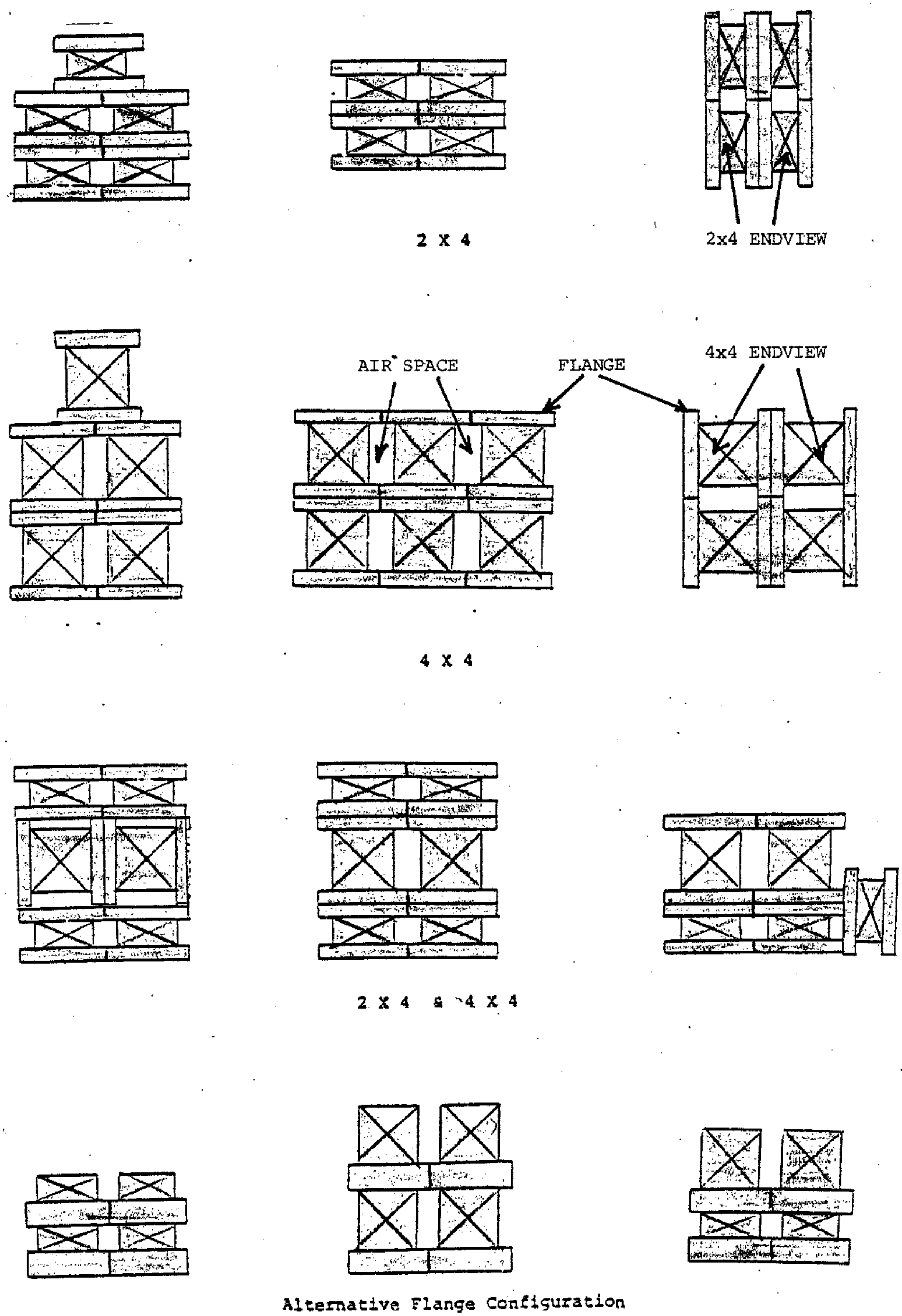


Figure 4.2-A



Woodstove Stacking & Loading Examples

Figure 4.2-B

EXAMPLES OF USABLE FIREBOX VOLUME

(Designated by Shaded Area)

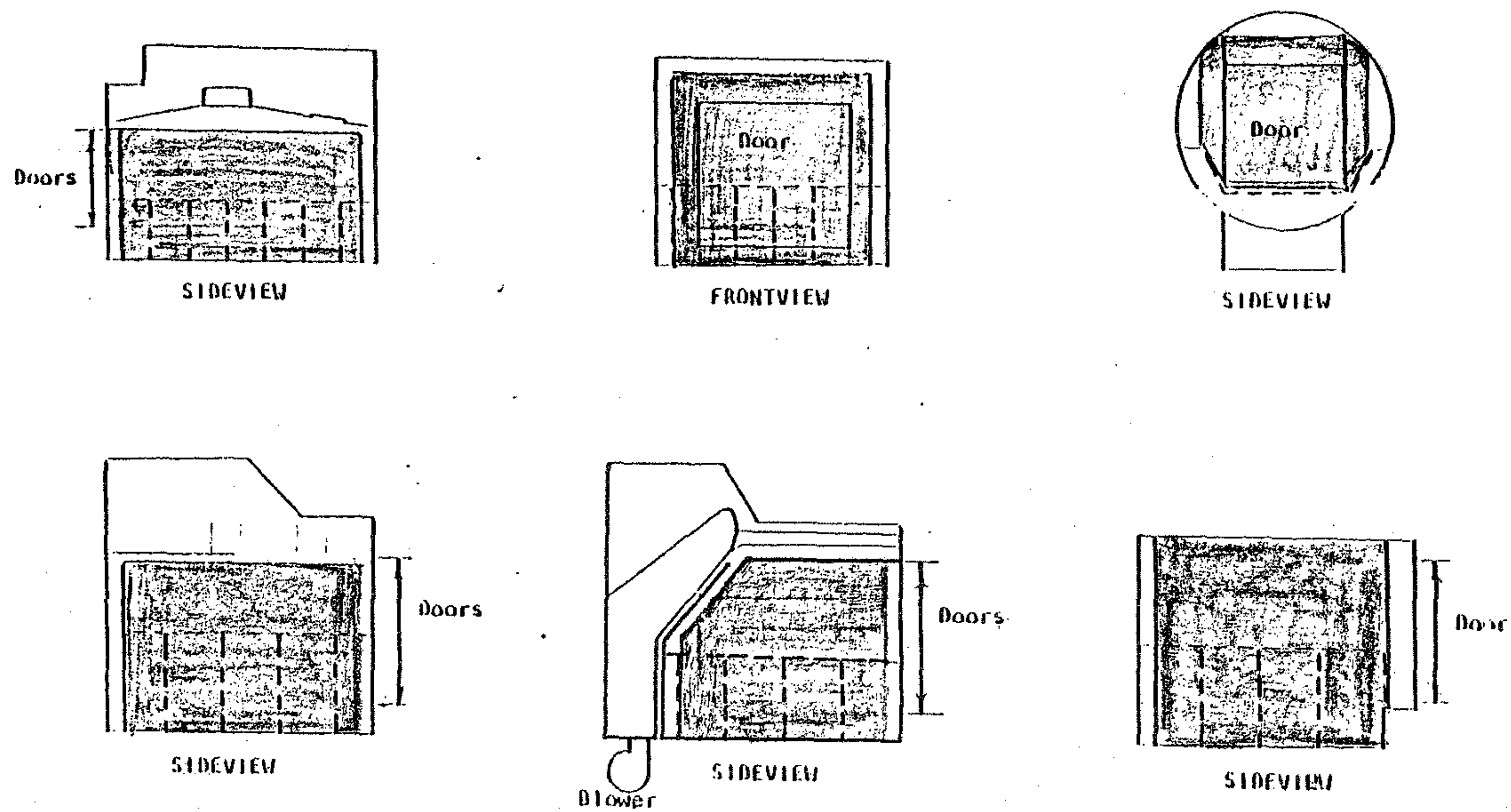


Figure 4.3

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY

Source Sampling Method 4

Determination of Moisture Content of Stack Gases

1. Principle and Applicability

1.1 Principle. A gas sample is extracted from the flowing gas stream and its moisture removed and measured either volumetrically or gravimetrically. Alternately, the moisture can be estimated by less accurate techniques for the purpose of setting the nomograph for isokinetic sampling. A wet bulb-dry bulb technique is discussed.

1.2 Applicability. The reference method is applicable for the determination of moisture in exhaust gases from stationary sources. The alternate method is to be used only for estimating the moisture content for the purpose of setting the nomograph unless otherwise specified.

2. Reference method

2.1 The method employed is essentially the same as used in the particulate determination source sampling method 5 and will not be discussed here.

3. Alternate method

3.1 Theory. The water vapor in a non-saturated gas stream causes a depression of the wet bulb temperature which is proportional to the fraction of moisture present.

3.2 Procedure

3.2.1 Measure the dry bulb temperature in the conventional way using either a thermometer or thermocouple.

3.2.2 Insert the end of the temperature measuring device in a cloth sock and saturate the sock with water. Inset the sock into the flowing gas stream and allow the temperature to reach a steady state. Caution: after the water on the sock has evaporated, the temperature will rise to the dry bulb temperature. (Figure 4-1). The wet bulb temperature must be taken while the sock is saturated with moisture.

3.2.3 Apply the wet bulb and dry bulb readings to the appropriate graph (Figure 4-2, 4-3, or 4-4) and determine the approximate water vapor content if the barometric pressure is near 29.92 in. Hg.

3.2.4 Alternately apply the wet bulb and dry bulb readings to equation 4-1 in Figure 4-5.

4. Interferences

4.1 The following conditions may drastically change the wet bulb reading causing erroneous results:

4.1.1 The presence of acid gases in the gas stream, i.e. SO_2, SO_3, HCl.

4.1.2 The presence of hydrocarbons in the gas stream.

4.1.3 Marked differences from atmospheric pressure (29.9 in. Hg) of the gas stream (if the graphs are used).

4.2 Should any of the above interferences be present, the tester should consider another approach to determining moisture content.

4.3 Additionally, the following conditions can lead to difficulties.

4.3.1 Very high dry bulb temperature (in excess of 500°F).

4.3.2 Very high or very low gas velocities.

4.3.3 High concentration of particulate matter which may adhere to the wet sock.

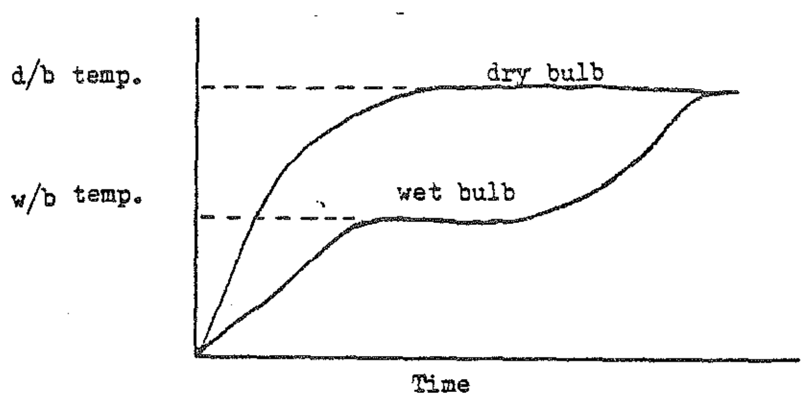


Figure 4-1

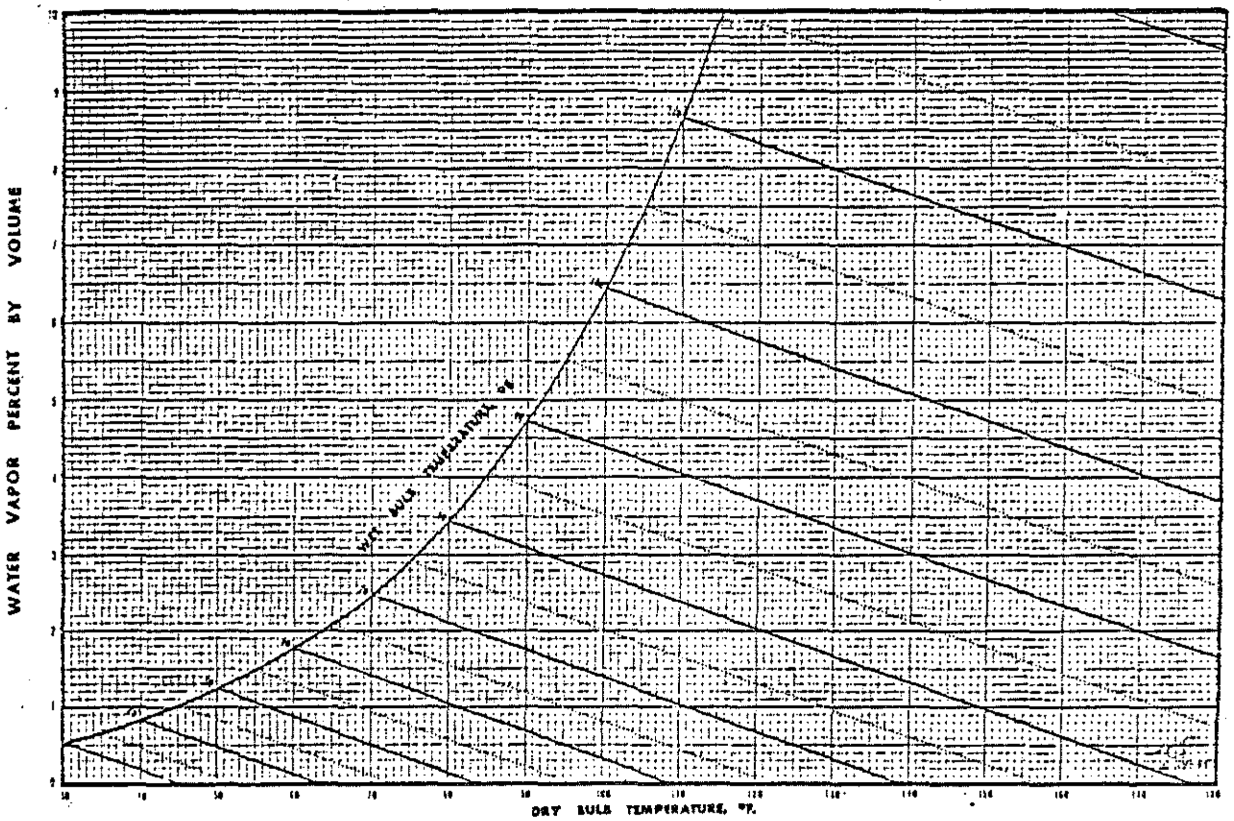


FIGURE 4-2

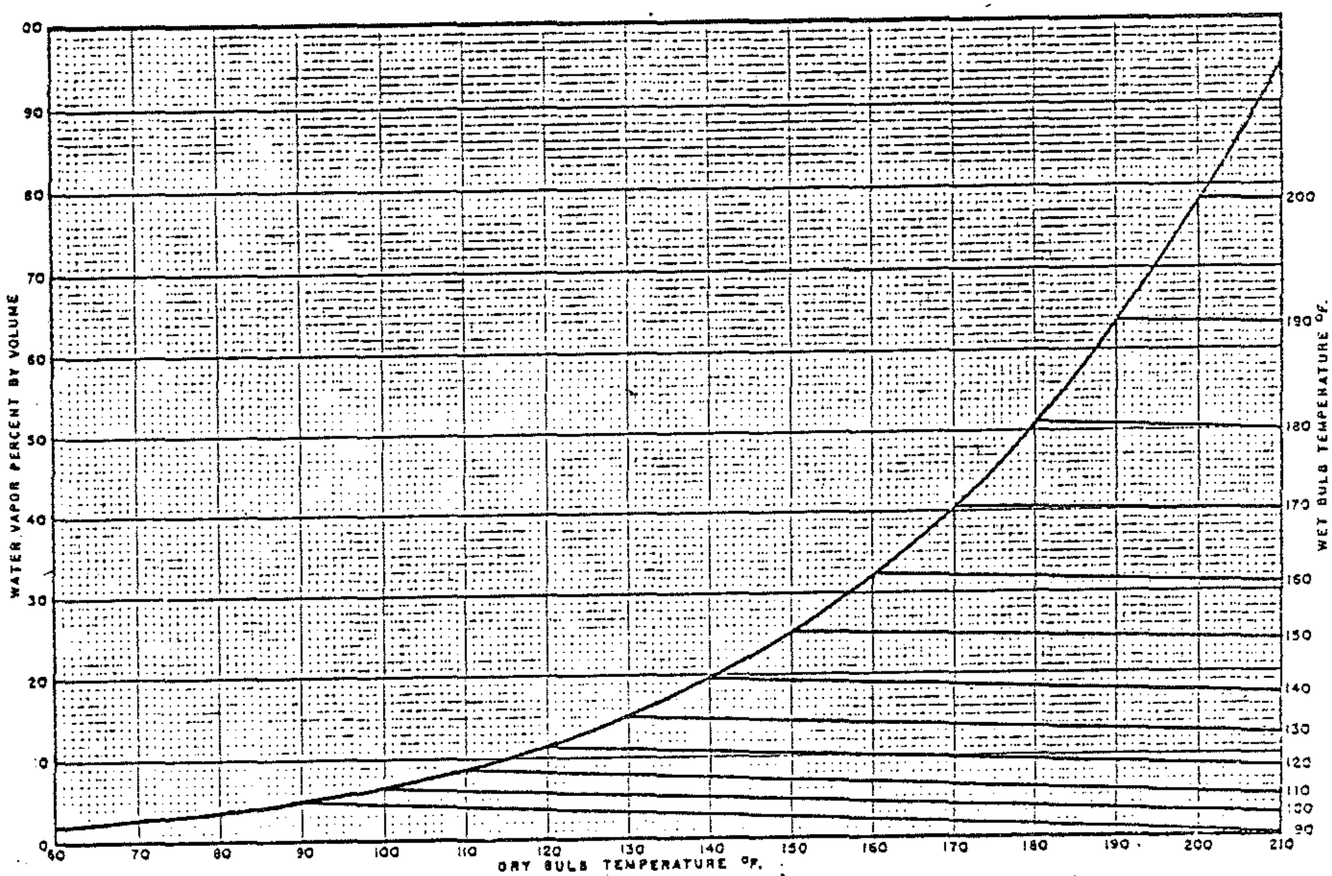
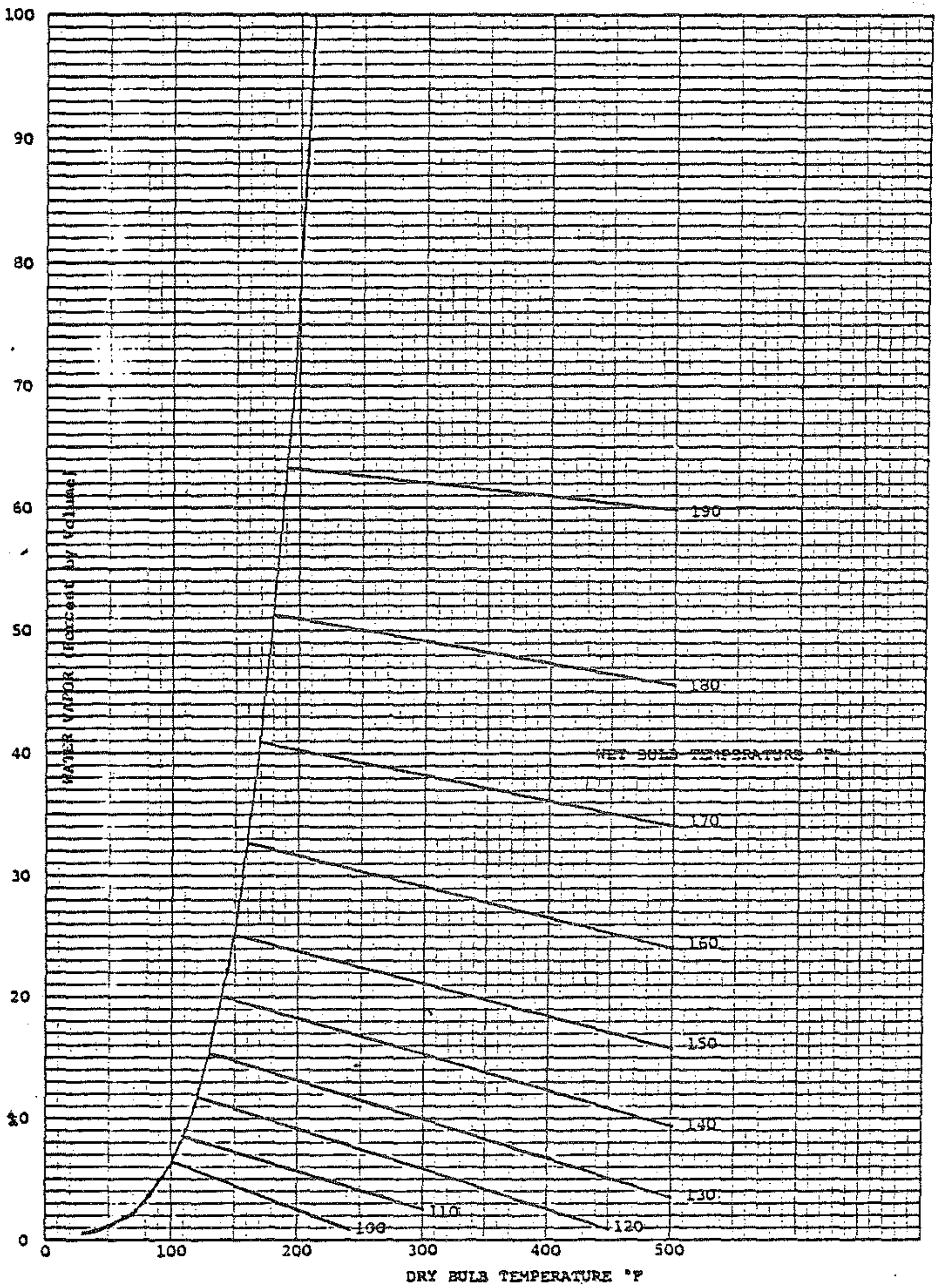


FIGURE 4-3



100
90
80
70
60
50
40
30
20
10
0
WATER VAPOR (Percent by Volume)
0
100
200
300
400
500
DRY BULB TEMPERATURE °F
190
180
170
160
150
140
130
120
110
100

Figure 4-4

$$\% \; H_2O = \frac{e'' - \dfrac{(P_a - e'')(t_d - t_w)}{2800 - 1.3\, t_w}}{P_a} \times 100 \qquad (4\text{-}1)$$

Where:

e'' = Vapor pressure of H_2O @ t_w, in. Hg (See Figure 4-5)

P_a = Absolute barometric pressure, in. Hg

t_d = Dry bulb temperature, ^oF

t_w = Wet bulb temperature, ^oF

VAPOR PRESSURES OF WATER AT SATURATION*
(Inches of Mercury)

Temp. Deg. F.	0	1	2	3	4	5	6	7	8	9
—20	.0126	.0119	.0112	.0106	.0100	.0095	.0089	.0084	.0080	.0075
—10	.0222	.0209	.0199	.0187	.0176	.0168	.0158	.0150	.0142	.0134
—	.0376	.0359	.0339	.0324	.0306	.0289	.0275	.0259	.0247	.0233
0	.0376	.0398	.0417	.0463	.0441	.0489	.0517	.0541	.0571	.0598
10	.0631	.0660	.0696	.0728	.0768	.0810	.0846	.0892	.0932	.0982
20	.1025	.1080	.1127	.1186	.1248	.1302	.1370	.1429	.1502	.1567
30	.1647	.1716	.1803	.1878	.1955	.2035	.2118	.2203	.2292	.2393
40	.2478	.2576	.2677	.2782	.2891	.3004	.3120	.3240	.3364	.3493
50	.3626	.3764	.3906	.4052	.4203	.4359	.4520	.4586	.4858	.5035
60	.5218	.5407	.5601	.5802	.6009	.6222	.6442	.6669	.6903	.7144
70	.7392	.7648	.7912	.8183	.8462	.8750	.9046	.9352	.9666	.9989
80	1.032	1.068	1.102	1.138	1.175	1.213	1.253	1.293	1.335	1.378
90	1.422	1.467	1.513	1.561	1.610	1.660	1.712	1.765	1.819	1.875
100	1.932	1.992	2.052	2.114	2.178	2.243	2.310	2.379	2.449	2.521
110	2.596	2.672	2.749	2.829	2.911	2.995	3.081	3.169	3.259	3.351
120	3.446	3.543	3.642	3.744	3.848	3.954	4.063	4.174	4.289	4.406
130	4.525	4.647	4.772	4.900	5.031	5.165	5.302	5.442	5.585	5.732
140	5.881	6.034	6.190	6.350	6.513	6.680	6.850	7.024	7.202	7.384
150	7.569	7.759	7.952	8.150	8.351	8.557	8.767	8.981	9.200	9.424
160	9.652	9.885	10.12	10.36	10.61	10.86	11.12	11.38	11.65	11.92
170	12.20	12.48	12.77	13.07	13.37	13.67	13.98	14.30	14.62	14.96
180	15.29	15.63	15.98	16.34	16.70	17.07	17.44	17.82	18.21	18.61
190	19.01	19.42	19.84	20.27	20.70	21.14	21.59	22.05	22.52	22.99
200	23.47	23.96	24.46	24.97	25.48	26.00	26.53	27.07	27.62	28.18
210	28.75	29.33	29.92	30.52	31.13	31.75	32.38	33.02	33.67	34.33
220	35.00	35.68	36.37	37.07	37.78	38.50	39.24	39.99	40.75	41.52
230	42.31	43.11	43.92	44.74	45.57	46.41	47.27	48.14	49.03	49.93
240	50.84	51.76	52.70	53.65	54.62	55.60	56.60	57.61	58.63	59.67

*Methods for Determination of Velocity, Volume, Dust, and Mist Content of Gases, Bulletin WP-50, Western Precipitation Corp., Los Angeles, Calif.

figure 4-5

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY

Source Sampling Method 5

Sampling Particulate Emissions From Stationary Sources

1. Principle and Applicability

1.1 Principle. Particulate matter including condensible gases are withdrawn isokinetically from a flowing gas stream. The particulate matter is determined gravimetrically after removal of combined water.

1.2 Applicability. This method is applicable to the determination of particulate emissions from stationary sources except those sources for which specified sampling methods have been devised and are on file with the Department.

2. Acceptability. Results of this method will be accepted as demonstration of compliance (or non-compliance) provided that the methods included or referenced in this procedure are strictly adhered to and a report containing at least the minimum amount of information regarding the source is included as described in Sections 15 & 16. Deviations from the procedures described herein will be permitted only if permission from the Department is obtained in writing in advance of the tests.

3. Sampling Apparatus (Figure 5-1)

3.1 Probe - With heating system capable of maintaining sample gas temperature at 250° F at its exit end during sampling. Probes which are to be used at temperatures of 600° F or less may have liners constructed of seamless 316 stainless steel, Pyrex Glass or Incoloy 825[1]. Probes for temperatures in excess of 600° F may be constructed of Borosilicate glass (limit 900° F) or Quartz glass (limit 1650° F). Probes for temperatures in excess of 1650° F must be approved by the Department before use. Testing in corrosive atmospheres may require a special probe liner to prevent contamination of the sample.

3.2 Probe Nozzle - Constructed of stainless steel (316) with an external taper 30° or less to a sharp leading edge. The inside diameter of the nozzle shall be constant throughout the length of the nozzle. The wall thickness of the nozzle shall be less than or equal to 0.065 in. and a straight run of at least two times the internal diameter shall be provided between the leading edge and the first bend or point of disturbance. The nozzle shall be connected to the probe liner in such a way as to provide an airtight seal with no exposed threads or gaps to collect particulate matter. Calibration of the nozzle is covered in Section 13.3.

[1] Trade Name

3.3 Pitot tube - Type S or equivalent attached to the probe. The probe nozzle and face openings of the pitot tube shall be adjacent and parallel to each other (not necessarily in the same plane) and the free space between the nozzle and the pitot tube shall be at least 0.5 in. Calibration of the pitot tube is covered in Section 3, Source Sampling Method 2 .

3.4 Differential pressure gauges - Inclined or vertical fluid manometer capable of measuring the pressure differential to within 10% of the minimum measured value. Below 0.1 in. H_2O gauge, micromanometers with sufficient sensitivities shall be used. Other differential pressure measuring devices may be used provided they are calibrated against a fluid manometer and are adequately sensitive.

3.5 Cyclone (optional) - Miniature glass cyclone used when heavy concentrations of particulate are expected. The cyclone will extend the time a filter can be used before plugging.

3.6 Filter holder - Pyrex [1] glass with a glass frit filter support and silicone rubber gasket. The holder shall provide a positive seal against leakage from the outside or around the filter.

3.7 Filter heating system - Capable of maintaining a temperature of 250° F around the filter holder. A temperature gauge shall be provided to monitor this temperature.

3.8 Impingers - Greenburg-Smith design. The first, third and fourth may be modified by replacing the tip with a 1/2 inch ID glass tube extending to withint 1/2 inch of the bottom of the flask. The second impinger shall have the standard tip installed.

Note: All connections between the probe and last impinger shall be made with glass ball joints.

3.9 Metering system - Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5° F dry gas meter accurate to within $\pm$ 1% and flow measuring device (orifice or rotometer) enabling isokinetic sampling to be maintained.

3.10 Barometer - Mercury, aneroid or other type capable of measuring atmospheric pressure to within 0.1 in. Hg. If the barometric pressure is to be obtained from a nearby weather bureau station, the true station pressure (not corrected for elevation) must be obtained and an adjustment for elevation differences between the station and sampling site must be applied.

3.11 Temperature and pressure measurement equipment - As described in Source Sampling Method 2.

3.12 Gas analyzer - As described in Source Sampling Method 3.

3.13 Nomograph

3.14 Timer - Integrating type, accurate, readable to the nearest 5 seconds per hour.

[1] Trade Name

4. Sample Recovery Apparatus

4.1 Probe brush and nozzle brush - nylon bristle or equivalent at least as long as the probe liner and the nozzle respectively.

4.2 Wash bottles - inert to the solvent used in them (usually acetone).

4.3 Sample storage containers - glass with glass or Teflon[1] lined cap or other material which is leak tight, resistant to chemical attack from acetone and allows complete recovery of particulate matter.

4.4 Petri dishes - for filter samples, glass or plastic. Alternately, individual paper envlopes with waxed paper liners may be used, but tare and final weights should not be included in the weight of the envelope or liner.

4.5 Graduated cyliner and/or balance - to measure condensed moisture to within 1 ml or 1 g. Graduate cylinders shall have subdivisions of 2 ml or less and balances shall be sensitive to 1 g.

4.6 Plastic storage containers - air tight containers to store silica gel unless it is weighed at the sampling site or transported to the laboratory in the impinger.

4.7 Rubber policeman - to aid in recovering sample from the train previous to the filter.

4.8 Dessicator - laboratory type using Drierite [1], indicating dessicant or equivalent.

4.9 Analytical balance - accurate and sensitive to ± 0.1 mg.

5. Reagents

5.0 Separating funnel - 500-1000 ml with Teflon [1] stopcock and plug.

5.1 Beakers - 250 ml & 400 ml Pyrex[1] or equivalent.

5.2 Filters - glass fiber filters, without organic binder, of near neutral pH, free of pinhole leaks, and exhibiting at least 99.95% efficiency on 0.3 micron DOP smoke particles. MSA-1160BH or equivalent, individually numbered for identification and pre-weighed as described in Section 6.1.

5.3 Silica gel - indicating type 6-16 mesh, dried at 175°C (350°F) for 2 hours if previously used.

5.4 Water - distilled, with a maximum total residue content of 0.001%. (0.01 mg/ml).

5.5 Acetone - reagents grade with a maximum total residue content of 0.001%. (0.01 mg/ml)

5.6 Crushed ice - any grade, crushed fine enough to provide efficient cooling for the impingers.

5.7 Stopcock grease - acetone resistant, heat stable, silicone grease.

5.8 Diethyl ether - reagent grade with a maximum total residue content of 0.001%. (0.01 mg/ml)

5.9 Chloroform - reagent grade with a maximum residue content of 0.001%. (0.01 mg/ml)

6. Sampling Train Preparation

6.1 Weigh numbered glass fiber filter paper to the nearest 0.1 mg on an analytical balance after dessication over Drierite for 24 hours or more.

6.2 Insert the filter into the filter holder and assemble taking care not to tear or bend the filter. Tighten the filter holder sufficiently to prevent leaks.

6.3 Add 100 ± 1 ml of distilled water to each of the first two impingers.

6.4 Add approximately 200 g of accurately weighed silica gel (± 1 g) to the fourth impinger.

6.5 Alternately after charging each of the impingers with the appropriate material, weigh the impinger and contents on balance to the nearest 1 g.

6.6 Assemble the train as shown in Figure 5-1 and check for leaks as in Section 8.

6.7 Seal the train with aluminum foil, a blanked connector or some other means to prevent contamination.

7. Pretest Preparations

7.1 Select a sampling site and the minimum number of traverse points as described in Source Sampling Method 1.

7.2 Determine the approximate moisture content as described in Source Sampling Method 4.

7.3 Make a preliminary pitot traverse to determine the maximum, minimum, and average pitot reading, duct temperature, and static pressure as described in Source Sampling Method 2.

7.4 Choose a nozzle size based on the range of pitot readings as described in Section 12 such that it is not necessary to change the nozzle size in order to maintain the isokinetic sampling rates for all traverse points.

7.5 Clean the chosen nozzle and probe (the shortest available which will reach all the traverse points), assemble and seal each end with aluminum foil to prevent contamination.

7.6 Attach the probe to the sample case, attach the electrical and hose connections, and turn on the probe and filter heating system. Adjust the heater controls to maintain the appropriate temperatures.

8. Leak Check

8.1 Plug the inlet to the filter.

8.2 With the fine flow adjustment (bypass) completely open, open the coarse flow adjustment completely and adjust to a vacuum of 15 in. Hg by closing the fine flow adjustment.

8.3 After sufficient time has elapsed for stabilization, measure the leakage rate for 1 minute or more and record. A leakage rate of less than 0.02 cfm at 15 in. Hg is acceptable. Use acetone resistant stopcock grease on impingers and ball joints if necessary to seal against leaks.

8.4 Slowly remove the plug from the filter inlet and immediately close the coarse flow adjustment.

9. Particulate Train Operation

9.1 Each point should be sampled a minimum of 2 minutes and a complete set of data readings should be taken at every point. If each point is sampled more than 5 minutes, a complete set of data readings should be taken at equal intervals during the sampling of every point but not less frequent than every five minutes.

9.2 Pack crushed ice around the impingers, turn on the probe heater and adjust so that the gases leaving the probe are 250°F. Add ice occasionally during the test in order to keep the temperature of the gas leaving the train at 70°F or less.

9.3 Position the probe nozzle at the first traverse point (taking care not to allow the nozzle to touch the stack walls) and block off the openings around the probe. Record the initial gas meter reading, temperatures, static pressure and pitot reading on the Particulate Field Data Sheet (Figure 5-5).

> Note: The probe should never be left in the stack when not sampling as particulate will be collected in the nozzle.

9.4 Calculate (as described in Section 12) and record the desired orifice setting, open the coarse flow adjustment and immediately start the timer.

9.5 As rapidly as possible, adjust the orifice reading using the coarse and fine flow adjustments to the desired reading.

9.6 At the end of the first sampling point (or not more than 30 seconds before) reposition the probe nozzle at the next sampling point.

Note the gas meter reading exactly at the end of the first time interval.

9.7 After the pitot readings have stablized, note the pitot reading, calculate the desired orifice setting, and adjust with the fine and coarse flow adjustments to the new setting. This should be done as rapidly as possible to avoid anisokinetic sampling.

9.8 Continue the above steps until all traverse points have been sampled an equal interval of time (except adjusted traverse points as described in <u>Source Sampling Method 1</u>.)

9.9 At the conclusion of the run, close the coarse flow adjustment, note the final gas meter reading and temperatures and withdraw the probe completely.

9.10 Seal the nozzle with aluminum foil as soon as it cools sufficiently to do so, disconnect the probe from the sample case, seal all other openings and transport to the cleanup (or storage) area.

9.11 Throughout the sample run, collect an integrated gas sample for composite analysis as described in <u>Source Sampling Method 3</u>.

9.12 Under no circumstances disconnect or loosen any part of the airtight train until the probe has been completely removed from the stack.

10. Particulate Train Cleanup

10.1 Cleanup should be performed in an area free of wind and airborne dust which may contaminate the sample or cause sample loss. If possible, the train should be cleaned in a laboratory.

10.2 After the probe and nozzle have cooled, remove the end seals and brush while rinsing with acetone into a suitable container (labelled).

> <u>Note</u>: Exercise caution so that none of the rinse is lost and no extraneous material enters the rinse (such as from the pitot tubes).

10.3 Should it be necessary to clean the train in the field, use the following procedure:

10.3.1 Rinse all sample exposed surfaces prior to the filter (including the front half of the filter holder) with acetone. Remove any adhering particles with the aid of a rubber policeman. Place the rinsings in the probe rinse bottle.

10.3.2 Remove the filter without disturbing the particulate cake, place in a petri dish and seal.

10.3.3 Measure and record the volume (or weight) increase of the first three impingers and transfer their contents into a labelled container. Rinse the impingers and interconnects with distilled water and add to the container.

10.3.4 Rinse all sample exposed glassware between the filter (excluding the glass frit filter support) and the fourth impinger with acetone and store in a suitable marked container.

10.3.5 Determine the weight gain of the silica gel in the fourth impinger and record. Alternately transfer the silica gel quantitatively to an airtight container to be weighed in the laboratory.

10.3.6 Collected samples should be analyzed within one week of collection in order to prevent any possibility of biological or chemical degeneration.

11. Analysis

11.1 Dessicate the filter (in the field container) for 24 hours and weigh to constant weight.

11.2 Transfer the acetone rinse (Section 10.3.1) into a tared beaker or evaporating dish. Be sure all particulate is removed from the container. Evaporate the solvent at laboratory temperature and pressure, dessicate for 24 hours and weigh to constant weight ($\pm$ 0.5 mg change in 6 hours or more).

11.3 Transfer the acetone rinse from the back-half (Section 10.3.4) to a tared beaker or weighing dish. Evaporate as in 11.2 and weigh to constant weight.

11.4 Transfer the water in the impingers to a separatory funnel (Teflon[1] stoppered). Rinse the container with distilled water and add to the separatory funnel. Stopper and vigorously shake the separatory funnel 1 minute, let separate and transfer the chloroform (lower layer) into a tared beaker or evaporating dish. Repeat twice more. Repeat the above procedure using three 25 ml portions of diethyl ether in place of the chloroform.

11.5 Transfer the remaining water in the separatory funnel to a tared beaker or evaporating dish and evaporate at 105° C. Dessicate for 24 hours and weigh to constant weight.

11.6 Evaporate the combined impinger water extracts from Section 11.4 at laboratory temperature and pressure, dessicate for 24 hours and weigh to constant weight.

11.7 Evaporate portions of the solvents used in a manner similar to the sample evaporation to determine the solvent blanks.

11.8 Record all laboratory data on the Laboratory Data Reporting Sheet, Figure 5-9.

12. Nomograph Operation

12.1 Correction factor

12.1.1 Determine $\Delta H@$ for the orifice as described in the calibration Section 13.1

12.1.2 Estimate the probable meter temperature, Tm, often 20° F above ambient temperature, H_2O in stack gas, and Ps/Pm (ratio of absolute stack pressure to absolute meter pressure) as described in Section 7.

12.1.3 Determine the correction factor "C" using the correction factor nomograph, Figure 5-2a, as described on the nomograph. Correction of the factor "C" for a pitot Cp other than 0.85 can be made using the following equation:

$$C(\text{corrected}) = C \frac{c_p^2}{(0.85)^2}$$

12.2 Operating Nomograph

12.2.1 Adjust the sliding scale on the operating nomograph, Figure 5-2b, such that the "C" factor determined in Section 12.1.3 is opposite Reference Point A.

12.2.2 Using the preliminary pitot traverse data and duct temperature determined in Section 7, draw a line from T_s to the values of ΔP and select a suitable D (nozzle diameter) from the probe tip diameter scale.

12.2.3 Draw a line from T_s through D (actual diameter of nozzle to be used) and note where the line crosses the ΔP scale.

12.2.4 Draw a line from the ΔP obtained in 12.2.3 to Reference Point B on the ΔH scale and note where the line crosses the K factor scale. This point should be marked for future reference.

12.2.5 During sampling, align the pitot reading, ΔP, with the K factor setting, Section 12.2.4, to obtain the desired ΔH.

12.2.6 If T_s (absolute) changes by more than 50° F the K factor should be recalculated starting with 12.2.3.

13. Calibration

13.1 Orifice and dry gas meter

13.1.1 Connect the components as shown in Figure 5-3. The wet test meter is a 1 cf per revolution with $\pm$ 1% accuracy and capable of operating at a rate comparable to the expected sampling rate.

13.1.2 Run the pump about 15 minutes at an orifice reading of about 0.5 in. H_2O to allow the dry gas meter and pump to warm up and to wet all interior surfaces of the wet test meter.

13.1.3 Gather the information as required in Figure 5-4.

13.1.4 Calculate γ and $\Delta H@$ as described in Figure 5-4. If an average γ of 1.00 $\pm$ 0.01 is not obtained, the dry gas meter must be adjusted. If an average $\Delta H@$ of 1.84 $\pm$ 0.25 is not obtained, the orifice opening should be enlarged or replaced. Additionally the $\Delta H@$ should not vary more than $\pm$ 0.15 over the range of operation of 0.5 to 8 inches of H_2O.

13.1.5 Calibrate the orifice and dry gas meter every month or after every 5 tests whichever occurs first.

13.2 Temperature gauges

13.2.1 Check temperature gauges against mercury-in glass thermometers of certified accuracy or against suitable temperature standards (boiling or freezing points) at least yearly.

13.3 Probe Nozzle

13.3.1 Measure the inside nozzle diameter on at least 10 different diameters - to the nearest 0.001 inch using a micrometer or caliper. The nozzle diameter is the average of these readings to the nearest 0.001 inches.

13.3.2 The largest deviation from the average should not exceed $\pm$ 1% of the average diameter.

13.3.3 Calibrate the nozzle at least before every test.

14. Calculations

14.1 Gas velocity

14.1.1 Calculate the average gas velocity, V_s, from the pitot tube readings and gas temperatures using equation 5-2

$$(V_s)\text{avg} = \frac{K_p C_p}{\sqrt{P_s M_s}} \sqrt{(\Delta P_s T_s)}\text{avg} \qquad (5\text{-}2)$$

Where the symbols and units are the same for equation 2-2 in Source Sampling Method 2.

14.2 Gas volumetric flow rate

14.2.1 Calculate the volumetric flow rate of the gas from the duct area and the average gas velocity using equation 5-3

$$q_s = \frac{0.123A_s\ (V_s)_{avg}\ (1\text{-Bwo})P_s}{T_s} \qquad (5\text{-}3)$$

where the symbols and units are the same as equation (2-3) in Source Sampling Method 2.

14.3 Dry gas volume

14.3.1 Calculate the volume of gas sampled using equation 5-4

$$Q_d = \frac{17.65Q_m\ (P_o + \frac{\Delta H}{13.6})}{T_m} \qquad (5\text{-}4)$$

where Q_d = volume of gas sample, SDCF
Q_m = volume of gas through meter (meter conditions), CF
P_o = barometric pressure, absolute, in. Hg.
ΔH = average pressure drop across the orifice, in. H_2O
T_m = average dry gas meter temperature, ^oR

14.3.2 In the event the gas passing through the dry gas meter was not dry, the above equation must be multiplied by $(1-B_{wm})$ where B_{wm} is the volume fraction of water in the metered gas (assume saturation at the temperature of the last impinger).

14.4 Moisture content of duct gas

14.4.1 Calculate the moisture content of the duct gas from the total volume of water vapor condensed using equations (5-5), (5-6), and (5-7).

$$Q_v = 0.0474\ V_v \qquad (5\text{-}5)$$

where Q_v = volume occupied by water vapor, SCF
V_v = volume of water condensed in impingers and on silica gel, g or ml.

$$m_v = \frac{100\ Q_v}{Q_d + Q_v} \qquad (5\text{-}6)$$

where mv = volume percent of moisture in the sampled gas.

$$m_d = \frac{Q_d}{Q_d+Q_v} = 1-\frac{m_v}{100} \qquad (5\text{-}7)$$

where m_d = volume fraction of dry gas in the sampled gas

14.5 Calculate the molecular weight of the wet gas using the volume fraction of dry gas and the dry molecular weight using equation 5-8.

$$M_s = m_d M_d + 18\ (1-m_d) \qquad (5\text{-}8)$$

where M_s = molecular weight of the wet stack gas, lb/lb mole
M_d = molecular weight of the dry stack gas as defined in Source Sampling Method 3, equation (3-2)

14.6 Calculate the total particulate grain loading and correct to 12% carbon dioxide (when necessary) from the volume of gas sampled, the total weight of particulate sample and the % CO_2 using equation 5-9, and 5-10.

$$C_g = \frac{0.0154\ W}{Q_d} \qquad (5\text{-}9)$$

where C_g = total particulate grain loading, gr/sdcf
W = weight of particulate sample, mg

$$C_g' = \frac{12\ C_g}{\%\ CO_2} \qquad (5\text{-}10)$$

where C'_g = total particulate grain loading corrected to $12\% \ CO_2$, gr/sdcf @ $12 \% \ CO_2$

$\%CO_2$ = percent by volume carbon dioxide as determined in Source Sampling Method 3.

14.7 Calculate the total particulate emission rate from the total particulate grain loading and the volumetric flow rate using equation 5-11

$$C_t = 0.00857 \quad C_g q_s \qquad (5\text{-}11)$$

where C_t = total particulate emission rate, lbs/hr

q_s = Volumetric flow rate in duct, DSCFM as determined in Source Sampling Method 2.

14.8 Calculate the percent of isokinetic sampling rate from equation 5-12.

$$I = \frac{1039 \ T_s Q_d}{V_s P_s m_d D_n^2 \ t} \qquad (5\text{-}12)$$

where I = Percent of isokinetic sampling rate

T_s = Average stack temperature, ^oR

P_s = Average stack absolute pressure, in. Hg

D_n = Average nozzle inside diameter, in.

t = Total sampling time, min.

Q_d = Volume of gas sampled, SDCF

V_s = Average gas velocity, FPM

m_d = Volume fraction of dry gas

15. Minimum Acceptable Test Requirements

15.1 In order for a source test by this method to be acceptable as sufficiently accurate, the following requirements must be met unless otherwise indicated by the Department in writing:

15.1.1 A minimum sample volume of 60 SDCF of gas per run must be sampled.

15.1.2 A minimum run time of 60 minutes on continuous operations or one complete cycle covering at least 60 minutes on cyclic operations. A minimum of two runs per test is required.

15.1.3 The Department is notified in advance of all source tests so that it may have an observer present if desired.

15.1.4 All equipment used in the test shall be as specified in Section 3,4, and 5.

15.1.5 All equipment used in the test shall be calibrated at the specified interval or more often and the calibration data and results included in the test report.

15.1.6 Accurate description of the sampling site including photographs.

15.1.7 Sufficient data to confirm that the sampling rate was within ± 10% of isokinetic.

16. Minimum Test Report Information - the following information concerning the source shall be included in the source test report.

16.1 Boilers

16.1.1 Name of manufacturer, nameplate capacity, and installation date of boiler and associated control equipment.

16.1.2 Control equipment on boiler (including cinder reinjection equipment).

16.1.3 Steam production rate, steam pressure and range of steam flow where possible. Use of a steam flow integrater is desirable.

16.1.4 Fuel composition (including estimated moisture content where applicable).

16.1.5 Opacity readings during or immediately after test by a certified reader.

16.2 Asphalt Plants (See Note 1)

16.2.1 Type, location and capacity of plant.

16.2.2 Control Equipment present.

16.2.3 Pressure drop across control equipment, water pressure on scrubber nozzles when present.

16.2.4 Production rate and type of mix during test.

16.2.5 Dryer fuel and firing rate.

16.2.6 Mix temperature (on drum mix plants)

16.2.7 Fines content of total aggregate feed.

16.2.8 Opacity readings during or immediately after test by a certified observer.

16.2.9 Photographs of plant in operation including plume after steam dissipation.

16.2.10 Special testing or production problems encountered.

NOTE 1: The source test requirements for asphalt plants constructed or modified after June 11, 1973 differ from this method in that only the particulate collected in the front half of the train (from the probe to the filter inclusive) is used for compliance evaluation. The impinger catch, however, must still be reported.

16.3 Incinerators

16.3.1 Manufacturer and capacity of incinerator.

16.3.2 Control equipment present.

16.3.3 Type and quantity of material incinerated.

16.3.4 Charging and stoking times.

16.3.5 Auxiliary fuel used and quantity consumed during test (measured).

16.3.6 Opacity readings during test by a certified observer.

16.3.7 Photographs of incinerator in operation including plume.

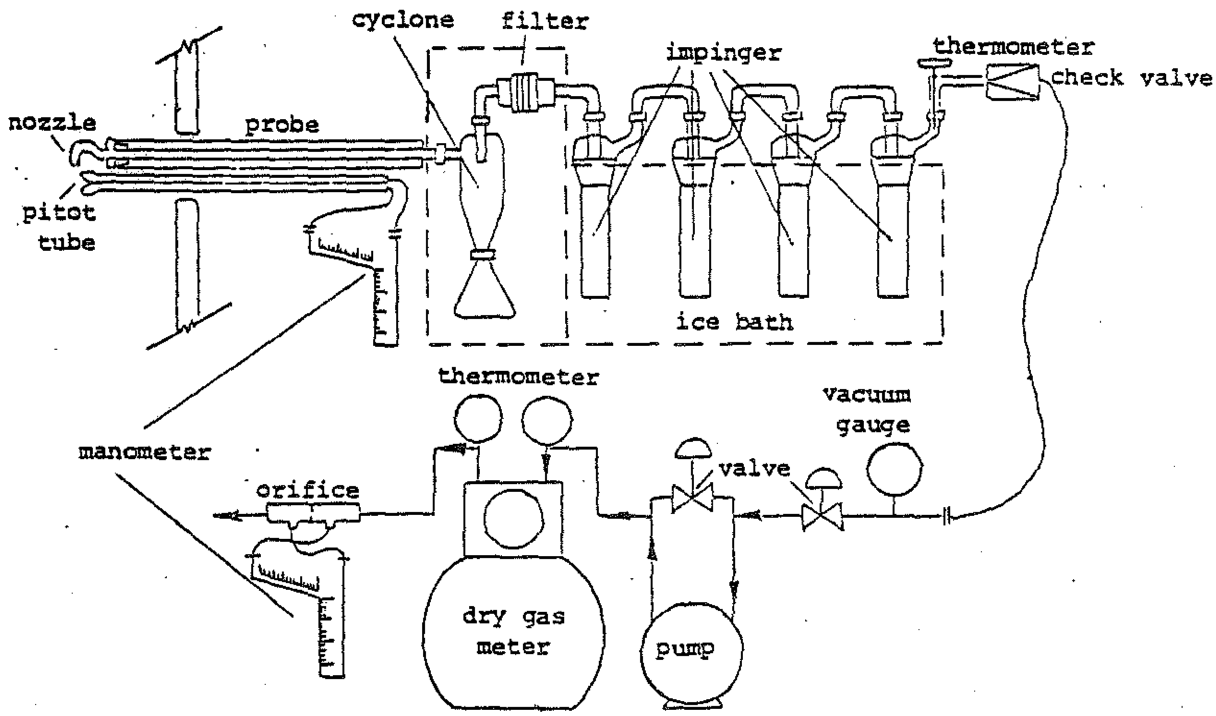

cyclone
filter
impinger
thermometer
check valve
nozzle
probe
pitot
tube
ice bath
thermometer
vacuum
gauge
manometer
valve
orifice
dry gas
meter
pump

FIGURE 5-1

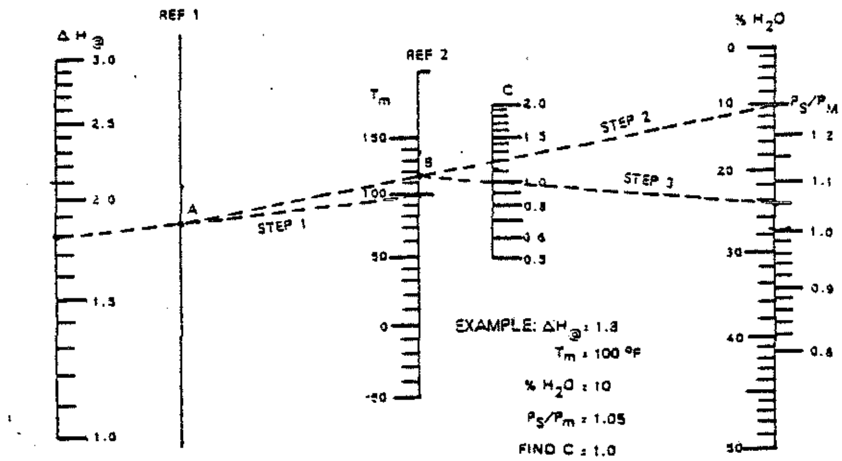


Figure 5-2(a)

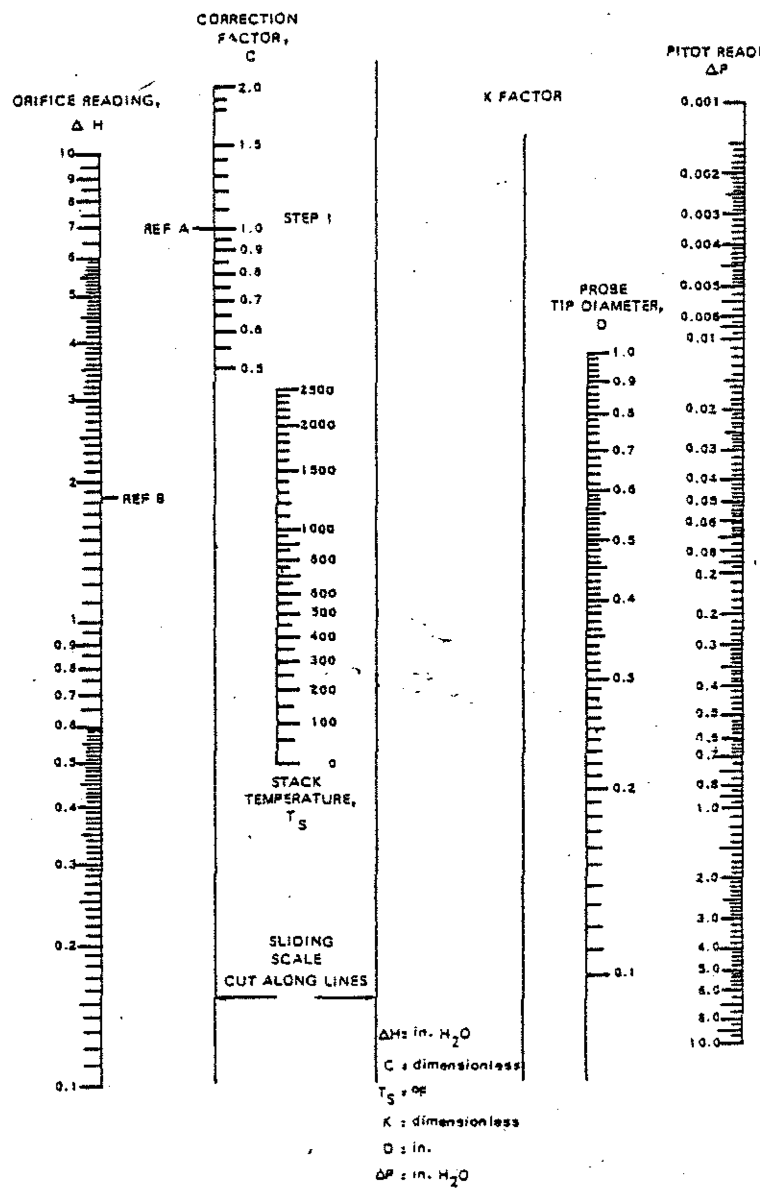


Figure 5-2(b)

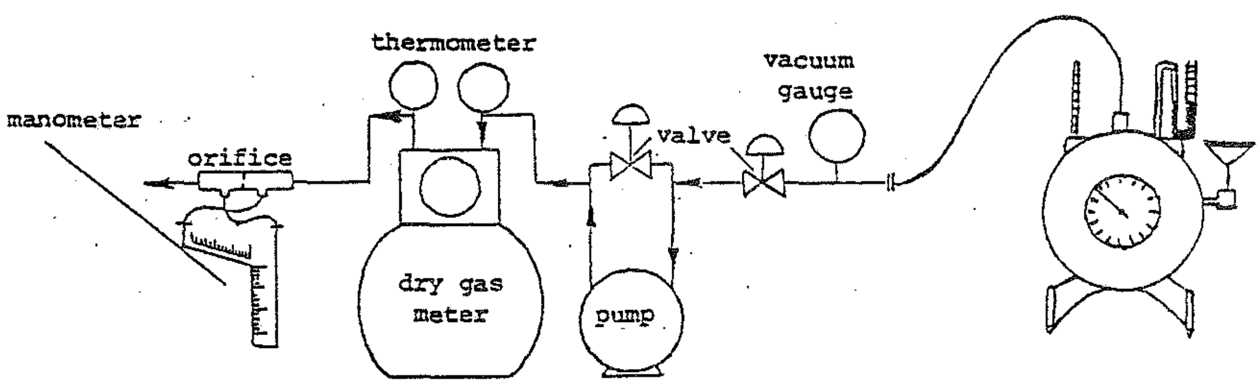

thermometer
vacuum
gauge
manometer
valve
orifice
dry gas
meter
pump

Figure 5-3

CALIBRATION SHEET

Figure 5-4

Orifice Gas Meter Date Barometric Pressure Pb:

Orifice Manometer ΔH in.H_2O	GAS VOLUME Wet Test Meter V_w,cf	Dry Gas Meter V_d,cf	TEMPERATURE Wet Test Meter t_w, °F	Dry Gas Meter Inlet t_{di}, °F	Outlet t_{do}, °F	Average t_d, °F	TIME θ,min.	RESULTS γ	ΔH@
							Average		

$$\gamma = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$$

$$\Delta H@ = \frac{0.0317\ \Delta H}{P_b (t_{do} + 460)} \left[\frac{(t_w + 460)\theta}{V_w}\right]^2$$

Probe Nozzle Date

D_n, in.	D_n, in.	D_n, in

Averages

Pitot Tube Date

Forward ΔP_s	ΔP_{std}	C_p	Reverse ΔP_s	ΔP_{std}	C_p

Average

$$C_p = 0.99 \left[\frac{\Delta P_{std}}{\Delta P_s}\right]^{\frac{1}{2}}$$

SOURCE SAMPLING FIELD DATA SHEET

Figure 5-5a

Plant ______________________

Address ______________________

Source ______________________

Date __________ Run __________

Train No. __________ Box No. __________

Probe Length ______ Probe material ______

Pitot C_p __________

Rinsings:

Other Samples:

Sketch of Sampling Site

DB Temp. ______ WB Temp. ______

Assumed Moisture ______ P. baro ______

Static Pressure ______ $\Delta H@$ ______

"C" Factor ______ Nozzle ______

Stack Dimensions ______________

Train Operator ______________

Box Operator ______________

Orsat

CO_2				
O_2				
CO				

Remarks:

						Orifice ΔH		Gas Meter				
Point	Distance	Clock	Meter Vol.	Pitot ΔP	Stack Ts	Calc.	Act	T in	T out	Vac.	Box T	Imp. T.

Figure 5-5b

Figure 5-6

VELOCITY DATA AND CALCULATIONS

Run No.____________ Date_______________

Plant_________________________________

Sampling Location_____________________

Point No.	Stack Pressure Ps in. Hg gauge	Stack Temp. ts °F	Ts °R	Vel. Head ΔP in. H_2O	(Δ P x Ts)	$S\sqrt{\Delta P \times Ts}$
Avg.						

Ps = absolute pressure - Ps + Po = ______ in. Hg

Ambient temp. = _________°F

Ambient press.= _________ inches of Hg

STACK TEMP. Dry Bulb ________°F

Wet Bulb ________°F

CONST. C = __________

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
VELOCITY DATA AND CALCULATIONS

Run No.________________ Date____________

Plant__________________________________

Sampling Location______________________

Point No.	Distance Inches	Stack Temp. Ts °F	Ts °R	Vel. Head ΔP in H_2O	(ΔP x Ts)	$S=\sqrt{\Delta P \times Ts}$
Avg.						

Static Pressure, Ps______________in. H_2O

Atmospheric Pressure, Pb_________in. Hg

Stack Pressure, Ps_______________in. Hg

Dry Bulb Temp.________°F

Wet Bulb Temp._______°F

Moisture_________%

Figure 5-6 (Revised)

Figure 5-7

COMBUSTION GAS ANALYSIS DATA SHEET

Source ______________________________ Date ____________

Sampling Point Location ______________________________

RUN ____

	CO_2	O_2	CO	N_2
Analysis 1				
Analysis 2				
Analysis 3				
Average				

Time ____________

Test conditions: ____

____

____

____

CO_2	O_2	CO	N_2
Atomic Wt. (44)	Atomic Wt. (32)	Atomic Wt. (28)	Atomic Wt. (28)

________ + ________ + ________ + ________ = Total Atomic Wt.

RUN ____

	CO_2	O_2	CO	N_2
Analysis 1				
Analysis 2				
Analysis 3				
Average				

Time ____________

Test conditions: ____

____

____

____

CO_2	O_2	CO	N_2
Atomic Wt. (44)	Atomic Wt. (32)	Atomic Wt. (28)	Atomic Wt. (28)

________ + ________ + ________ + ________ = Total Atomic Wt.

PARTICULATE SAMPLING CALCULATIONS

Plant ____________________ Sampling Location ____________________

Date of Test ____________________ FIGURE 5-8

Symbol	PARAMETERS TO BE CALCULATED: Definition, Units	Calculating Equation	RESULTS: Run___	Run___	Run___	Avg.
Qm	Sample gas volume at meter conditions, $ft.^3$	Avg. from field data sheet				
H_2O	% H_2O	Moisture escaping last impinger				
tm	Gas meter temp., °F	Avg. fr. field data sheet				
H	Orifice pressure drop in H_2O	Avg. fr. field data sheet				
Po	Barometric pressure (in. Hg)	Field data sheet				
Vv	Tot. vol. of condensed water	Total fr. lab data sheet				
Md	Molecular weight of dry gas	Gas analysis-Atomic Wt.				
Ps	Stack pressure in Hg abs	$.07355 \times Ps' + Po$				
S	$\sqrt{P \times Ts}$	Avg fr. Vel calc. sheet				
Cp	Pitot Tube Coeff.	From Calibration Data				
As	Stack area ($in.^2$)	Field data sheet				
Ts	Stack temp., °R	Avg. fr. field data sheet				
Dm	Nozzle diameter (in.)	Field data sheet				
t	Total sampling time, min.	Total fr. field data sheet				
W	Wt. of particulate sample, mg	Total fr. lab data sheet				
$\%CO_2$	% CO_2	CO_2 analyzer				
Qd	Dry gas sample vol. at std. cond., scf.	$Qd = \frac{17.65\ (Qm)}{(tm+460)}\left[Po + \frac{\Delta H}{13.6}\right]$				
Qv	Tot. vol. of condensed water vapor @ std cond. (scf)	$Qv = 0.0474Vv$				
mv	% moisture in stack gas	$mv = \frac{100\ Qv}{Qv + Qd}$				
md	Mole fraction of dry gas	$md = \frac{Qd}{Qv + Qd}$				
Ms	Molecular wt. of stack gas	$Ms = mdMd + 18\ (1-md)$				
Vs	Stack velocity at stack, fpm	$Vs = 5129(Cp)(S)\left[\frac{1}{PsMs}\right]^{\frac{1}{2}}$				
qs	Stack flowrate at standard cond., scfm	$qs = \frac{0.123\ (Vs)(As)(md)(Ps)}{Ts}$				
I	Percent Isokinetic	$I = \frac{1039\ TsQd}{(Vs)(Ps)(md)(Dn^2)(\Delta t)}$				
Cg	Total particulate grain load., gr/scf	$Cg = \frac{0.0154W}{Qd}$				
Cg'	Grain load. at 12% CO_2 gr/scf	$Cg' = Cg \times \frac{12}{(\%\ CO_2)}$				
Ct	Total particulate emission lb/hr.	$Ct = .00857\ (Cg)(qs)$				

Figure 5-8 (Revised)

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY CONTROL DIVISION

PARTICULATE SAMPLING CALCULATIONS

Plant____________________ Sampling Location____________________

Date of Test____________________

Symbol	Definition, Units	Calculating Equation	Run__	Run__	Run__	Avg.
Qm	Sample gas volume at meter conditions, $ft.^3$	Avg. from field data sheet				
tm	Gas meter temp., ^oF	Avg. from field data sheet				
H	Orifice pressure drop in H_2O	Avg. from field data sheet				
Po	Barometric pressure (in.Hg)	Field data sheet				
Vv	Tot. vol. of condensed water	Total fr. lab data sheet				
Md	Molecular weight of dry gas	Gas analysis-Atomic Wt.				
Ps	Stack pressure in Hg abs	$.07355 \times P\acute{s} + Po$				
S	$\sqrt{P \times Ts}$	Avg. fr. Vel. calc. sheet				
C_p	Pitot Tube Coeff.	From calibration data				
As	Stack area $(in.^2)$	Field data sheet				
Ts	Stack temp., ^oR	Avg. fr. field data sheet				
Dm	Nozzle diameter (in.)	Field data sheet				
Δt	Total sampling time, min.	Total fr. field data sheet				
W	Wt. of particulate sample, mg.	Total fr. lab data sheet				
$\%CO_2$	$\% CO_2$	CO_2 analyzer				
Qd	Dry gas sample vol. at std. cond., scf	$Qd = \frac{17.65(Qm)}{(tm+460)} \left[Po + \frac{\Delta H}{13.6}\right]$				
Qv	Tot. vol. of condensed water vapor @ std. cond. (scf)	$Qv = 0.0474\ Vv$				
mv	% moisture in stack gas	$mv = \frac{100\ Qv}{Qv + Qd}$				
md	Mole fraction of dry gas	$md = \frac{Qd}{Qv + Qd}$				
Ms	Molecular wt. of stack gas	$Ms = mdMd + 18\ (1-md)$				
Vs	Stack velocity at stack, fpm	$Vs = 5129(Cp)(S)\left[\frac{1}{PsMs}\right]^{\frac{1}{2}}$				
qs	Stack flowrate at standard cond., scfm	$qs = \frac{0.123(Vs)(As)(md)(Ps)}{Ts}$				
I	Percent Isokinetic	$I = \frac{1039\ Ts\,Qd}{(Vs)(Ps)(md)(D_n 2)(\Delta t)}$				
Cg	Total particulate grain load., gr/scf	$Cg = \frac{0.0154W}{Qd}$				
$C\acute{g}$	Grain load. at 12% CO_2 gr/scf	$C\acute{g} = Cg \times \frac{12}{(\% CO_2)}$				
Ct	Total particulate emission lb/hr	$Ct = .00857\ (Cg)(qs)$				

Figure 5-9

SOURCE SAMPLING-LABORATORY ANALYSIS OF PARTICULATE SAMPLE

Test ____________________

Date of Test ____________________

CONDENSED WATER DETERMINATION

Run No.	Impinger:	#1	#2	#3	#4	Total Condensate
	Final weight					
	Initial weight					
	Net weight					
	Final weight					
	Initial weight					
	Net weight					
	Final weight					
	Initial weight					
	Net weight					

GRAVIMETRIC RESULTS

Run No.	Contents	Filters	Probe & Filter Holder	Impinger Rinse	Impinger Extract	Impinger Water	Total Wt.
	Beaker No./Vol.						
	Gross wt.						
	Tare wt.						
	Net wt.						
	Blank wt.						
	Final wt.						
	Beaker No./Vol.						
	Gross wt.						
	Tare wt.						
	Net wt.						
	Blank wt.						
	Final wt.						
	Beaker No./Vol.						
	Gross wt.						
	Tare wt.						
	Net wt.						
	Blank wt.						
	Final wt.						

Sample Preparation: Volatiles evaporated at ________ C, Duration ____ hrs
Water evaporated at ________ C, Duration ____ hrs
Desicated at ________ C, Duration ____ hrs
Laboratory Balance Type ____________________

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY

Source Sampling Method 7

Sampling Condensible Emissions From Stationary Sources

1. Principle and Applicability

1.1 Principle: Particulate matter including condensible gases is withdrawn isokinetically from a flowing gas stream. The particulate matter is determined gravimetrically after extraction with organic solvents and evaporation.

1.2 Applicability: This method is applicable to stationary sources whose primary emissions are condensible gases. It should be considered a modification of Source Sampling Method 5 and applied only when directed to do so by the Department.

2. Sampling Apparatus (Figure 7-1)

2.1 The probe, sampling train, and metering system are the same as outlined in 3. Sampling Apparatus of Source Sampling Method 5 with the following exceptions:

2.1.1 The heated filter and cyclone are optional, but should be used if significant quantities of solid particulate are present.

2.1.2 An unheated glass fiber filter is placed between the third and fourth impingers.

3. Sample Recovery Apparatus

3.1 The sample recovery apparatus is the same as outlined in 4. Sample Recovery Apparatus of Source Sampling Method 5.

4. Reagents

4.1 The reagents are the same as outlined in 5. Reagents of Source Sampling Method 5.

5. Sampling Train Preparation

5.1 The sampling train preparation is the same as outlined in 6. Sampling Train Preparation of Source Sampling Method 5 with the following exception:

5.1.1 Insert numbered and weighed filters into each of the front (if used) and rear filter holders.

6. Pretest Preparations and Lead Check

6.1 The pretest preparations and leak check are the same as outlined in Sections 7 and 8 of Source Sampling Method 5.

7. Condensible Particulate Train Operations

7.1 The train operation is the same as outlined in Section 9 of Source Sampling Method 5. It is important to note that the gas temperature leaving the last impinger must not exceed 70°F as temperatures above this may cause loss of condensible material by revolatilization.

8. Condensible Particulate Train Cleanup

8.1 Cleanup should be performed in an area free of wind and airborne dust which may contaminate the sample or cause sample loss. If possible, the train should be cleaned in a laboratory.

8.2 After the probe and nozzle have cooled, remove the end seals and brush while rinsing with acetone into a suitable marked container.

Note: Exercise caution so that none of the rinse is lost and no extraneous material enters the rinse (such as from the pitot tubes or condensed material from the outside of the nozzle).

8.3 Should it be necessary to clean the train in the field, use the following procedure:

8.3.1 Thoroughly rinse all sample exposed surfaces prior to the front filter support, with acetone. Remove any adhering particles with the aid of a rubber policeman. Place the rinsings in the probe rinse bottle. If the front filter is not used, all sample exposed surfaces prior to the first impinger should be included in this rinse.

8.3.2 Remove the front (if used) and rear filters, place in a petri dish and seal. Since a heavy loading of condensible material on the rear filter may leave a residue in the filter container which would necessitate removal with solvent, glass petri dishes are preferred.

8.3.3 Measure and record the volume (or weight) increase of the first three impingers to the nearest 1 ml (or 1 g) and transfer their contents to a labeled container. Rinse the impingers and interconnects with distilled water and add to the container.

8.3.4 Rinse all sample exposed glassware between the front filter (if used) or the first impinger (if the front filter is not used) and the fourth impinger (including glass filter frits) with acetone and place in a suitable marked container. If the moisture condensate in Section 8.3.3 was determined by use of a graduated container, it should also be rinsed with acetone and the rinse added to the impinger rinse container.

8.3.5 Determine the weight gain of the silica gel in the fourth impinger and record. Alternately transfer the silica gel quantatively to an air tight container to be weighed in the laboratory.

8.3.6 Collected samples should be analyzed within one week of collection in order to prevent any possibility of biological or chemical degradation.

9. Analysis

9.1 Desiccate the filter(s) at 70°F or less in the field container for 24 hours and weigh .

Note: In some cases, desiccation may give rise to a slow vaporization of the condensible material. Therefore it is not recommended that an attempt to weigh to constant weight be made.

9.2 Transfer the acetone rinse (Section 8.3.1) into a tared beaker or evaporating dish. Rinse the container with acetone (police to remove particulate) and add the rinse to the beaker. Evaporate the solvent at 70°F or less and laboratory pressure, desiccate 24 hours and weigh . See note in Section 9.1.

9.3 Transfer the acetone rinse from the impingers (Section 8.3.4) to a tared beaker or evaporating dish and treat as in Section 9.2.

9.4 Transfer the water (Section 8.3.3) to a separatory funnel. Rinse the container with distilled water and add to the separatory funnel. Add 25 ml of chloroform to the separatory funnel, stopper and vigorously shake 1 minute, let separate and transfer the chloroform (lower layer) into a tared beaker or evaporating dish. Repeat twice more. Repeat the above extraction using three 25 ml portions of diethyl ether in place of the chloroform. Transfer the ether (upper layer) to the same container as used to contain the chloroform.

Note: It is necessary to rinse the field container for water (if used) with solvent. This rinse may be made using the extracting reagents in which case it is added to the impinger extract container or with acetone in which case it is added to the container in Section 9.3.

9.5 Transfer the remaining water from the separatory funnel to a tared beaker or evaporating dish and evaporate at 105°C . Desiccate for 24 hours and weight.

9.6 Evaporate the combined impinger water extracts from Section 9.4 at 70°F or less and laboratory pressure, desiccate for 24 hours and weigh . See note in Section 9.1.

9.7 Evaporate portions of the solvents used in a manner similar to the sample evaporations to determine the solvent blanks.

9.8 Record all laboratory data in the Laboratory Data Reporting Sheet, Figure 5-9, Source Sampling Method 5.

10. Calculations

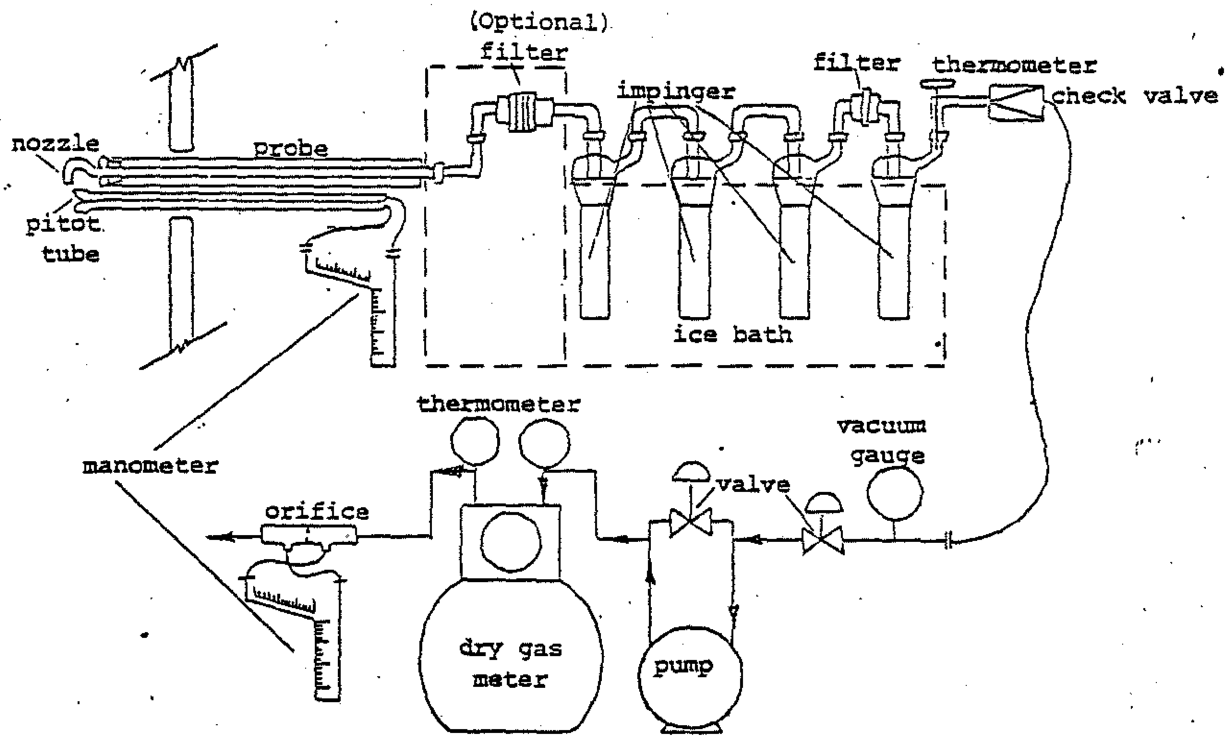
10.1 The calculations are the same as outlined in 14. Calculations of Source Sampling Method 5.

11. Minimum Acceptable Test Requirements

11.1 The minimum acceptable test requirements are the same as outlined in 15. Minimum Acceptable Test Requirements of Source Sampling Method 5.

12. Minimum Test Report Information

12.1 The test report should contain sufficient information about the source to accurately define its operation during the test. Also sufficient data and calculations shall be included to document the source test results.



(Optional)
filter
impinger
filter
thermometer
check valve
nozzle
probe
pitot
tube
ice bath
thermometer
vacuum
gauge
manometer
valve
orifice
dry gas
meter
pump

Figure 7-1

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY

Memorandum

To: Environmental Quality Commission Date: 6/1/84

From: Fred Hansen

Subject: Hearings Report for Proposed Woodstove Certification Rules

Attached are the Hearings Officer Reports and copies of the written testimony the Department received concerning the proposed woodstove certification rules.

Attachment 1 contains the Hearings Officer Reports and written testimony received at the hearings:

Part A - Portland
Part B - Bend
Part C - Eugene
Part D - Medford
Part E - Pendleton

Attachment 2 contains a summary and copies of written testimony received by the close of the hearing record, May 4, 1984.

Attachment 3 contains copies of written testimony received after the close of the hearing record.

/cs
Attachments

PORTLAND

May 1, 1984 - Afternoon

Graig Spolek described the composition of the Woodstove Advisory Committee and its mission and mode of operation. Committee members were well-informed on the technical issues related to the mission and extensively discussed the social and economic implications of the committee effort. From the outset, committee members were concerned about the limited data base and test conditions used. However, both DEQ and the committee used the same data. Consequently, their differing recommendations arise from differences in interpretation. DEQ incorporated committee recommendations on testing procedure, performance grading, and the concept of a staged standard. This shows DEQ's basic appreciation of the committee's credibility. DEQ's rejection of the committee's recommended 9/4 standard is inconsistent and mistaken. The advisory committee's recommendation should be adopted.

Doug Anderson of Underwriters Laboratory, addressed issues relating to aspects of laboratory accredidation and product certification. The essential functions of a product certification program are initial testing and examination to determine compliance with applicable requirements, a follow up program, a system of controlled labeling and marking, and procedures for corrective action in case of noncompliance. Prototype testing should be subject to initial production inspections at the factory by qualified testing laboratory personnel. An advantage is a reduced likelihood of product recall. A testing laboratory procedure comparable to the one used by the Oregon Department of Commerce is preferrable to the proposed procedure in the woodstove regulations. (See OAR 814-22-160.)

Gerald Griswold of Anchor Tools & Woodstoves, Inc., believes that DEQ has abandoned a responsible education program for a program of unrealisticly restrictive regulation. Implementation of a standard excluding all but one type of unproven technology (catalytics) is irrational and counterproductive of reducing emissions from woodburning stoves. DEQ's data development process was faulty and conjectural, based on DEQ's use of a very small stove designed with midrange heating. The Medford airshed model is suspect for failure to separate the contribution of woodstove emissions from those of other sources. If the Medford airshed is used the Medford wood supply (65 percent hardwood, 35 percent fir) should be used. Because Medford is the worst case airshed in the state, testing should be consistent with the needs of the Medford airshed. In short, DEQ should use a "real world" model of home woodburning conditions and homeowner burning habits. The regulations should be limited to the exceedence airshed. The particulate contribution from recreational fireplaces and wood furnaces should be considered in the airshed analysis. Anchor Tools & Woodstoves, Inc. believes that DEQ has subverted the legislative intent in an effort to create a self-serving bureaucratic boondoggle. The proposed testing fees are too high. The Woodheating Alliance comments and testimony are supported.

Richard Blackburn of A. S. Yotul and Yotul USA urges the Environmental Quality Commission to review and adopt the technical arguments presented by the Woodheating Alliance. Failure to do so will result in destruction of the woodstove industry. Yotul has found Oregon a fruitful market and has responded by being responsible and supportive of sound regulations. Their negative reaction to the proposed standard is not the reaction of a company unwilling to accept regulation but is an effort to achieve a rational test methodology and a supportable standard.

Daniel Melcon is a self-employed independent sales representative in the woodstove industry and a co-owner of a retail stove shop and chimney sweeping company. He is involved in trade associations and writes for a variety of woodstove industry publications. The interim standard of 15/6 will decimate the woodstove industry by eliminating 95 to 98 percent of the models available in stores today. Few, if any, manufacturers will spend the research and testing monies to develop a stove for an interim standard. No noncatalytic technology is anticipated which will allow manufacture of marketable stoves able to meet a 7 or 9 standard. The standard's undue stringency will encourage circumvention of the law by bootlegging stoves from other states or buying underground stoves. The traveling baseline (average level of emissions for stoves in the field) was originally set at 40 grams per hour and now has dropped to 30 grams per hour. If the baseline is 30, the interim standard will only produce a 50 percent reduction in emissions, but if a higher baseline is used the reduction will be greater. An 80 percent reduction in emissions is now postulated by DEQ staff although, during the legislative process, a 68 to 75 percent was used. Mr. Melcon believes that air quality may be improving because firewood consumption has been decreasing. DEQ should educate the public to induce voluntary air quality improvement efforts. He urges a program that is reasonable, feasible, and technologically achievable.

R. Bruce Snyder appeared on behalf of the Associated Oregon Industries Air Quality Committee, one of the organizations which supported legislation to establish emission performance standards for woodstoves. He believes that industrial, commercial, and residential users of the airshed should share the obligation to keep it clean. Particulate emissions from residential wood combustion exceed the amount of particulate emitted from industry in the Portland area and about equal the amount emitted from grass burning in the Willamette Valley. Continued exceedence of air quality standards can mean fewer jobs due to resulting industrial growth limitations. Presently, Portland, Eugene-Springfield, and the Medford-Ashland areas are in a nonattainment status for particulates and other areas verge on nonattainment. If nonattainment exists for a particular pollutant, new or expanded industrial facilities must offset proposed new emissions with reductions from existing emissions. Offset requirements make industrial expansion difficult as potential offsets are scarce. AOI urges a standard based on available technology with significantly reduced emissions which will attract current woodstove owners to replace older, inefficient models.

Michael Sciacca is Technical Director of the Woodheating Alliance, which is the principle trade association for manufacturers, distributors, retailers, testing laboratories, and others directly involved in the manufacture, sale, and testing of wood fueled appliances, including the woodheating stoves which are the subject of the proposed rules. He stated that although the proposed woodstove emission standards appear to be rational and defensible, they are founded on a very tenuous data base. The proposed standards depend on a series of assumptions which are unsupported at best, and questionable at worst. There is not enough data at present to permit WHA to be comfortable with the DEQ proposal. The industry wants a woodstove certification program with which it can grow and develop and serve the energy needs of the public. Mr. Sciacca believes there is little or no verifiable connections between the ambient atmospheric loading of particulates contributed by woodstoves, and the DEQ recommended reductions in emission rates from woodstoves. The legislation that prompted the proposed regulations was based on an anticipated reduction of 68 to 75 percent of ambient woodstove generated particulate, not 80 percent. WHA believes that DEQ's assumptions significantly and erroneously underestimate the particulate emission rates from existing woodstoves. Because DEQ has proposed an 80 percent reduction from what it assumes to be the existing emission rates, it has come up with proposed rates which are far more stringent than are necessary to achieve the desired ambient reductions. For example, DEQ has assumed, on the basis of a single set of test data under some questionable conditions, that the average woodstove in Oregon emits at the rate of 30 to 34 grams per hour for 12 hours each day for six months of each year. Industry data suggests that woodstoves actually emit in the range of 50 to 60 grams per hour under shorter time spans and with heavier fire box loadings. WHA suggests that a 15/6 grams per hour rate will actually achieve a 75 percent reduction. This is the rate it urges the EQC to adopt effective in 1986. Further, the Commission should leave open the question of additional reductions in 1988 or thereafter. This will permit development of rational and verifiable data. WHA offers a pledge to cooperate with the DEQ in the development of the data. Further, WHA suggests that (1) the proposed certification procedures should be revised to reflect more realistically the actual conditions under which woodstoves are operated and the fuels which are actually burned in the home; (2) the proposed rules should contain a provision under which a manufacturer can declare certain information in its application to be proprietary and confidential so as to protect its design and trade secrets from its competitors; (3) independent review of design modifications by DEQ, in addition to laboratory certification, is duplicative and wasteful, and should be unnecessary; (4) recertification of an approved woodstove design at five-year (or any other periodic) intervals is unnecessary once the stove has been certified and where no modifications have been proposed; and (5) the Condar Particulate Emission Method should be adopted as being superior to the proposed Oregon Method Seven.

John Powell represents the Wood Energy Institute-West (WEI-West), an association comprised of woodstove industry members including retailers, distributors and manufacturers of woodstoves. Many woodstove industry members supported passage of woodstove legislation, acknowledging the need to improve air quality and agreeing that a reduction of emissions from woodstoves would have to be a part of that air quality improvement.

Nonetheless, the group opposes the proposed rules as establishing unreasonable emission standards. In testimony before the 1983 Legislature, DEQ consistently testified that statewide woodstove certification would reduce particulate emissions by 68 to 75 percent by the year 2000. The proposed rules insist on a reduction of 80 percent. The Legislature was assured that the technology to meet proposed certification standards would be currently available and on the market. The proposed 7/3 standard is technology forcing but provides no realistic prospect of achievement. The Legislature accepted assurances that many of the clean burning stoves on the market would meet the standard. Test results indicate that the proposed standard eliminates most existing woodstoves by 1986 and all but a prototype of a stove with a combustor by 1988. No noncatalytic stove meets the proposed 7 grams per hour standard and only 1 prototype with a catalyst approaches the 3 grams per hour standard. The DEQ proposal is based on a phased standard, implying the industry will have time to meet the final standard. However, the 1986 standard eliminates all but the small noncatalytic stoves and some catalytic stoves. The proposed rules direct the woodstove industry to a catalytic technology. The elimination of noncatalytic technology is not good for consumers or air quality. The Wood Energy Institute West questions the advisability of depending on user replacement of combustors since it will require a substantial cash outlay and the removal and installation of new combustors. Catalytic technology in woodstoves is relatively new and subject to maintenance problems. The Commission should understand and recognize the value of wood energy as an alternative energy resource. Costs of providing home heating are escalating. Wood provides a viable alternative with diminished cost. The WEI-West believes it is possible to set emission standards which will substantially reduce particulate emissions from woodstoves while avoiding the devastation the proposed rules will cause industry and consumers.

Roger Rook, attorney for Heating Energy Systems, Inc., a local woodstove manufacturer, believes that a 7/3 standard will limit available woodstoves to those with catalytic converters. The catalytic converter is not practical. It will not be used as designed and will stop functioning eventually, will need to be repaired or replaced, and will result in an overall long range worsening of air quality. Heat Energy Systems, Inc. accepts a 15/6 standard but fears that the 7/3 standard will be a death blow to the woodstove industry.

Robert J. Lonzway of Northwest Energy Wholesale traces his Oregon origin to 19th century ancestors and served as a proponent of the Oregon spirit of voluntary cooperation for the public good. He accused the agency of creating a bureaucratic red tape quagmire and of deception in abandoning the advisory committee recommendations.

Tim Nissen, owner of Willamette Woodstoves, opened his woodstove specialty store after the passage of HB2235 authorizing DEQ regulation of woodstoves. He assumed that the woodstove emission standard would be reasonable and now believes he was wrong. He states that DEQ's claim that an 80 percent reduction in woodstove emissions is required to meet federal clean air standards in the Portland and Medford airsheds is based on an air quality model that contains naive and erroneous assumptions about consumer behavior, supply and demand economics, and growth. There is no evidence that airshed capacity is limiting Oregon's economic growth, or that reductions in particulate violations will encourage an influx of industry. A very restrictive emission standard will sharply reduce available woodstove models. Without a variety of products, the hardware and building supply places and specialty stores which sell woodstoves will no longer find the products profitable. The proposed 1986 standard comes close to outlawing woodstoves and the 1988 standard actually does constitute an effective ban. Mr. Nissen's business tried to see the woodstove bill as a marketing opportunity, not as a problem. However, although he carries the cleanest burning stoves available, he has sold a negligible number of these products because they are far more costly but only slightly more efficient than other models. The woodstove industry offers good employment in Oregon directly to woodstove sellers and indirectly to wood suppliers, masons, installers and chimney sweeps. Salem complies with federal clean air standards, yet the woodstove regulations affect the Salem area suppliers. The proposed emissions standard is based on best case assumptions about stove sales and technological development while it is based on worst case assumptions about the economic rationality of the woodburning public. A test method that does not discriminate against conventional stoves is needed and an emission standard that will favorably impact air quality while not stifling development of a viable Oregon industry is essential.

Joseph Weller, State Program Director, Oregon Lung Association, urges a single stage 7/3 standard. The goal of a woodstove emission standard should be to bring air quality into compliance with federal clean air standards. Economic and political concerns should not be a consideration in the agency's recommendation. If after good faith efforts, the woodstove industry cannot meet a 7/3 standard by 1986, the Commission could relent. If DEQ assumptions about stove replacement and maintenance, burning practices, and stove purchases are overly optimistic, even a 7/3 standard may not ensure necessary airshed improvements.

John A. Charles, Executive Director of the Oregon Environmental Council (OEC), urges adoption of a single-stage 3 grams per hour standard for all stoves effective July 1, 1986. Testing shows that technology to meet this standard exists today. An 80 percent reduction in emissions from residential woodstoves is the minimum reduction necessary to meet Oregon's total suspended particulate ambient air standard.

A two-stage standard is unsatisfactory because it will delay the particulate reduction program; the second phase may never be implemented (as was the case with some standards for aluminum plants); and a phase-in program will put added burden on all other sources of particulate in the nonattainment airsheds.

A single standard should apply to catalytic and noncatalytic stoves as sub-optimal particulate levels are too likely to occur in noncatalytic stoves after degradation of the equipment.

OEC believes the agency must conform to the wording of the statute authorizing woodstove regulation without concern for the legislative history of the unambiguous statute. As written, the statute does not require the Commission to implement the statute in a way that would keep both catalytic and noncatalytic technologies economically viable.

Keith Cochran served on the Woodstove Advisory Committee. He reports that the committee was required to act under pressuring time constraints and eventually proposed 15/6 and 9/4 standards in an effort to reach a unanimous posture. He expressed his belief that DEQ staff had improperly manipulated the Woodstove Advisory Committee's operation and improperly screened its access to information. Mr. Cochran supports the Woodheating Alliance position because he feels too many questions remain unanswered. He questions whether the testing methodology, procedures, and data relied on by DEQ are valid and whether the procedure is workable. Mr. Cochran provided a compilation of test data from which he infers that the data base used by DEQ in developing the recommended standards was based on a single Blaze King prototype. He recommends delay in establishing a standard until air studies prove the amount of reduction required and until the industry is better able to control emissions. Wood heating helps conserve nonrenewable resources. Current Oregon business should not be destroyed to make room for new industry.

Charles Schade, M.D. served as a medical advisor to the Woodstove Advisory Committee. He supports the 7/3 standard proposed by DEQ staff. Protection of public health is the essential purpose of air quality laws. He believes it is unfortunate but sometimes unavoidable that private industry is regulated out of business in a necessary effort to achieve that goal.

PORTLAND

May 1, 1984 - Evening

Lois Renwick, owner of Irons In The Fire, a specialty retail woodstove shop, located in Portland, Oregon, purchased her business almost four years ago. She believes the proposed woodstove standard will curb product selection. She will cease operating her store if she cannot operate according to a high business standard of service. The public will lose the benefits of free literature, counseling on stove selection, and advice on safety and installation. Oregon will be viewed as a state which discourages and dismembers small businesses because of government regulation.

Bette Hume is the president of Klickitat Enterprises, Inc., an Oregon corporation that distributes Kent Heating products in the United States. She served as a member of the Oregon Woodstove Advisory Committee. An early supporter of woodstove legislation, she relied on Department assurances to the legislature and at committee meetings that the regulations to be proposed and promulgated by the Commission would be balanced, providing for the improvement of the Oregon airshed, while maintaining a reasonable standard that woodstove manufacturers could meet. During the legislative hearings, Department proposed a goal of 65 to 75 percent emissions reduction. Currently, the Department seeks an 80 percent emissions reduction. The data base on which the Department relied in proposing a two-stage 15/6 and 7/3 standard appears unreliable. The second stage standard will have a seriously chilling effect on the woodstove industry, will eliminate virtually all noncatalytic woodstoves using existing technology from the Oregon market, will increase the cost to consumers of woodheating, and will encourage purchase of nonconforming woodstoves from outlets in other states. Ms. Hume urges the Commission to adopt a 15/6 standard effective July 1, 1986 and to defer promulgation of any standard for 1988 until additional data has been accumulated and examined.

Bill Smith is a consumer, user of woodstoves, and a member of the woodstove industry. He believes the woodstove industry has helped the United States move toward energy independence. He believes auto emissions should be addressed in Medford and Eugene before woodstove emissions are regulated. He notes that fireplaces are used as garbage incinerators yet they are not regulated. Oregon is 47th nationally in hospitality to industry. Oregon is the woodstove capital and the industry should not be discouraged. The proposed regulations will lead to out-of-state stove purchases. Oregon may become a national park where people will come to listen to trees grow. To avoid this, jobs, business, and commerce must be the state's top priorities.

Paul B. Stegmeier, consultant, lecturer and writer, credits his work for raising the consciousness and improving the focus of the woodheating industry toward safer, cleaner, more responsible development of products and practice related to the proper use of woodheating systems. He is concerned that the goal of providing cleaner air for Oregon through improved products will be jeopardized by an unrealistic and excessively stringent proposed emission standard. He believes that many gaps exist in the chain of assumptions and proof necessary to objectively set in motion the machinery to control and regulate future emissions from woodstoves. The 7/3 standard may discourage development of the woodstove product after 1988. Consumers will be reluctant to give up their old stoves in favor of the more repair-prone new stoves. As the choice of complying products is reduced, the number of stove dealers will decrease, leaving fewer knowledgeable dealers available to serve the public in providing education and advice on safety and clean woodheating. The 15/6 grams per hour standard for 1986 will provide at least a 50 percent reduction in emissions from woodburning appliances. It will allow several technologies to be used in meeting the clean air goal. It will afford a broader base of consumer choice and support a more viable marketplace encouraging manufacturers to shoot for an attainable target.

Robin Fellenger of All-Ways Warm Co., believes that the proposed regulations will put Oregon woodstove dealers out of business. The proposed standards will funnel business to out-of-state suppliers and marketers of mail order and homemade stoves and encourage consumers to hold on to their older, poorly designed woodstoves. The regulations do not ensure education of woodstove users, although there seems to be consensus within the industry that as consumers are educated, they will gradually and voluntarily replace their stoves with cleaner burning, more efficient models. The regulations fail to provide for regulation and testing of the fuel used in woodstoves. Rather than dictating the standards, DEQ should cooperate with the industry and encourage voluntary improvement of stoves and their use.

Kurt Rumens is president of Lopi International, Ltd., as well as a member of the Board of Directors of the Woodstove Heating Alliance. He provides testimony on behalf of Lopi. When the woodstove emissions reduction program was initiated, Lopi directed its engineering staff to take a responsible position to comply with or surpass whatever standards the DEQ proposed. In March, 1983, in a series of tests conducted by OMNI Environmental Services, Lopi surpassed the then proposed DEQ standard (noncatalytic). The Lopi product has since been used by the DEQ in legislative hearings as one of the twelve products that would comply. Lopi has also contributed and invested technological advice and funds to verify emissions reduction efforts. Lopi supports the Woodstove Heating Alliance approach and will not endorse or continue to invest time or funds "to comply with what clearly has evolved from a reasonable approach, to a combination of misrepresented figures and manipulated data by the DEQ that will indeed eliminate the opportunity for the Oregon homeowner to purchase a new alternative energy appliance after July, 1988."

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WOODSTOVE ADVISORY COMMITTEE: SUMMARY OF ACTIVITIES

Graig Spolek, Chair

In testimony before the hearings officer for the Environmental Quality Commission, I would like to summarize the activities of the Woodstove Advisory Committee. The DEQ has forwarded the final recommendations of that committee, so they will not be repeated here. Rather, the background information leading to those recommendations and their perceived validity will be highlighted.

The Woodstove Advisory Committee was formed to include citizens from a wide range of backgrounds and disciplines that span the parties most immediately impacted by the woodstove certification program. Representation included woodstove manufacturers and retailers, and members of the woodstove service field; these members were initially perceived to possibly be anti-control. Also included were representatives of environmental groups, state and local government, and stove testing labs; these, possibly pro-control. A member of the scientific community was also elected and, presumably unbiased, was selected to chair the meetings. Finally, two medical advisors were included in non-voting positions. All committee members served on purely a voluntary basis. The majority of the committee members had formal scientific training, which was essential since several of the issues addressed were very technical and could only be discussed on that basis.

The mission of the Advisory Committee was clearly stated from the beginning of deliberations, "to aid and advise the EQC in the adoption of emission performance standards and emission and efficiency testing criteria for wood stoves." The chair tried to limit committee discussion to those issues directly connected to this mission.

The committee met once a week, each meeting lasting three hours or more (sometimes much more), for about twenty meetings. Outside of the meetings, much more time was spent by each member in reviewing the technical literature on woodstove testing and performance. Included in that set of research reports were all work conducted by the DEQ (both experiments and surveys) and most of the work published by national and international workers in the area of woodstove research. Most of these works were located and provided to the committee by the DEQ staff. They have been accused of selectively filtering the information in this step; there is no reason to suspect that any omissions were other than inadvertant. The committee also invited and listened to woodstove researchers present their very latest work that has not had time to reach the published literature. As a result of these efforts, the members of the Advisory Committee had a complete picture of the technical issues related to their mission.

Since there were also social and economical issues related to the certification program, the committee members had extensive discussions with persons well versed in these areas. Specifically, we met with woodstove manufacturers from around Oregon, the nation, and other countries, as well as woodstove distributors and retailers. Further meetings were held with the WHA Technical Subcommittee, WHA officers and technical personnel, independent consultants, advisors, manufacturing representatives, and government officials from other states with woodstove emissions problems.

Following this extensive information gathering period, the committee conducted extensive discussion of each issue to be addressed. Throughout, we worked very closely with the DEQ, for they provided the technical support as needed. The DEQ provided a set of recommendations for testing procedures and the emission standard based upon their interpretation of, and projections from, the data base. From the beginning, many committee members expressed concern with the limited size of the data base, and the fact that those tests that had been performed were under different conditons, used different fuels, burned at different rates, etc. The DEQ staff concurred with the concern, but felt that it was possible to make reasonable recommendations from the existing data, and that their set of recommendations reflected that. Very early in the meeting schedule, at the second meeting, the DEQ was requested to perform more tests, but replied that it was not feasible within existing time and money constraints. Later, both the time and money were found to perform those tests. But at that time, the committee was informed that it would have to make its decisions based on the available data. This was, of course, the exact same data base that the DEQ had to form their recommendations. Hence, any difference between DEQ and the Advisory Committee recommendations had to arise from differences in interpretation. Notwithstanding such limitations, the committee formulated a set of recommendations that will meet the air quality demands of Oregon while accomodating the national concerns. These recommendations are sound in three important respects: scientifically, economically, and environmentally.

The EQC has before them a set of the final recommendations of the Advisory Committee; only a few of the highlights will be mentioned here. The stove testing procedure mirrors many of the original DEQ recommendations, with a few important modifications. Overall, it is a methodology that can accurately measure stove performance for a reasonable cost, and is representative of actual home use conditions. Most of the modifications required by the committee were designed to enhance this actual use similarity. The committee required a fuel charge where the individual wood piece size is scaled to the size of the stove, and is stacked the way cordwood would be stacked rather than in a crib configuration. Also, the committee recommended that the stove be tested at different burn rates that span the range that are actually used in the home, rather than testing at a single burn rate as the DEQ had originally suggested. The DEQ incorporated both of these recommendations into theirs, which implies that they afforded credibility to the views of the committee.

The committee spent very much time deciding on the best way to grade the performance of a given stove and on the passing grade for Oregon; again, many of the results were not in accord with the original DEQ recommendations. It was suggested that not only should the stove be tested over a wide range of burn rates, but it should be graded in that way, since the heating rate in the home will reflect the current demand. Thus, a weighted averaging technique was developed to use the actual weather patterns of Oregon to generate the grade for a stove. The origal DEQ recommendation called for testing at a single burn rate. Again, the DEQ apparently saw the rationale of the committee's suggestion for they incorporated it into their final set of recommendations.

Another aspect of the emission standard recommendation that the committee felt was important enough to incorporate was the concept of a two-stage standard. Much concern was expressed over the long term or broad scale viability of catalytic converters, even though their laboratory performance is impressive. If the woodstove industry has more time and an intermediate standard that would indicate a potential reward for research into non-catalytic technology, then perhaps they would pursue that avenue. The resulting developments in mechanical enhancement, even if incapable of achieving the necessary reduction in emissions, could be incorporated into clean burning designs in concert with catalysts to provide a greater margin of safety if the catalysts themselves did not live up to their expectations. Therefore, the Advisory Committee recommended a two-stage standard as the most likely approach for encouraging non-catalytic technology. With some reluctance, the DEQ included this concept also in their final recommendation set.

As can be seen, the Advisory Committee must have been promoting rather convincing arguments, for in many critical areas the DEQ adopted the committee recommendations in favor of their own original ideas. This should not be a surprise, for this was the purpose of the committee and it reflects the qualifications and preparation of the committee members. Based on the available data, the committee was equally qualified to recommend an appropriate passing grade for stoves.

The committee recommended two different passing grades, one for the first phase of the certification program and a second, more stringent one for the second phase. The first, the 15/6 standard for 1986, was projected to be achievable in that time frame; it was adopted by the DEQ because it was reasonable. The second standard was identified to be more critical since it would become the long term standard that is ultimately responsible for air quality. Since air quality studies show that woodstove emissions need to be reduced by about 80%, it was imperative to establish what current, dirty stoves emit during normal operation: the baseline. The DEQ suggested a baseline of about 40 gm/hr to arrive at their originally recommended standard of 8.2 gm/hr. The individual members of the Advisory Committee were polled, and suggested standards that ranged from 8 to 20 gm/hr. After much discussion, argument, and negotiation, much of which was politically motivated to forward a recommendation in accordance with what was thought to be DEQ's standard, the final recommendation of the committee was the 9/4 gm/hr standard.

This standard was thought to be reasonable, fair, and the best possible conclusion to be drawn from the data base. It would produce the necessary reduction of woodstove emissions, yielding a 77% reduction if the true baseline is 40 gm/hr, and yielding 74% reduction if the baseline is 35 gm/hr as the DEQ has switched to since confirmation tests. The 9/4 standard is probably less accomodating of the concerns of woodstove manufacturers, even though the DEQ asserted from the beginning that the final standard should not be technology forcing. Based on currently available data, there are no non-catalytic stoves on the market that would pass this standard, and only prototype catalytic stove that appear capable of passing. Only time will tell if production catalytic stoves will pass.

The DEQ has rejected the Advisory Committee's recommendation for a 9/4 standard, and has forwarded instead a more stringent 7/3 standard. In doing so, the DEQ has implied that the committee's credibility, established over a long string of sound recommendations that were incorporated, does not extend to the most important of all of the recommendations. This is probably a mistake. It is inconceivable that there is any other single body with a broader background or better preparation for making this crucial recommendation than the Woodstove Advisory Committee. The EQC should carefully consider the recommendation of the Advisory Committee, the 9/4 standard, for it is probably the best one.

UL

UNDERWRITERS LABORATORIES INC.
1655 SCOTT BLVD. · SANTA CLARA, CALIFORNIA 95050

an independent, not-for-profit organization testing for public safety

May 2, 1984

Department of Environmental Quality
Public Affairs Section
P. O. Box 1760
Portland, OR 97202

SUBJECT: Proposed Woodstove Certification Rules - Public Hearing, May 1, 1984

Gentlemen:

Attached is a transcript of the testimony I presented at the afternoon public hearing in Portland, OR, on May 1, 1984.

Should you require additional information please let me know.

Very truly yours,

Douglas A Anderson

DOUGLAS A. ANDERSON
Associate Managing Engineer
Burglary Protection and
Signaling Department

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DAA/ls

Enclosures

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WOODSTOVE CERTIFICATION RULES PUBLIC HEARING

Portland, Oregon
May 1, 1984

I am Doug Anderson with Underwriters Laboratories in Santa Clara, California.

First, I think we should commend the Department of Environmental Quality and the Woodstove Advisory Committee for a tremendous effort, resulting in a well written set of rules. I will not be speaking on the most controversial issue of acceptable emission levels. I wish to speak only to the aspects of laboratory accreditation and product certification.

There are four basic functions which are essential to a product certification program.

First, there must be initial testing and examination to determine compliance with the applicable requirements.

Second, there must be the establishment and conduct of a follow-up program to determine that certified products continue to comply.

Third, there must be provision for a system of controlled labeling and marking to identify products produced under the certification program, and

Fourth, there must be procedures for corrective action in cases where certified products are found not to comply.

Compliance testing is accomplished thru accredited laboratories. Where production units are tested, there is a strong likelihood that the documentation submitted to DEQ will match the first woodstoves produced bearing the emission and efficiency certification labels.

However, when prototypes are tested, it becomes critical to have initial production inspections at the factory by qualified personnel from the testing laboratory. Any necessary product changes can then be judged by the laboratory with regard to their affect on emissions and efficiency. Otherwise it is completely at the discretion of the manufacturer to determine whether or not changes affect emissions or efficiency. Furthermore, it is also completely his decision whether or not to report those changes.

Certainly the best place to take corrective action is at the point of manufacture. If a problem is identified at the end of the distribution chain, such as at a retail establishment, corrective action will be far less effective. If a stove is actually found not to meet requirements, a product recall would be necessary. Product recalls have proven to be an extremely ineffective means to identify and remove products from the marketplace.

It is far better to catch the problem where it can be corrected. This can only be done with a follow-up program to assure that certified products continue to comply with requirements.

The proposed rules do not provide for this.

The rules do provide for a system of labeling to identify certified products, but this label is not controlled any more than the production operation. If a certification mark of the approved testing laboratory were required to identify complying stoves, then the laboratory would have an interest in controlling the mark to retain accredited status. The factory follow-up program will control the certification marks to the extent that only complying stoves would be allowed to bear the mark.

Where products are found not to comply, they could be corrected to comply or they could be distributed without the certification mark to markets outside the state of Oregon.

In conclusion, while it is possible that Underwriters Laboratories will seek to be accredited by the State of Oregon to test woodstoves for emissions and efficiency whether a complete certification program is established or not, we feel obligated to provide input regarding the lack of control over certified stoves under the proposed rules.

We urge you to look closely at the Oregon Administrative Rules, Chapter 814, Division 22 - Department of Commerce. Specifically Section 814-22-160, regarding testing laboratory approval. These regulations were established after years of discussion and evaluation and would be most applicable to the wood stove certification program. (A copy is attached.)

Thank you for the opportunity to present our views.

over 8 feet from the building, to facilitate the raising of ladders where necessary for fire fighting.

[**Publications**: The publication(s) referred to or incorporated by reference in this rule are available from the office of the Department of Commerce.]

Stat. Auth.: ORS Ch. 479
Hist: DC 10, f. 4-13-72, ef. 5-1-72; DC 41, f. 1-20-75, ef. 2-11-75; DC 47, f. 6-4-75, ef. 6-25-75; DC 103, f. 11-29-77, ef. 1-1-78; DC 8-1978, f. 3-16-78, ef. 4-1-78; DC 13-1978, f. & ef. 4-20-78; DC 14-1978, f. & ef. 4-20-78; DC 19-1978(Temp), f. & ef. 5-22-78; DC 20-1978(Temp), f. 6-20-78, ef. 7-1-78; DC 23-1978, f. & ef. 9-1-78; DC 9-1980, f. & ef. 8-29-80; DC 12-1981, f. 9-29-81, ef. 10-1-81; DC 10-1982, f. & ef. 3-1-82; DC 8-1983, f. & ef. 3-11-83

[**ED. NOTE**: The text of Temporary Rules is not printed in the Oregon Administrative Rules Compilation. Copies may be obtained from the adopting agency or the Secretary of State.]

Rules for Electrical Contractors Desiring to Make Electrical Installations Under Working Permits

814-22-145 Any electrical contractor who elects to utilize a working permit authorized by ORS 479.840(12) shall, on behalf of himself and his surety:

(1) Submit to the Department a corporate surety bond or a cash bond on a form approved by the Department, in the sum of $2,000.00 guaranteeing the payment of all fees provided for under ORS 479.510 to 479.850.

(2) Apply to the Department for the working permit and affix at the job site before any electrical installation is commenced.

(3) Submit the supplementary permit application and the total permit fee as soon as the fees for that job can be reasonably determined and in no case, more than 3 months from the date work commenced on the job. Provided, that in special long term construction projects such as high rise buildings and large industrial buildings, where the electrical contractor has procured the prior approval of the Department, a new working permit may be issued for 3 months for the same building if all fees for the electrical installations under the working permit issued for the preceding 3 month period have been paid in full.

(4) Be deemed to have agreed that the aggregate amount of unpaid fees outstanding at any time shall not exceed the amount of the electrical contractor's bond. No working permit shall be issued and any existing working permit shall become null and void, as to any work performed or contemplated, where fees totaling over $2,000 are owed by any electrical contractor at any given time.

(5) Be deemed to have agreed that if any unresolved dispute arises as to the amount of fees due on a particular installation, job, or in the aggregate, that such matters will be decided by the Department after a hearing before themselves with the Electrical Board.

Stat. Auth.: ORS Ch. 479
Hist: DC 10, f. 4-13-72, ef. 5-1-72; DC 12-1981, f. 9-29-81, ef. 10-1-81

Electric Pilot Ignition

814-22-150 (1) Definition. Central space heating equipment is environmental heating equipment from which heated air is supplied by means of ducts or pipes to rooms and areas other than the rooms or space in which the equipment is located.

(2) Prohibited Sale of Certain Equipment. On or after January 1, 1979, no person shall sell or offer for sale in this state any new gas-fired, forced-air central space heating equipment, clothes dryer or domestic range and, on or after January 1, 1981, new gas-fired swimming pool heaters, unless such equipment, heater, dryer or range is equipped with an electric ignition pilot which complies with the applicable standards of the American Gas Association in effect on October 4, 1977, and which standards are adopted by the Department of Commerce pursuant to ORS 479.740.

(3) Nothing in this rule shall apply to:

(a) Gas appliances used in recreational vehicles;

(b) Portable gas appliances used for outdoor recreational purposes; or

(c) Gas appliances used in a structure which is not served by electric power.

Stat. Auth.: ORS Ch. 479
Hist: DC 9-1980, f. & ef. 8-29-80

Electrical Products

814-22-160 (1) Testing Laboratory Approval:

(a) General. In order to qualify as an approved testing laboratory for certification of electrical products, the laboratory and its certification operation shall meet the criteria of this section as applicable to the categories of electrical products for which approval is sought.

(b) Definitions:

(A) "Certification Mark" means a specified approved testing laboratory identification indicating that a certified electrical product has been manufactured in accordance with the requirements of appropriate standards or tested for specific end uses.

(B) "Certification Program" means a specified set of testing, inspection and quality assurance procedures, with appropriate implementing authority directed toward evaluating products for certification of compliance to the requirements of appropriate standards.

(C) "Certified electrical product" means an electrical product that is certified under ORS 479.760:

(i) To which a label, symbol, or other identifying mark of an approved testing laboratory has been attached to indicate that the manufacturer produces the product in compliance with appropriate standards or performance in a specified manner.

(ii) That is not decertified.

(D) "Labeled" means an electrical product to which a label, symbol or other identifying mark of an approved laboratory is attached.

(E) "Laboratory operations control manual" means a document consisting of specific procedures and information for each test method responding to the application requirements of the product standard.

(F) "Quality control manual" means a document consisting of general guidelines for the quality control of the laboratory's method of operation. Specific information is provided for portions of individual test methods whenever specifics are needed to comply with the criteria or otherwise support the laboratory's operations.

(c) Organization. The laboratory shall be an independent, third-party testing and inspection organization with no organization, managerial, or financial affiliation with manufacturers, suppliers or vendors of products covered under its certification programs:

(A) The laboratory shall not be owned by manufacturers or vendors.

(B) The laboratory administration shall not be controlled by manufacturers or vendors.

(C) The laboratory shall be legally constituted and permitted to perform certification work.

(D) The laboratory shall not be engaged in the promotion or design of the product being evaluated, tested, or certified.

(E) The laboratory shall have sufficient diversity of clients or activity so that the loss or award of a specific contract regarding certification would not be a determinative factor in the financial well being of the laboratory.

(F) The employment security status of the personnel of the laboratory shall be free of influence or control of manufacturers or vendors of products certified.

(d) Professional and Ethical Business Practices. The laboratory shall be operated in accordance with generally accepted professional and ethical business practices and shall agree in writing that as a minimum it will be its policy to:

(A) Perform the examinations, tests, evaluations and inspections required under the certification programs in accordance with the designated standards and procedures.

(B) Assure that reported values accurately reflect measured data.

(C) Limit work to that for which competence and capacity are available.

(D) Treat test data, records, and reports as proprietary information.

(E) Respond and attempt to resolve complaints contesting test results and certifications.

(F) Be capable of performing all examinations, tests, evaluations and inspections for certification programs for which it is approved according to the latest effective version of applicable safety standards as adopted by rule, and require that all certified products produced after the effective date comply with such standards.

(G) Maintain an independent relationship between its clients, affiliates, or other organizations, so that the laboratory's capacity to render test reports and certifications objectively and without bias is not adversely affected.

(H) Notify the Department within 30 calendar days should it become unable to conform to any of these criteria.

(e) Quality Control System. The laboratory shall maintain a quality control system to help assure the accuracy and technical integrity of its work:

(A) The laboratory's quality control system must include a quality control manual or a laboratory operations control manual containing written procedures and information in response to the applicable requirements of the product standard. The procedures and information may be explicitly contained in the manual or may be referenced so that their location in the laboratory is clearly identified. The written procedures and information must be adequate to guide a testing technician and inspector in conducting the tests and inspections in accordance with the test methods and procedures required for the certification programs for which accreditation is sought.

(B) The laboratory shall have a current copy of its quality control manual or laboratory operations control manual available in the laboratory for use by laboratory personnel and shall make the manual available to the Department for review and audit.

(f) Personnel. The laboratory shall be staffed by personnel competent to perform the tests, examinations, reevaluations, and inspections for certification programs for which accreditation is sought:

(A) The laboratory shall assure the competency of its staff through the observation and/or examination of each relevant staff member in the performance of tests, examinations, and inspections that each member is assigned to perform. The observations must be conducted at intervals not exceeding one year by one or more individuals judge qualified by the person who has technical responsibility for the operation.

(B) The laboratory shall make available the description of its training program for assuring that new or untrained staff will be able to perform tests and inspections properly and uniformly to the requisite degree of precision and accuracy.

(C) The laboratory shall maintain records, including dates of the observation or examination of performance of personnel.

(g) Calibration, Verification and Maintenance of Facilities and Equipment. The laboratory shall provide evidence of the calibration, verification, and maintenance of the facilities and equipment specified for each test method for certification programs for which accreditation is sought by means of the following:

(A) A description of the procedures used in calibrating, verifying and maintaining the test equipment and facilities, including as applicable:

(i) Calibration and verification equipment or services used.

(ii) Reference standards and materials used.

(iii) Measurement assurance, corraborative reference, or other programs in which the laboratory participates.

(iv) Specified maintenance practices.

(B) Calibration and verification records, including as applicable:

(i) Equipment description or name.

(ii) Name of Manufacturer.

(iii) Model, style, and serial number, or other identification.

(iv) Equipment variables subject to calibration and verification.

(v) Statement of the instrument's allowable error and tolerances of readings.

(vi) Calibration or verification schedule (intervals).

(vii) Dates and results of last calibrations or verifications and schedule of future calibrations or verifications.

(viii) Name of laboratory person or outside contractor providing the calibration or verification service.

(ix) Traceability to NBS or other standard reference authority as required.

(h) Plans for Certification Programs. The laboratory shall maintain plans for its certification programs for which accreditation is sought which shall include, as applicable, instructions for:

(A) Equipment maintenance and verification checks.

(B) Sample selection.

(C) Data collection, analysis, and reporting.

(D) Quality control checks and audits.

(i) Records. The laboratory shall maintain records and prepare reports of those testing, inspection and certification activities associated with each program for which approval is sought. The laboratory shall make available to the Department, upon request, a typical completed test or inspection report with the name of the client and source of any product deleted. Test and inspection reports shall contain as applicable:

(A) Name and address of the laboratory.

(B) Pertinent dates and identification of tests or inspections.

(C) Name of client.

(D) Description and identification of the sample including, as necessary, where and how the sample was selected.

(E) An appropriate title.

(F) Identification of the test, inspection or procedure as specified for the certification program.

(G) Known deviations, additions to, or exclusions from testing, inspection and certification activities in order to be appropriate to new or innovative products not contemplated by the standard.

(H) Measurements, examinations, derived results, and identification of test anomalies.

(I) If necessary, a statement as to whether or not the results comply with the requirements of the standard.

(J) Signature of person(s) having responsibiltiy for the report.

(K) Data generated during testing if not included in the test report, such as raw data, calculations, table, graphs, sketches and photographs, shall be maintained.

(L) Sample control forms documenting the receipt, handling, storage, shipping, and testing of samples or a written description of the procedures and separate records that are maintained to control these operations.

(M) The laboratory shall have copies of applicable standards and other documents referred to or used in performing each test or inspection for product certification for which approval is sought.

(N) The laboratory shall maintain records of its quality control checks and audits for monitoring its test work associated with its certification programs, including:

(i) Records of products assurance (follow-up) test results.

(ii) Records of detected errors and discrepancies and actions taken subsequent to such detection.

(O) The laboratory shall maintain a record of written complaints and disposition thereof.

(P) The laboratory shall retain records required by these criteria for a minimum of three years.

(j) Product Certification Program:

(A) General. The testing laboratory shall be approved only to certify those products identified by the laboratory in its application. The certification program shall contain the procedures and authority to ensure that the certified product complies with the standard (requirements) established by the program.

(B) Electrical Product Safety Standard Used. The standard used as the basis of the certification program shall be a stated approved product safety standard that is determined to provide an adequate level of safety or define an adequate level of safety performance:

(i) Generally, such standards shall:

(I) Be recognized as a national electrical product safety standard.

(II) Be compatible with and be maintained current with periodic revisions of applicable national codes and installation standards.

(III) Be developed by standards developing organizations under a method providing for input and consideration of views of industry groups, experts, users, consumers, and governmental authorities, and others having broad experience in the electrical product safety field involved.

(ii) All ANSI safety designated electrical product standards are deemed acceptable without further qualification.

(iii) If a testing laboratory desires to use a published standard other than an ANSI standard, then the Board shall evaluate the proposed standard to determine that it provides an adequate level of safety. If there exists an ANSI standard, or other published standard meeting the criteria of paragraph (i) of this subsection which has been recognized by the Board for use in certification programs, the laboratory shall identify and justify all differences between the proposed standard and such ANSI standard or other standard previously recognized by the Board.

(iv) Where there is no published standard meeting the above cited criteria for the equipment under consideration, the Board shall evaluate the proposed standard to determine that it provides an adequate level of safety. The laboratory shall identify and justify the adequacy of the standards or other specifications used as a source of requirements.

(C) Components of certified products shall be evaluated for compliance with standards applicable to such components or found to be suitable for use in the product as stated in the end product standards.

(D) Certification Agreement. Measures, such as the following, to provide for manufacturer compliance with the provisions of the product standard and laboratory control of the use of certification mark shall be embodied in an agreement between the manufacturer and the testing laboratory:

(i) Require the manufacturer to provide such information and assistance as needed by testing laboratory to conduct the necessary product conformity and production assurance evaluation.

(ii) Require the manufacturer to provide testing laboratory's representative access during working hours to the factory for inspection and audit activities without prior notice.

(iii) Restrict the manufacturer to application of certification marks only to products that comply with requirements of the product standard.

(iv) Secure the manufacturer's agreement to the publication of notice by testing laboratory where hazard is determined and the product is already available in the marketplace.

(v) Whenever the standard covering that product is revised, require reevaluation of product as a condition of continued use of the certification mark.

(vi) Provide for notification by the laboratory of the manufacturers personnel responsible for and authorized to institute product recall in the case of a hazard.

(vii) Provide for control of certification marks (or labels) by the testing laboratory.

(viii) Require that the testing laboratory provide to the manufacturer a report of original product evaluation, which documents by test results and other data, when conformity with the applicable product standard is achieved.

(ix) Require the manufacturer to provide the identification of the manufacturer or vendor of the product, and, if the product is produced in more than one location, the place of manufacture of the product.

(E) Identification of Certified Products. Certified products shall be labeled or marked with the certification mark of the approved testing laboratory:

(i) The certification mark shall:

(I) Be owned by the testing laboratory and be registered as a certification mark with the U.S. Patent Office.

(II) Not be readily transferable from one product to another.

(III) Be directly applied to each unit of production in the form of labels or markings suitable for the environment and use of the product, except where the physical size of the unit does not permit, in which case markings may then be attached to the smallest package in which the unit is marketed.

(IV) Include name or other appropriate identification of the testing laboratory.

(V) Include product category where such is not completely obvious.

(F) Directory (List) of Certified Products. The testing laboratory shall publish annually, a Products Directory to identify products that are authorized to bear the laboratory's certification mark (label). The Products Directory shall briefly describe the program, the products covered, the name of the manufacturer or vendor of the certified products, and the identification of the published standards or the compiled requirements on which the program is based, and shall be available to the public. Supplemental up-to-date information shall be publicly available at the office of the testing laboratory at any time during normal business hours.

(G) Original Conformance (Engineering) Evaluation. Prior to authorizing the use of certification mark on a product, the testing laboratory shall:

(i) Determine by examination and/or tests that representative samples of the product comply with the requirements (standard). Components of certified products shall also be required to comply with the safety standards (requirements) applicable to such components or found to be suitable for use as stated in the end product standard. Evaluation of the product design shall be made on representative production samples or on prototype product samples with subsequent verification that factory productions is the same as the prototype.

(ii) Determine that the manufacturer has the necessary facilities, test equipment, and control procedures to ensure that continuing production of the product complies with the requirements.

(k) Product Assurance (Follow-up) Activities:

(A) General. Concurrent with and subsequent to authorizing the manufacturer to use the testing laboratory's certification mark, the testing laboratory shall establish a factory follow-up inspection program to determine continued compliance of certified products with the applicable standard.

(B) Follow-Up Inspection Manual. The testing laboratory shall prepare and utilize an inspection manual which shall be prepared by the testing laboratory setting forth the conditions governing the use of the certification mark on the products and shall include the identification of the products authorized for certification, identification of manufacturer and plant location at which manufacture and certification is authorized, description, specifications and requirements applicable to product, description of processes where needed for control purposes, description of manufacturer's quality assurance program when used as part of follow-up program, description of inspections and tests to be conducted by the manufacturer and the inspector, description of countercheck tests to be conducted in laboratory, and the form and means of applying the certification mark.

(C) Follow-Up Procedures and Activities. Follow-up procedures and activities shall include the following:

(i) Periodic unannounced inspection at the factory with testing at the factory or testing laboratory of representative samples selected from production and, if appropriate, from the market.

(ii) Periodic auditing or surveillance of the manufacturer's quality assurance program through the witnessing of manufacturer's tests, review of the manufacturer's records, and verification of the manufacturer's produced data.

(iii) Investigation of alleged field failures.

(iv) Procedures for control of the use of the certification mark by:

(I) Keeping records of the release and use of certification marks.

(II) Removal of marks from noncomplying products.

(III) Return or destruction of unused marks when the authority to use the marks is terminated.

(IV) Legal Action.

(v) Frequency of Follow-Up. The frequency of follow-up inspections shall be sufficient to provide a reasonable check on the means which the manufacturer exercises to assure that the product bearing the certification complies with the applicable standards. The frequency shall not be less than once each three months, unless adequate data is provided to the Board to justify less frequent inspections.

(2) Requests for Approval of Testing Laboratories:

(a) Laboratory Approval Program Implementation:

(A) The Board may establish a standing committee for the purpose of recommending board action regarding approval of testing laboratories, and reviewing of applications, non-ANSI standards, and other technical criteria.

(B) The Department shall develop forms and procedures which will enable applicants to submit the data necessary for evaluation according to the laboratory approval criteria.

(b) Initial Laboratory Evaluation:

(A) The Department shall:

(i) Accept requests for testing laboratory certification.

(ii) Make an administrative review to insure completeness and accuracy of information.

(iii) Forward requests to the Board.

(B) The Board shall:

(i) Review the request.

(ii) Arrange for the laboratory to be site-inspected by a technically qualified representative for compliance with approval criteria. The cost shall be borne by the applicant.

(C) The Board shall accept or deny laboratory approval. Such approval shall be subject to re-examination when deemed necessary by the Board.

(3) Special Deputies:

(a) Under authority of ORS 479.760 Special Deputies are appointed by the Department for the purpose of evaluating electrical products to determine whether they meet minimum safety standards.

(b) Duties of Special Deputies: The Department shall certify any electrical product if it is shown to meet minimum safety standards by one of the following methods:

(A) By review of a specimen, sample or prototype by the Department staff to determine whether it meets minimum safety standards for workmanship and materials as adopted by the state; or

(B) By review of a specimen, sample or prototype by one of the Department's appointed special deputies who shall contest in writing to the Department that a product evaluated by the Special Deputy meets the minimum safety standards for workmanship and materials as adopted by the state; or

(C) By review by a testing laboratory approved by the Board of an electrical product that the product meets minimum safety standards on behalf of the Department; or

(D) By submitting proof to the Department that a product has been inspected by a testing laboratory approved by the Board under these rules and is shown to meet minimum safety standards.

(c) Written Report. Special deputies shall make their findings, in writing, to the Department on the Department's product inspection form, listing any defect and specified corrections.

(d) Product Acceptance by Special Deputies. Special deputies, upon approving a product, shall place the Department's seal of approval on the unit inspected.

(e) Request for Product Approval. Application for product approval shall be in writing. Applicant shall submit either a specimen or prototype of the product to be reviewed and inspected or testing laboratory data showing the safety of their product in conformance with the Department's standards.

(f) Product Acceptance or Denial. The Department shall, within 6 months of receiving an application and specimen, prototype, or laboratory testing data of an electrical product, evaluate the product or test data and certify or reject it. In rejecting a product, the Department shall state its reasons, in writing, to the applicant.

(4) Support Data:

(a) Applicants for product approval, by a special deputy, shall be accompanied by engineering data, wiring diagrams, and other test data available to evaluate the product.

(b) Applicants requesting product approval by special deputies shall make arrangements to pay the special deputy's expenses incurred in making such inspections at the following rate: Fees for Product Certification:
Product Evaluation .... $40/Hr.

(c) If the special deputy is a laboratory or engineering firm, the inspection fee shall be the actual cost billed to the Department for such service, to be paid by deposit of assumed costs.

(5) Exemptions:

(a) The product certification rules do not apply to products described in this section that comply with the minimum electrical installation safety code. This section does not exempt any products used in locations determined to be hazardous in the electrical code of this state. The following apply to this section:

(A) Industrial electrical equipment.

(B) The rotating equipment portion of power generating equipment.

(C) Testing equipment used in a laboratory or hospital.

(D) Commercial electrical air conditioning equipment.

(E) Prefabricated work performed by an electrical contractor with licensed electrical personnel in the contractor's place of business for assembly on the job site if the work is composed of parts that are certified electrical products.

(b) Electrical equipment that has been in use for one year or more is exempt from the product safety rules.

Stat. Auth.: ORS Ch. 479
Hist: DC 9-1980, f. & ef. 8-29-80; DC 10-1982, f. & ef. 3-1-82

Equivalent Standards

814-22-170 (1) Equivalent Requirements for General Journeyman:

(a) Minimum Qualifications of Applicant:

(A) Age. Be at least 22 years old;

(B) Education. Educational achievement level of at least high school or equivalent G.E.D.

(b) Work Processes and Minimum Hours. Applicants for acceptance under equivalent requirements must show proof of the following minimum work processes and hours of on-the-job training (Subject — Minimum Category Hours):

(A) Stockroom and Material 100
(i) Shop;
(ii) Service.
(B) Residential Wiring 1,000
(i) Service and panel;
(ii) Conduit, flex, romex boxes, ceiling heat;
(iii) Wire pulling and taps;
(iv) Wiring devices and fixtures;
(v) Remodel and finish work.
(C) Commercial Installations 1,000
(i) Services, switchboards, and panels;
(ii) Conduit, flex, metal moldings, floor duct and boxes;
(iii) Wire pulling and taps;
(iv) Wire devices;
(v) Lighting fixtures — high voltages, explosion proof, perimeter lighting.
(D) Industrial Installations 1,000
(i) Services, switchboards, and panels;
(ii) Conduit, fiber duct, tray and boxes;
(iii) Wire pulling and taps;
(iv) Motor and equipment installations;
(v) Lighting fixtures — high voltage, explosion proof, security lighting.
(E) Intercommunication, Signal & Control Systems..... 500
(F) Underground Construction 100
(i) Tunnel rack work;
(ii) Ditch digging and material handling;
(iii) Conduit preparation.
(G) Trouble Shooting and Maintenance 250
(H) Finishing and Fixture Hanging 50
(I) Other Than Previously Listed .... _____
TOTAL MINIMUM SUBJECT HOURS 4,000

(c) Total Hours Required. In no case shall the minimum work hours under each subject be less than the hours specified. The total electrical work experience to be a Journeyman Electrician shall be at least 8,000 hours performing tasks "A" through "I". No more than 300% credit shall be given under subjects "A" through "I" for any one subject.

(d)(A) Related Training for General Journeyman Electricians. Applicants applying for a General Journeyman Electrician's License shall submit transcripts with passing grades of "C" or better in the following related elected training classes or take the Oregon Equivalency Examination(s) with a passing grade of 70%:

(i) Basic electrical mathematics;
(ii) Safety and accident prevention;
(iii) Care and use of hand and power tools;
(iv) Blueprint reading and electrical symbols;
(v) Introduction to National Electrical Code;
(vi) Electrical fundamentals and basic theory, including AC and DC;
(vii) Electric measuring devices;
(viii) Wiring methods;
(ix) Low voltage circuits;
(x) Residential, industrial and commercial calculations;
(xi) Motors, generators and transformers;
(xii) Practical circuit sketching;
(xiii) Lighting circuits;
(xiv) Fundamentals of electronics;
(xv) High voltage distribution and equipment.

(B) Testing for Related Training. An applicant for an electrical license with trade experience from a trade school may submit transcripts of his/her class experience. Class experience will be judged by the minimum subjects needed under related training for the license applied for. An applicant may elect to challenge the related educational requirements by demanding to take the equivalency examination(s) which shall be given upon demand, provided the applicant first meets the work experience requirements for the license requested. The educational equivalency examination(s) shall test an applicant's knowledge of all of the subject matter covered under related training. The test should be written by the Board and administered by the Department.

(2) Equivalency Requirements for Limited Journeyman Industrial and Limited Journeyman Manufacturing Plant Electricians:

(a) Minimum Qualifications of Applicants:

(A) Age. Be at least 22 years old;

(B) Education. Educational achievement level of at least high school or equivalent G.E.D.

(b) Work Processes and Approximate Hours. Applicants for acceptance under equivalent requirements must show proof of the following minimum work processes and hours of on-the-job training (Subject — Minimum Category Hours):

(A) In-Plant installations of electrical circuits 1,000
(B) Motors and generators 500
(i) Dismantling, removing windings, checking physical conditions;
(ii) Winding, forming, taping, installing, and connecting;
(iii) Cleaning, painting, varnishing, baking;
(iv) Assembly and testing;
(v) Repair and maintenance;
(vi) Internal and external connections to change direction of rotation and speed and for a change of supply of voltage;
(vii) Motor setting, drives, pulleys, gears, coupling devices;
(viii) Related mechanical equipment: traction units, cranes, winches and hoists.
(C) Controls. Manual and automatic, including magnetic and solid state 1,000
(D) Trouble shooting 500
(i) Circuit analysis;
(ii) Use of test equipment;
(iii) Emergency repairs for temporary maintenance of service.
(E) Power distribution 1,000
(i) Inside and outside, high and low voltage distribution systems, maintenance and replacement;
(ii) Transformer connecting, testing and repairing;
(iii) Switch gear and load centers, maintenance and repair;
(iv) Wiring, maintenance, repair and adjustment of control panels, instruments and relays.
TOTAL MINIMUM HOURS 4,000

(c) Total Hours Required. In no case shall the minimum work hours under each subject be less than the hours specified. The total experience to be a Limited Journeyman Industrial or Limited Journeyman Manufacturing Plant Electrician shall be at least 8,000 hours, performing tasks "A" through "E". No

Gerald Griswold

Comments

of

Anchor Tools & Woodstoves, Inc.

to be presented to the

Oregon Environmental Quality Commission

Re: Proposed OAR
340-21-100 through 340-21-166

ATW has been concerned with emissions and efficiency for many years and in 1979 was a financial supporter in the developmemt of one of the earliest low emissions appliances, the Jetstream boiler, following up the initial development in 1976-1977 being funded by a D.O.E. grant through the University of Maine to Dick Hill.

ATW has worked with the DEQ since 1979, starting with the emissions testing program in its earliest stages, helping to identify some of the basic problems associated with emissions and efficiency, and continuing through the latest testing program to lend its support in any way possible. Through this concerted effort we have hoped to achieve a workable solution to the obvious problem of wood stove emissions, but feel it is now time to point out what we see as shortcomings with regards to the DEQ's position on several points and interpretations of data concerning the proposed wood stove emission standard.

We had hoped to achieve more results with educational programs, but during the last few years, our industry has felt abandoned by DEQ as a result of their efforts seemingly spent on negative P.R. programs rather than positive education efforts designed to reduce these emissions. For the air shed to be positively affected by emissions regulations, the regulations have to be realistic, achievable, and attuned to real world conditions. To regulate for the sake of regulation would seem very short sighted. To test in a manner which reflects little if any real world conditions has little if any meaning. To denote a burn rate which is not the correct burn rate would be simply ridiculous. To set a standard which would be unnecessarily too restricting to be economically and/or commercially viable would be catastrophic to this industry and this program. To implement a standard excluding all but one type of unproven technology (catalytics) is contrary to rational thought and can not, by any means be justified. Resultingly, there would be more adverse effects, and little if any long term gains towards reducing emissions from wood burning stoves. It appears that Oregon D.E.Q. proposed regulations are designed to do all of the above, creating the exact opposit effect desired.

Let me outline a few specific points.

I. One of the stoves used for the latest base line stove emissions was a 602 Jøtul. A very small stove designed with mid-range heating at 13,000 BTU/hr. The 602's low emissions helped the DEQ justify its most recent lowering of the base line stove emissions. Also, the base line stove emissions average which was supported by the confirmation testing data using the proposed fuel load which appears to drastically reduce stove emissions by a factor of two (1980 Battelle-Columbus Laboratory testing) is faulty, also DEQ's conjecture of a 20gr/kg base line stove is disproven by 1980-81 DEQ tests of typical wood heaters corrected to current format with emissions of over 50gr/kg average.

II. The air shed model (Medford) has several suspect areas of concern as to the contribution of emissions directly related to wood stoves, rather than other sources, namely veneer driers and possible slash or backyard burning with identical fingerprinting and the probalility of above average usage of fireplaces and stoves over the Christmas holiday season on which the wood stove emissions factor was based.

III. With the Medford air shed being the basis for the statewide wood stove standard it seems inconsistent to use fir as the fuel wood (1983 Medford survey 60% hardwood-35% fir) which produces twice the emissions of hardwoods (1983 DEQ 4 tests on one stove).

IV. Medford being the worst case air shed in the state, we should be testing in a manner that is consistent with the needs of the Medford air shed. Also, there is great probability of unrealistic results and performances of stoves within the field as compared with stoves tested under the proposed testing format. From this point forward can we only design and sell stoves to produce 13,000 BTU/hr? This attitude negates the years of efforts by responsible stove merchants on how to properly operate a wood burning stove (with small hot fires, "batch loading" at times of low heat needs). This 13,000 BTU/hr. is based on the average energy usage in the state averaged over the heating season. It does not address the proper way to operate a woodburning stove or even the way an increasingly larger segment of woodburners burn wood each year.

SUMMARY

I. Since the purpose for the proposed OAR 340-21-100 through 340-21-166 is to reduce emissions from wood burning stoves, it seems unrealistic to base a standard soley on criterion that does not reflect the "real world" home woodburning conditions and homeowner burning habits. Further, it is asinine to justify this unrealistic approach by a disclaimer on the bottom of the proposed stove label i.e. (performance may vary from test values depending on actual home operating conditions.)

II. There is no sound reason for regulating emissions on a stove outside the effected air sheds or to base the burn rates soley on a 13,000 BTU usage when there are drastically differing heating needs in various sized, constructed, or located homes, cabins, and businesses.

III. To disregard the emissions from like fueled equipment; namely recrational fireplaces and wood furnaces is, without doubt, an unfair and short-sighted program.

It is felt by Anchor Tools & Woodstoves, Inc. that the intent of the legislature has been subverted by the DEQ and the good intentions of the legislature to clean up the effected air sheds has turned into a bureaucratic boondoggle. From all appearances the wood stove industry in Oregon will be replaced by DEQ staff (for a fee of course) making all decisions as to design, testing, labeling, labs, and seemingly duplication of multitudes of paper work better left to the testing labs. The DEQ fee for the first stove tested is approaching the amount initially thought to be the total stove testing fee.

Let's remember that the wood stove industry in Oregon represents far more people than "just a few scattered employees" welding stoves together. Let's remember all the support people: truck drivers, bankers, paint manufacturers, masons, home builders, sheet metal workers, installers, chimney sweeps, wood cutters, chain saw sales people, clerical personnel, advertising agencies and medias, distributors, retailers, accountants, telephone personnel, ad infinitum.

Anchor Tools & Woodstoves supports the comments and testimony of the Wood Heating Alliance.

AOI AIR QUALITY COMMITTEE TESTIMONY

DEQ WOODSTOVE STANDARDS HEARING

May 1, 1984

My name is Bruce Snyder and I appear today on behalf of the Associated Oregon Industries Air Quality Committee.

AOI supported HB 2235 to establish emission performance standards for woodstoves. The reason for the association's support is well summarized from this statement contained in the 1982 Air Quality Annual Report of the Department of Environmental Quality:
"On an annual basis, particulate emissions from residential wood combustion exceed the amount of particulate emitted from industry in the Portland area and about equal the amount emitted from grass burning in the Willamette Valley. These emissions are projected to double by 1987 from 1977 levels if uncontrolled. In terms of airshed capacity, continued exceedance of air quality standards can mean less jobs due to necessary industrial growth limitations.".

Presently, Portland, Eugene-Springfield and the Medford-Ashland areas are in a nonattainment status for particulates and other areas verge on nonattainment. AOI believes that all pollution sources should be addressed when an airshed problem exists.

If a nonattainment situation exists for a particular pollutant in an area of the state, regulations require any new or expanded industrial facility which will emit a significant quantity of that pollutant to offset the new emissions with reductions of existing emissions in that area unless there is an available growth cushion to accommodate both population and industrial growth. Offset requirements make industrial expansion very difficult.

The availability of existing or potential offsets is low, and the acquisition transactions are not easy to negotiate. Offsets are presently hard to find because not only are they scarce, firms with potential offsets are reluctant to relinquish their rights to them; they may need the offsets themselves someday.

Monitoring and analyses conducted by DEQ show that woodstoves contribute to the nonattainment problem. Certainly they do. Nearly all pollutant emissions contribute, regardless of the source. What is important about woodstoves is that in total they emit significant quantities of particulate matter and these emissions have increased rapidly. Again, in the Portland area, which is presently nonattainment for particulate pollution, annual woodstove particulate emissions are greater than industrial emissions by more than two to one. However, the absolute amount is not the only consideration; other factors magnify the effect of woodstove emissions:

-Woodstoves operate primarily during the cool months. This seasonal operation means that the annual emissions are squeezed into fewer months than a steady emission source and the threat of violating a daily atmospheric concentration standard during those months is increased.

-Pollutants emitted from a roof-top woodstove chimney relatively near the ground are more likely to affect ground-level atmospheric concentrations than an equal amount of similar pollutant discharged from a tall stack.

Excessive woodstove emissions could hinder industrial growth. Yes, primarily by the threat to air quality and the barriers (e.g. offsets) which result from a nonattainment situation. Furthermore, existing industries could be affected if lack of control on non-industrial pollution sources requires additional reductions by the existing facilities.

If a nonattainment situation exists, it would be a formidable task, with uncertain success, to satisfy the regulatory requirements for installing new or expanded industrial facilities. And, to the extent that woodstove emissions contribute to a nonattainment status, they indeed represent a threat to industrial growth. If these emissions are not controlled, they could also result in inequitable demands for further emission control by existing industrial sources, regardless of the substantial reductions already accomplished by those sources.

It appears to AOI that woodstove emission performance standards, combined with other DEQ programs such as those which will limit backyard burning and suppress fugitive dust, can assist in removing nonattainment status to existing areas of the state and assist in providing a needed growth cushion. However, it also appears to AOI that the woodstove market is reasonably saturated and that possibly the major emission reductions will occur by replacement, as rapidly as possible, of the existing population of stoves currently in use, many of which are oversize and underdesigned. Since the current stove population is at the root of the problem, we hope that the standards to be adopted are based on available technology, with significantly reduced emissions, which will attract current woodstove owners to replace older, inefficient models.

Industrial, commercial and residential uses share an airshed, and it makes little sense to ask only one group of occupants to make an effort to keep it clean, especially when that group has already made substantial efforts with definite and positive results.

BEFORE THE

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

PROPOSED WOODSTOVE CERTIFICATION RULES

Preliminary Comments of the Wood Heating Alliance

Portland, Oregon
May 1, 1984

(Mr.) (Madam) Hearing Officer, ladies and gentlemen. My name is Michael Sciacca. I am a professional engineer and Technical Director for the Wood Heating Alliance. With me today is Richard D. Bach, a lawyer with the Portland firm of Stoel, Rives, Boley, Fraser & Wyse who are special Oregon counsel to the Wood Heating Alliance.

On behalf of the Wood Heating Alliance (WHA) I would like to make a few observations and general comments with respect to the DEQ's proposed wood stove certification regulations, and with respect to the process which led to the DEQ proposal. We are now preparing more detailed comments and recommendations, including some specific proposals where we feel the rules can be improved for the benefit of Oregon and its citizens; and we plan to submit those detailed proposals when the record closes this Friday, May 4, 1984.

At the outset, let me briefly describe the Wood Heating Alliance. The Wood Heating Alliance is the principal trade association for manufacturers, distributors, retailers, testing laboratories, and others directly involved in the manufacture, sale and testing of wood fueled appliances, including the wood heating stoves which are the subject of House Bill 2235 and the regulations to be adopted by the Oregon Environmental Quality Commission (EQC) on or before July 1, 1984. While certain Oregon members of WHA have been members of the Advisory Committee, and WHA's Technical Director and other representatives of WHA have commented from time to time at various stages during the development of the proposed regulations, this is WHA's first opportunity to comment formally and appear of record during these proceedings. As a result of our extensive experience with testing and certification of wood heating appliances, we believe that WHA is especially well qualified to comment on DEQ's proposed testing and certification regulations.

In addition, I would like to take this opportunity to commend the DEQ staff, the members of the Advisory Committee, and all of the other people involved in this project since its inception when the legislature first began to consider the regulation of wood stoves in Oregon. They have performed a seemingly herculean task in a very short time, and have done so in a conscientious manner in view of the many constraints along the way. These dedicated citizens have sincerely attempted to comply with the mandate given to the DEQ and the ECQ by the legislature; and with the few changes we will suggest here tonight and in our formal comments, those citizens will have served the people of Oregon well.

We only wish that there had been more time--more time to weigh all the issues, more time to obtain more reliable data, and more time to assure all of us that these rules will be in the best interests of Oregon and the nation--because whether intended or not, these rules will be a yardstick for other states. Oregon has, and will continue to be a leader in environmental matters, and other states may well look to these rules for their inspiration.

Which brings me to the thrust of WHA's comments. Although the proposed wood stove emission standards appear on their face to be rational and defensible, they are in fact founded on a very tenuous data base. The proposed standards depend on a series of assumptions which are unsupported at best, and questionable at worst.

Please do not misunderstand us--we are not challenging these assumptions or the DEQ data base at this time. We are simply suggesting that there are not enough data at present to permit our members to be comfortable with the DEQ proposal--especially the second stage standards to be effective in 1988. And our industry sincerely wants a wood stove certification program with which it can be comfortable--with which it can grow, and develop, and serve the energy needs of the public. I need not remind you that there are people out there--on both sides of the retail line--who are opposed to any wood stove regulations. If such opponents perceive any deficiencies in this program, they will seize the opportunity for mischief. We are on your side in this issue; our members want a program which is reasonable, realistic, and legally defensible--they want the certainty which comes from knowing what the rules are and knowing that they can play by those rules.

Let me point out the main area where we perceive the data and the assumptions to be somewhat tenuous, and vulnerable to challenge. There appears to be little or no verifiable connection between the ambient atmospheric loading of particulates contributed by wood stoves at the present time on one hand, and the DEQ recommended reductions in emission rates from wood stoves on the other hand.

The legislative history of the debate which led to the adoption of HB 2235 is replete with suggestions that a reduction of 68 percent to 75 percent of ambient wood stove generated particulate concentrations would be the objective of this law. DEQ started with some fairly good data--the amount of particulates contributed to ambient conditions per kilogram of firewood burned, the total amount of firewood burned in wood stoves each year in Oregon, and the number of wood stoves in the state. But at this point we all--including the industry and DEQ--began to run into problems. It was quickly realized that an emission limitation had to be expressed in terms of grams per hour because wood stoves operate and ambient concentrations respond on the basis of emissions over time.

So in order to convert grams of emissions per kilogram of wood burned (knowing the total amount of wood consumed and the number of wood stoves doing the burning), some very basic and very important assumptions had to be made. DEQ had to estimate, among other things, how long each stove is operated on average, how the average stove owner loads his or her stove, and what type of firewood is used.

This is where we depart from the DEQ approach. We believe that DEQ's assumptions significantly and, unfortunately erroneously, underestimate the particulate emission rates from existing wood stoves. And because DEQ has proposed an 80 percent reduction from what it assumes to be the existing emission rates, it has come up with proposed rates which are far more stringent than are necessary to achieve the desired ambient reductions.

Let me pause here for a moment and make sure that there is no misunderstanding. Although we submit that current emission rates are substantially greater than assumed by DEQ, we are not suggesting that air pollution from wood stoves is worse than we think. The DEQ data on ambient concentrations, and the fraction of total suspended particulates attributable to wood stoves, is quite good and is easily verifiable by DEQ methods. What we do say, however, is that each stove, when it is operated, contributes to the total particulate loading in the atmosphere at a higher rate than was assumed by DEQ. Thus, if we were to apply the percentage reduction urged upon the legislature to the greater emission rate which we believe actually occurs, we would still achieve the desired reduction in ambient concentrations--but without the severe dislocations inherent in the DEQ proposal.

Let me illustrate. DEQ has assumed, on the basis of a single set of test data under some questionable conditions, that the average wood stove in Oregon emits at the rate of 30 to 34 g/h for 12 hours each day for 6 months of each year. All of the other data available to the industry, to the testing laboratories, and to the federal Environmental Protection Agency (EPA), indicate that wood stoves actually emit in the range of 50 to 60 g/h under shorter time spans and with heavier firebox loadings. (We will furnish additional information and more detail to support these assertions in our written comments.)

When DEQ applies a 50 percent reduction to its 30 to 34 g/h emission rate (for implementation by July 1, 1986) and an 80 percent reduction (to be applicable in 1988), it arrives at proposed emission limits of 15 g/h and 7 g/h respectively. (These are, of course, reduced further to

6 g/h and 3 g/h, respectively, for catalytic stoves to compensate for catalyst degradation.)

On the other hand, if one were to apply the 68 percent to 75 percent reduction factor suggested by DEQ to the legislature during its deliberations on HB 2235, against the 50 to 60 g/h existing emission rate supported by the verifiable data, one would arrive at essentially the same reduced emission rate proposed by DEQ for 1986, i.e., 15 to 16 g/h.

This then is our suggestion. DEQ submits that a 15/6 g/h rate will achieve a 50 percent reduction, and WHA submits that this same rate will achieve approximately a 75 percent reduction. We urge the EQC to adopt this rate to become effective in 1986, and that the Commission leave open the question of further reductions in 1988 or thereafter. This will give industry, wood stove users and DEQ more time to develop the rational and verifiable data base required to support any further emission reductions if they should prove necessary to the health and welfare of the state and its citizens.

WHA pledges to cooperate with the DEQ in developing such additional data. We might point out that there is a large body of information being accumulated at the present time by Bonneville Power Administration at Hood River, by the Canadian government, by testing laboratories all over the country, by the wood stove industry itself, by EPA, and by the environmental agencies of other states. We fully expect that within 3 years--in plenty of time to make mid-course corrections before 1988 if necessary--the data will be available to make rational, reasonable and defensible decisions with respect to wood stove emissions. In the meantime, a workable program will be in place, and a significant reduction in wood stove emissions will be inexorably leading toward better air quality.

We have a few other suggestions with respect to the administrative aspects of the proposed wood stove certification rules. I do not want to take any more time at this hearing than is necessary, except to point out that these are also very important issues and we will discuss them in more detail in our written comments. Suffice it to say that we suggest that:

1. The proposed certification procedures should be revised to reflect more realistically the actual conditions under which wood stoves are operated and the fuels which are actually burned in the home;

2. The proposed rules should contain a provision under which a manufacturer can declare certain information in its application to be proprietary and confidential so as to protect its design and trade secrets from its competitors;

3. Independent review of design modifications by DEQ, in addition to laboratory certification, is duplicative and wasteful, and should be unncessary;

4. Recertification of an approved wood stove design at 5-year (or any other periodic) intervals is unnecessary once a stove has been certified and where no modifications have been proposed; and

5. The Condar particulate emission method should be adopted as being superior to the proposed Oregon Method Seven.

Again, we will flesh out these comments in far more detail in our written submissions. We do, however, wish to thank you and the members of the public here tonight for your patience in listening to our presentation, and for the opportunity to offer these thoughts. These rules will have an important impact on a significant segment of Oregon's population, especially those who depend upon wood stoves for their health and comfort. Clean air is vitally important to us all, but we must ask you to consider whether it must be achieved to the exclusion of other vital factors. We can be warm and healthy and economically secure at the same, and we submit that adoption of the proposed WHA suggestions will let us be all three.

* * * * * * * * *

For more information, contact the Wood Heating Alliance, 1101 Connecticut Avenue, NW, Washington, D.C. 20036, telephone (202) 857-1181.

John Powell & Associates
P.O. Box 13640
Salem, Oregon 97309

TESTIMONY PRESENTED
TO THE
ENVIRONMENTAL QUALITY COMMISSION
May 1, 1984
Portland, Oregon

My name is John Powell, representing the Wood Energy Institute West (WEIW). WEIW is an association comprised of woodstove industry members including retailers, distributors and manufacturers of woodstoves.

It should be noted at the outset that most of the woodstove industry members I am currently working with supported passage of HB 2235. In fact, several actually testified in favor of the legislation during the 1983 Legislative Session. We acknowledge the need to improve air quality, and agree that a reduction of emissions from woodstoves must be a part of that air quality improvement.

The testimony we submit today takes violent exception with the proposed rules under consideration. Our opposition stems from what we believe to be unreasonable emission standards that violate the spirit of representations made to the 1983 Legislature, and if adopted by the E.Q.C., will unreasonably cripple if not destroy the woodstove industry in Oregon.

<u>THE LEGISLATURE WAS TOLD A STATEWIDE WOODSTOVE CERTIFICATION PROGRAM WOULD REDUCE EMISSIONS FROM WOODSTOVES BY 65-75%. THE PROPOSED RULES INSIST ON A REDUCTION OF 80%</u>.

In testimony before the 1983 Legislature, the Department of Environmental Quality consistantly testified that "Statewide woodstove certification will reduce particulate emissions by 68-75 percent by the year 2000." (Page 3, <u>HB 2235 Oral Testimony Summary</u>, copy attached) D.E.Q. Director Bill Young stated to the House Environment and Energy Committee on February 14, 1983, that, "The fact remains that you are going to see a substantial difference in the performance of a clean burning stove as compared to the average of the stoves that we have out there right now, both connected to exactly the kind of chimney they should be connected to. Our projections are that in that instance one will see a reduction in the order of 65 percent of the pollutants coming from that cleaner burning stove." (Tape #42, 1983 House Environment and Energy Committee)

At no time was it represented to the Legislature that a woodstove certification program could reduce emissions from this source by 80%. While the industry would like to accommodate such a reduction, the evidence clearly indicates the proposed standards necessary to achieve an 80% reduction would eliminate nearly all, if not all, clean burning stoves. In a report dated April 19, 1984, Dr. Stockton G. Barnett writes, "In this report I will present evidence that the recent D.E.Q. proposal to require a 3 grams/hour emission limit for catalytic stoves exceeds both performance levels of "best practical technology" and "best available technology" as we now know it to be." (See Page 1, <u>Implications of Oregon D.E.Q. Emissions Test Data On Catalytic Stove Emission Standards</u>, copy attached.)

<u>THE LEGISLATURE WAS ASSURED THAT THE TECHNOLOGY TO MEET STANDARDS IS CURRENTLY AVAILABLE AND ON THE MARKET</u>.

D.E.Q. Director Young said in testimony during the 1983 Legislative Session, "The standard when it is adopted is not going to be particularly technology forcing because in fact there are stoves out there now, certainly others, the technology is there now to generate others to meet that kind of a standard." (Tape #41, Side B, 1983 House Environment and Energy Committee)

The fact is, the testing method proposed in these rules eliminates the stoves and technology Director Young suggested were available.

Again in testimony before the Legislature, Director Young indicated the availability of stoves that would meet the standards. He said, "We have three designs certified in New Zealand to a standard approximately 7 grams per kilogram. There are two currently undergoing testing and the anticipation there appears to be that those units will be certified and one of those New Zealand units that we're talking about has in fact been offered for sale here in the State of Oregon. There is one of those units currently marketed in the State." (Tape #42, Side B, 1983 House Environment and Energy Committee)

Attached to this testimony is a letter from the Research and Development Manager of the New Zealand manufacturer referred to as marketing a clean stove in Oregon. The letter is dated April 3, 1984. I quote the following from that letter, "As far as we are concerned, this 7/3 proposal amounts to a ban on woodstoves going into effect in Oregon officially in 1988, but in reality somewhat earlier than that. We can see no realistic prospect of meeting a 7/3 standard with any reliable technology that we would be prepared to offer to the public." (See attachment)

The legislative record is full of assurances from the D.E.Q. that technology and woodstoves are currently on the market that would satisfy an emission standard. For the sake of brevity, other examples of such assurances have been eliminated from this document.

<u>THE LEGISLATURE ACCEPTED ASSURANCES THAT MANY OF THE CLEAN BURNING STOVES ON THE MARKET WILL MEET THE STANDARD. THE FACT IS EVEN THOSE CLEAN BURNING STOVES DO NOT MEET THE PROPOSED STANDARD</u>.

Representative Darlene Hooley, Chair of the House Environment and Energy Committee said during floor debate on HB 2235, "I want to make it very clear it is not a ban on woodstoves. We can have woodstoves and clean air at the same time. This is just a ban after 1986, July first, on dirty ones. We already have clean burning stoves available." (Tape #9, Side A, 1983 House Floor Session)

Nearly two months later, when arguing for concurrence with Senate amendments to HB 2235 on the House Floor, Representative Hooley stated to the members of the House of Representatives, "Since we've heard it on the House side, already two more stoves have been tested that meet the standards or what is likely to be the standards which brings that up to over 12 models that have been tested and are currently available for the State." (Tape #9, House Floor Session)

Arguing for passage of HB 2235 in the Senate, Senator Steve Starkovich told members of that body, "Now the question comes up, how many woodstoves are there that comply and what are the technologies available? There are about a dozen models that currently comply with what D.E.Q. will say to us will be their standard.... These are stoves that already comply with what D.E.Q. estimates that will be their standard. They estimate their standard will be somewhere in the area of about 7 grams of particulate emitted for every kilogram of wood burned. So we are not passing legislation here that is going to mean that there will be no woodstoves that comply or ever can comply."

Test results indicate that the proposed standard eliminates most existing woodstoves by 1986 and all but a prototype of a stove with a combustor by 1988. No non-catalytic stove meets the proposed 7 grams/hour standard and only one prototype with a catalyst approaches the 3 grams/hour standard.

The statements clearly speak for themselves. The Legislature was told that a statewide certification program would reduce emissions by 65-75 percent. The proposed rules mandate an 80 percent reduction. The Legislature was told and believed the technology existed to meet standards and at least a dozen stoves currently on the market would meet those standards. The proposed rules before us today are not representative of the information given the Legislature.

THE D.E.Q. PROPOSAL IS BASED ON A PHASED STANDARD, IMPLYING THE INDUSTRY WILL HAVE TIME TO MEET THE FINAL STANDARD. THE FACT IS, THE 1986 STANDARD ELIMINATES ALL BUT THE SMALL NON-CATALYTIC STOVES AND SOME CATALYTIC STOVES.

The 1986 standard will eliminate all but the small room heater sized non-catalytic woodstoves. Even the Jotul 201, a small two stage combustor chamber stove that was used as an example of a stove likely to meet the standard during legislative hearings, tested in a range between 9.25 to 16.01 grams/hour. (See Page 2, Woodstove Certification: The D.E.Q.'s Proposed Legislation, Copy attached) [redacted]

[redacted] The small stoves require frequent refueling and have a limited heating capacity. They are not what the consumer necessarily seeks to heat a house.

Only a few catalytic equipped stoves will meet the 6 grams/hour standard set for July 1, 1986. Even if as many as six or seven catalytics qualify, the question still remains whether or not manufacturers will go to the expense (a minimum of $7,600) of certification for a two season sales benefit. The fact is, the 1988 standard will govern decisions made by the industry. While other states will likely begin to regulate woodstove emissions in the future, a negative experience in Oregon will harm the movement, not promote it.

THE PROPOSED RULES DEFINITELY DIRECT THE WOODSTOVE INDUSTRY TO A CATALYTIC TECHNOLOGY. THE ELIMINATION OF NON-CATALYTIC TECHNOLOGY IS NOT GOOD FOR CONSUMERS OR AIR QUALITY.

The 7 grams/hour, 3 grams/hour standard will by necessity direct the woodstove industry soley to a catalytic technology. Test data does not make it reasonable to assume non-catalytic stoves will be capable of meeting the final standard. The elimination of non-catalytic technology is at best unfortunate. Consumers prefer non-catalytic stoves for price and ease of maintenance. Because combustors must be replaced when destroyed or their normal life span ends, air quality improvements depend on the user replacing the combustor on a regular basis. We question the advisability of depending on the user replacing the combustor since it will require a substantial cash outlay and the removal and installation of a new combustor. If only those consumers who chose catalytic equipped stoves purchased them, perhaps better maintenance could be expected. However, the proposed rules will not give the consumer a choice.

Catalytic technology in woodstoves is relatively new. Problems persist in field use of stoves equipped with catalysts. I have attached a copy of a letter dated February 21, 1984, from a manufacturer to owners of stoves and inserts equipped with catalysts. The letter speaks for itself and needs no further explanation. (See attachment)

Catalytic equipped stoves are often compared to catalytic equipped automobiles. There are many differences which should be noted. First, the catalyst on the automobile lasts the lifetime of the vehicle, not so with woodstoves. Secondly, the fuel consumed by automobiles is regulated and consistent. Fuel used in a woodstove varies greatly by content, fuel load, and temperature burned. For these reasons and others, a direct comparison between the automobile and woodstoves is drastically flawed.

It is undeniable that the proposed rules will eventually eliminate all existing non-catalytic stoves and no one in the industry predicts a consumer acceptable technology in the non-catalytic stove that will meet the final standard. If consumers do not replace existing dirty burning stoves with cleaner burning models, the desired air quality improvements will not be forthcoming. We strongly believe that the proposed rules will prove injurious to consumers and air quality potential.

Although the proposed rules pose other concerns to the industry, I will let those with technical backgrounds address them. The department has received information from several parties indicating those concerns as well.

In conclusion, I think it important for the Commission to understand the value of wood energy. First, it should be mentioned that alternatives to wood energy have negative environmental and social costs. Wood as a valued energy source is well recognized in Oregon. Governor Atiyeh in proclaiming September 1983 as "Wood Energy Month" said, "Wood as an alternative energy resource can make a significant contribution toward meeting Oregon's present and future energy needs. Wood residues in Oregon forests have the potential to supply approximately 200 trillion BTU's of energy on an annual basis, or an estimated 30 million barrels of oil."

The National Consumer Law Center reported in early 1983 that the average Supplemental Security Income recipient in Oregon spent about 46 percent of their benefit for heat. The report also showed that Oregon households depending on unemployment benefits spent 26 percent of that income on heat. Costs of providing home heating continue to escalate. (See Newspaper Article, Not Much Left After Heat Bill, Copy attached)

Wood as a heating source is not merely a convenience, it is a necessity to many. We urge the E.Q.C. to structure the regulation of woodstoves in a manner that will continue to provide reasonably priced heating appliances to Oregon consumers.

We believe it is possible to set emission standards that will substantially reduce particulate emissions from woodstoves without the devastation the proposed rules will cause to the industry and consumer. In fact, a reasonable standard will promote replacement of existing dirty woodstoves and improve air quality more rapidly than the proposal which is the subject of this hearing.

general public. The EQC takes into consideration not only current technology, but also economic effects and environmental benefits.

This bill allows a portion of the airshed savings to be allotted to industrial growth.

This bill doesn't: affect existing users, apply to fireplaces, set an emission standard without hearings, or ban woodstoves.

V. Effects of HB 2235

Statewide woodstove certification will reduce particulate emissions by 68 - 75 percent by the year 2000. As with the federal new car program, existing dirty units will be replaced with cleaner units over time. The technology for cleaner stoves already exists and is available on the market.

With the reduction of woodstove particulate emissions, we'll have room in our airshed for up to 24,000 new industrial jobs by the year 2000. The estimate is based on the amount of emissions per job in Oregon's largest industries: pulp and paper, wood products, and metallurgy.

Cleaner stoves are 40 percent more efficient than conventional stoves, so they require less fuel to create the same heat. By the year 2000, the cleaner stoves will save approximately 200,000 - 230,000 cords of wood a year, which is 26 percent of the wood now used. Consumers should save $31-$84 a year on firewood. Also, the cleaner stoves prevent build-up of creosote, so they are safer. Currently, woodstoves are the major cause of residential home fires in Oregon.

Woodstove certification will increase the initial price of stoves for the consumer by $300-$500, but the amount should drop over time with increased availability and competition. The increased selling cost will be offset over time by savings on firewood.

Certification will limit consumers' choice of stoves; however, there are currently four different tested stove designs and more than a dozen units that fall in line with the clean stove standard in use in New Zealand. The designs are: (1) catalyst-equipped, which allows good combustion to occur at low temperatures; (2) dual chamber, which burn gases more effectively; (3) "high mass" stoves, which burn fast and hot and release heat for long periods; (4) wood furnaces, which have forced or induced air and can be burned quite hot. The number of stoves available to consumers will depend on the level at which the EQC establishes a standard, and on industry's response to producing clean burning stoves.

Some manufacturers with similar, but inadequate, designs advertise their stoves as being clean burning. Stove testing and certification will end these misleading advertising claims, so consumers can be confident they are getting a cleaner, more efficient, safer stove. With the passage of HB 2235 all Oregonians, whether woodstove users or not, can be confident of getting fewer smoky nuisances, safer conditions, more room for jobs, and cleaner, healthier air.

2/14/83
FH812

IMPLICATIONS OF OREGON DEQ EMISSIONS TEST DATA ON CATALYTIC STOVE EMISSION STANDARDS

By
Stockton G. Barnett, Ph.D
Condar Company
Hiram, Ohio

INTRODUCTION

The EPA, following the provisions of the Clean Air Act, has historically developed regulations which, when based on technology performance, utilize either "reasonably available control technology"* hereinafter referred to as "best practical technology," "best available technology,"** or a phased-in combination of both. The DEQ, in its woodstove regulation program has followed the "best practical technology" approach by testing clean-burning stoves that are currently available and commercially viable.

In this report I will present evidence that the recent DEQ proposal to require a 3 gram/hour emission limit for catalytic stoves exceeds both the performance levels of "best practical technology" and "best available technology" as we now know it to be. A requirement of 3 grams/hour would invoke "technology forcing"; requiring development of technology beyond the best currently available so that the standard can be met.

I will document both the above position and will describe the development of an emissions limit I believe is applicable to "best practical technology" using data the DEQ has obtained.

The DEQ has conducted sixteen stove tests on catalytic stoves at Omni using their testing protocol. Three stoves, which use various versions of our catalytic technology were tested. In addition, at Condar we conducted 15 stove tests for DEQ in November 1983 using three other stoves employing the same technology.

I will attempt to analyze the available data in several different ways and then collate the results to see if they all point to a similar conclusion.

STOVES TESTED AT OMNI

(1) Blaze King Princess Prototype - This stove has served as the primary DEQ catalytic test stove. It was constructed in June 1982 by Keith Yarwood of Woodcutters and myself. The catalyst mixer and support system is a prototype of what is now our commercialized cast catalyst support system. The performance of the prototype version has proved essentially identical to the commercially available cast in our lab tests. The prototype stove used our thermostat control system but, its application is not standard. This causes lower maximum burn rates and a somewhat less steady burn than it should. The secondary air supply is greater than our program recommends.

* Best practical technology refers to technology which is generally now commercially viable.

** Best available technology is available but not considered commercially viable. This technology produces lower emissions than best practical technology, however.

KENT

KENT HEATING LIMITED
59 Tidal Road Mangere Auckland NZ
P.O. Box 23-340 Papatoetoe Tel (09) 275 8289

Telegrams: BLUEFLAME NZ 60254 KENTILE

Your Ref:- Our Ref:-

Date:- 3rd April 1984

John Powell
Box 12459
Salem
Oregon ... 97309
U.S.A.

Dear John

As you are aware, we are very concerned at the latest proposals to emanate from DEQ. As far as we are concerned, this 7/3 proposal amounts to a ban on woodstoves going into effect in Oregon officially in 1988, but in reality somewhat earlier than that. We can see no realistic prospect of meeting a 7/3 standard with any reliable technology that we would be prepared to offer to the public. We believe that this standard is untenable, and that the public must have the right to know the effect of this proposal, and we also believe that the DEQ staff are not fully aware of the disastrous nature of this most recent proposal.

Our understanding is that this measure will flow on to other states and because of this, we are preparing legal action designed to defeat the proposal should it become law. As you are aware, several manufacturers have offered to join us in this action.

Yours faithfully
for KENT HEATING LIMITED

J.S. Fleming
RESEARCH & DEVELOPMENT MANAGER

Anything else I should know?

- DEQ has already identified at least two stoves currently available that can provide a basis for and that can meet clean emission standards. One has a catalytic combustor, the other has a two-staged combustion chamber. Other stoves undoubtedly can meet the emission standard. Due to budget constraints, the DEQ was initially able to test only a few stoves.

- The program would go into effect in July 1985 with a one-year voluntary phase-in program prior to that.

- DEQ and woodheating industry data show that an average of 30,000 Oregon households will buy new or replacement stoves each year through 1990.

- The certification proposal is endorsed by the Portland and Jackson County Air Quality Advisory Committees, Associated Oregon Industries, Oregon Department of Energy, Bonneville Power Administration, Oregon Environmental Council, and, of course, the Environmental Quality Commission.

- Once again, the program applies only to new stoves and stove-like fireplace inserts; not antique stoves, not the stove you bought two years ago, not your fireplace.

- If you have additional questions or want more detail about the proposed certification program, contact Margaret McCue, air quality information representative, at DEQ headquarters: P. O. Box 1760, Portland, OR 97207, 229-6488.

FH721.2

Blaze NORTHWEST INC

601 POSTMA ROAD P. O. BOX 417
MOXEE, WASHINGTON 98936
(509) 575-5548

Wa: 1-800-572-5610 Out-of-State 1-800-541-9130

Rec'd 3/20/84

February 21, 1984

Dear Blaze King Owner:

This is to alert you to a potential problem with your Blaze King catalytic stove/insert. For reasons not fully understood at this time, we have reports of a few combustors which fracture after only a short period of operation. The combustors all seem to fracture along the 3" height of a cell. The size of the area affected varies from one or two cells to sections an inch or more across. The pieces which fall out may fall into the ash bed and may go unnoticed for quite some time. If large sections are involved it may show up first on the catalytic thermometer which may not exceed 1000 degrees over a period of time.

To date the problem has been identified only with King models but all models should be inspected.

THERE IS NO DANGER TO THE STRUCTURAL INTEGRITY OF THE STOVE/INSERT. Only the clean burning characterisitics will be affected. Regular operation can continue for home heating.

Inspection: DO NOT REMOVE THE COMBUSTOR!

1. If the stove is hot, use a pair of pliers to lift the catalytic thermometer out of the hole in the stove top. Do not set it on a combustible surface - it is hot. Look into the hole for evidence of combustor failure. Use a flashlight if necessary.

2. Allow the fire to go out and the stove to cool down. Using a flashlight and mirror, look up into the combustor area through the flame shield.

Replacement: If any fracturing is discovered, contact your dealer. He will advise you concerning return and replacement. Be prepared to provide the following data:

Model Number:
Serial Number:
Date of Purchase:
Dealer Name:
Serial Number of Combustor (if known)
(Reference Bill of Sale)

Statesman Journal

Salem, Oregon 3 Saturday, February 19, 1983 25 Ce
Single

Not much left after heat bill

WASHINGTON (AP) — The average Supplemental Security Income recipient in Oregon spent about 46 percent of his benefits for heat, leaving only about $36 a week to meet other expenses, according to the National Consumer Law Center.

An NCLC report released Thursday also showed that Oregon households depending on unemployment benefits spent 26 percent of that income on heat, leaving them with about $85 a week for other expenses.

Those findings were included in a report entitled "Out in the Cold" compiled by the law center with a grant from the Community Services Administration. The report summarized information for this winter, through Jan. 31.

"The combination of high heating bills and inadequate energy assistance resources has resulted in widespread suffering," said Carol Werner, a spokeswoman for the Washington-based NCLC.

"Even with Mother Nature on their side this winter, the elderly poor and the jobless have very little left after paying their heating bills," she said, "and energy assistance doesn't even begin to make up the difference."

About 131,000 Oregonians got an average $494 a month in jobless payments last October, the report said, while the maximum benefit for Oregon SSI recipients was $284.

The average annual energy assistance payment to Oregonians was $951 during the last fiscal year, with an average monthly payment of $130 during the winter months.

The study showed a nationwide average of $50 per week left out of the typical unemployment check after heating costs were paid.

My name is Roger Rook. I am an attorney for Heating Energy Systems, Inc. a local woodstove manufacturer.

The Woodstove Advisory Committee has recommended a 15-6 9-4 staged emissions standard. We understand the department favors a 15-6-7-3 staged standard.

Our position is that we could live with the 15-6. The reality of the 7-3 standard is that it puts everyone in Corning's pocket and requires catalytic converters.

The catalytic converter is not a practical or helpful assistance to the air pollution problem. It is a destructive rather than a constructive force. Despite some other notions, the catalytic converter will in the real world not be used generally as designed, will stop functioning eventually and the overall long range result will be worse not better air.

Since the 7-3 standard would force all stoves to the catalytic converter, it will surely inhibit progress in the improvement of the traditional stoves within the industry.

As our engineers have interpreted the data, the testing results reported by the department show that even the catalytic stove when new and properly operated cannot meet that standard.

Catalytic converters are not the answer. We say flatly that in the broad sense, they will <u>not</u> work. The real world will see very little repair or replacement.

The answer is a standard that allows the industry to gradually improve the technology.

The industry wants to improve the technology and to lower emissions. It fears it will be put out of business.

OREGON ENVIRONMENTAL COUNCIL
2637 S.W. Water Avenue, Portland, Oregon 97201
Phone: 503/222-1963

Testimony
of John A. Charles
Before the Environmental Quality Commission
Regarding proposed woodstove administrative rules
May 3, 1984

My name is John A. Charles. I am the executive director of the Oregon Environmental Council, a non-profit citizens' organization representing more than 2,000 individuals and 65 organizations throughout Oregon. OEC has participated extensively in DEQ's efforts to identify and control residential woodburning emissions since 1979. OEC actively supported DEQ's efforts to pass HB 2235 during the 1983 Oregon legislative session, and subsequently served on the department's Woodstove Advisory Committee. We are intimately familiar with both the technical aspects of woodstove burning and the regulatory overlay within which woodstove emissions need to be considered.

Our task today is, in a sense, fairly simple. Through the arduous efforts of the DEQ air quality staff and its woodstove advisory committee over the last 8 months, there are relatively few areas of disagreement among the various publics concerned with this issue. The woodstove advisory committee has generally endorsed the entire proposed rule package in its current form, with the exception of the emission standards. OEC concurs with the advisory committee in this regard.

In arriving at their decisions on various parts of the rule package, DEQ has generally been guided by the best data available upon which to make judgements. This reliance has served the department well where they stuck with it. However, in making its recommendation on the emission standard, DEQ has chosen to bring into the picture a number of variables that have little to do with the objectives of reducing woodstove emissions. This is reflected in DEQ's recommendation that, in an effort to please everyone, pleases almost no one, and strays seriously from departmental objectives.

I. Air quality objectives

Air quality modeling has predicted that an 80% reduction in emissions from residential woodstoves is necessary to meet Oregon's TSP ambient air standard. This prediction has been based on many assumptions, including the following:

1. Other control measures to be applied to RWC will effect a 40% reduction in emissions.
2. Other emitters of particulates will decrease their effluents slightly in the future.
3. The population growth will be modest.

If any one of these assumptions proves overly optimistic, an 80% reduction in woodstove emissions will be insufficient to meet the air quality standard. If all of the assumptions prove correct, an 80% reduction may meet the air quality standard but still will not allow for industrial growth within the airshed. In order to satisfy the air quality goals of the legislature, i.e. to meet the TSP standard with a growth cushion, it is necessary to reduce RWC emissions by more than 80%.

With regard to stove emission measurements, it is apparent that an 80% reduction in emissions demonstrated in laboratory testing will not result in an 80% reduction in total emissions for a number of reasons:

1. Less than 100% of stoves in use will be of the newer design. If, for example, 90% of stoves are of the newer design, the 80% improvement drops to 72%.
2. Not all stoves will be operated properly all of the time.

Factors responsible for improper operation include:

Catalytic Stove	Secondary Combustion Chamber Stove
improper adjustment of secondary air	improper adjustment of secondary air
deteriorated catalyst	not applicable
thermostat failure	thermostat failure
other mechanical failure	other mechanical failure

The only factor unique to the catalytic stove is the failure of the catalyst. This will probably be balanced in the field by the critical nature of the secondary air adjustment[1] on the non-catalytic stoves. There is no data upon which to base a prediction of the impacts of improper operation, but it is certain that the air quality improvement will be significantly less than with 100% proper operation.

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1 TVA Residential Wood Heater Test Report Phase II (1981-1983) vol. I, pgs. xiv, xv.

II. Emission Standard

It follows from the above discussion that in order to meet departmental objectives, a standard which will bring at least 80% emissions reductions is necessary. In the staff report DEQ has made a strong case in support of such a standard. We support the department whole heartedly in this regard.

Unfortunately, the department has seriously compromised the integrity of the program by recommending that the standard be implemented in two phases. There are many disadvantages to this:

1. The two-year phase-in will allow thousands of new stoves to be installed that will pollute for many years at levels significantly higher than stoves sold later. This will undercut the effectiveness of the program.

2. The phase-in will add unnecessary costs to the regulatory program, in that manufacturers will pay all the costs of testing stove models, with only moderate clean air benefits. Inevitably these costs will be passed on to the consumer, who will wind up subsidizing an inadequate control program.

3. It's very possible that the second phase may never be implemented, as was the case with some standards for aluminum plants. Should this occur, the department would be left with a regulatory program that would fall far short of what is needed.

4. The phase-in will put added burden on all other sources of particulate in the non-attainment airsheds, especially for new industrial sources. Given that DEQ's offsets program has not been widely used, continued non-attainment status for many of the airsheds in Oregon constitutes a major impediment to economic growth.

The technology exists today to implement the proposed second phase of DEQ's standards. These rules are not even technology forcing, as so many other air quality programs have been. Since standards can be met now with the new technology stoves, there is no rationale for waiting 4 more years to implement the program. The industry has had enough time to respond. It has been evident to any observer of Oregon air quality problems since the PACS and MACS studies of 1979-80 that the woodstove industry would need to be tightly regulated. HB 2235 existed in draft form midway through 1982. DEQ has made it clearly known since then how it intended to regulate stoves. There is simply no compelling reason to delay implementation of the statute until 1988.

III. Catalytic vs. Non-catalytic standards: Discriminatory Regulations

In recommending different standards for catalytic and non-catalytic stoves, DEQ has again strayed somewhat from technical considerations and attempted to incorporate other, less quantifiable considerations(i.e. concern for the health of small manufacturers of non-catalytics) into the rules. The result is a recommendation that has very little data to support it and establishes poor public policy.

A. Lack of data

DEQ relies on data from minimal testing of only two catalysts to conclude how much the performance of a catalyst will likely degrade over its useful life. Therefore, it is assumed that performance of stoves in the lab will not be equaled by performance in the field, over the long haul. This is a fairly reasonable conclusion to draw from the data.

However, DEQ makes no such assumption about the performance of non-catalytic stoves, because there is virtually no data. However, one can assume that non-catalysts will operate at sub-optimal levels if for no other reason than normal degradation of equipment. In addition, there is at least some data, though perhaps unreliable, that describes the difficulty in maintaining dual chamber non-catalytic stoves at optimum performance levels. When the secondary chamber fails to perform adequately, pollution levels increase significantly.

B. Policy implications

DEQ's standards assume sub-optimal performance by catalysts over the lifetime of the catalyst, but makes no such assumption about the performance of non-catalytic stoves. This is clearly an error which unfairly penalizes the catalytic stoves. The central problem here is that DEQ, facing a lack of data about stove performance over the useful life of the stove in the field, has chosen to make a number of unsupportable assumptions about what might or might not happen after the stove leaves the lab. The more of these variables the department plugs into the framework, the shakier it becomes.

The split standard assumes: (A) uniform degradation of the catalyst on all catalytic stoves; (B) replacement of the catalyst only after significant deterioration; and (C)non-catalytic stoves' performance will not degrade in the field.

All three contentions are nothing more than educated guesses about future events. This is not the basis for sound rulemaking.

DEQ should establish rules based on what can be quantified in the lab. This ensures fairness for all parties. It may well be that catalysts degrade over time. It may also be that some people will burn household garbage in their stoves and poison the catalyst. Perhaps dual chamber non-catalytics will never work well in the field and pollute significantly more than is expected.

None of these things have been adequately quantified to date. Therefore, DEQ should not consider them as serious factors in the decision-making process. It would be far better to assume degradation of all technologies over time, and set standards based on what is achievable under test conditions in the lab. This is the only way to ensure fairness, technical accuracy, and reproducibility of test conditions.

IV. Legislative History

Although the staff report does not explicitly delve into the legislative history of HB 2235, it is common knowledge that a great deal of consideration has been given to this by the advisory committee and the staff. The most commonly cited aspect of legislative history is the supposed legislative intent to implement the statute in a way that would keep both catalytic and non-catalytic technologies economically viable.

While this may be interesting to historians, it has no relevance to these proceedings. In the strict legal sense, legislative history is only a factor when the statute is ambiguous. That is not the case with HB 2235. The statute clearly and unambiguously states, in Section 5, that:

> "Before July 1, 1984, the commission shall establish by rule:
>
> (1) Emission performance standards for new woodstoves;
>
> (2) Criteria and procedures for testing a new woodstove for compliance with the emission performance standards;"

Clearly DEQ has been delegated the authority to promulgate rules in a manner it sees fit, based on the best information available. Nowhere in the statute does it dictate to the agency that it shall reach the objectives of the statute in any prescribed way. It does not anywhere suggest that certain technologies must be protected or eliminated. It only established the general policy, and authorizes DEQ to construct the program.

There is no mandate for or against any type of technology. Those legislators who think contrary should have written the statute differently if that's what they meant. They didn't. Therefore, given the plain language of the statute, any reference to committee hearings or floor speeches is irrelevant to this rulemaking.

This is an absolutely critical point for the Commission to consider. If the Commission adopts rules on the premise that vague legislative concerns(apart from the statute itself) are important, it will open a whole realm of difficult and unwieldy issues. It will put the Commission in the awkward position of guessing not only what legislators might have said in 1983, but what they might not have said as well. Or, even worse, force the Commission to contemplate what the legislature might think in 1985 in response to the 1984 rules. This will rapidly degrade into a useless game of "20 Questions" with the legislature, at a time when the very composition of the 1985 legislature is not even known.

By contrast, it would be far better to adopt rules on the assumption that the guiding forces will be :(A) the EQC's general statutory mission; (B) the specific statutory charge of HB 2235; (C) DEQ's air quality objectives; and (D) the scientific data available to the Commission at the time of decision-making.

This type of process will allow the Commission to move much more clearly towards a resolution of the conflicts inherent in the adoption of rules

V. Conclusion

DEQ has made a sound technical case for a standard that will bring 80% emissions reductions. OEC strongly supports that recommendation. However, we believe the department has erred in 2 regards:

1. The standard should not be phased in. It should go into effect in 1986, as dictated by statute.

2. There should be a single standard for all classes of stoves based on laboratory performance.

Therefore, Oregon Environmental Council recommends that the standard be set at 3 grams per hour for all stoves, effective July 1, 1986. The technology to meet this standard exists today. Critics who argue otherwise have never been able to explain how a catalytic stove tested for DEQ in December, 1983 measured at 1.5 grms p/h, fully 100% below the strictest proposed standard.

There is simply no reason to delay full program implementation until 1988.

May 1, 1984

LOPI INTERNATIONAL LTD

Warm Up to the Beauty of Wood Stoves and Inserts

EQC Hearing Section

MAY 07 1984

State of Oregon DEPARTMENT OF ENVIRONMENTAL QUALITY RECEIVED MAY 07 1984 OFFICE OF THE DIRECTOR

TO THE OREGON ENVIRONMENTAL QUALITY COUNCIL

COMMENTS OF KURT W. F. RUMENS
PRESIDENT, LOPI INTERNATIONAL, LTD.,
LOPI ENERGY SYSTEMS WEST, LTD.

My name is Kurt Rumens, I am the co-founder and President of Lopi International, Ltd., as well as a member of the Board of Directors of the Wood Heating Alliance. The following comments reflect the position and opinion of LOPI®, not those of the W.H.A.

LOPI® has not been visible or vocal to date on the developing standards here in Oregon. We have, in fact, been confident in the joint efforts and the expertise embodied in the Woodstove Advisory Committee and the initial "seemingly" sensible approach to this problem by the D.E.Q. Our opinion at that time was that a practical, effective solution would result. In retrospect, that was obviously a naive, optomistic viewpoint.

For the record, I feel compelled to qualify our position by giving a brief background on the scope of our organization.

LOPI® is a nationally prominent woodstove and fireplace insert design and manufacturing company with facilities in the U.S. and Canada. Our **ongoing** concern and commitment to reduction of woodstove emissions and improved efficiency is demonstrated by our accomplishments in this arena.

When the issue of emissions reduction came to our attention in the fall of 1982, our position was not to waste effort and time fighting the progressive standards but to direct our engineering effort to take a more responsible position, comply or surpass whatever standard the D.E.Q. was asking for.

In March of 1983, in a series of tests conducted by OMNI Environmental Services, we did comply, and in fact, surpassed the then proposed D.E.Q. standard (non-catalytic). The LOPI® product has since been used by the D.E.Q. in legislative hearings as one of 12 products that would indeed comply.

An industry publication, **Wood 'N Energy Magazine**, has remarked on our willingness to invest in and indeed have the ability to generate applicable technology effective in reduction of woodstove emissions.

In the past 18 months, LOPI® has donated substantial funds for confirmation testing as well as invested $25,000 in independent laboratory tests to verify emissions reduction efforts.

Here in the state of Oregon we are represented by a local wholesale company who, in turn, services a network of independent retail outlets state-wide.

Lopi International Ltd. 10850 117th Pl. N.E. Kirkland, WA 98033-5088 Phone (206) 827-9505

I feel it necessary and pertinent to point out these retailers typify a high standard of excellence in terms of their commitment to solid fuel safety, ongoing staff education and community service. Their principles have merited them leaders in their respective communities in retail woodstove sales.

Now then, the profile I've put before you is that of a technologically competent, healthy and very substantial portion of the retail solid fuel sales in the state of Oregon. At this time, we fully support the approach outlined earlier today by Mike Sciacca of the Wood Heating Alliance as an effective means to begin to accomplish the task before us of emissions reductions, while offering the Oregon consumer the choice to utilize an alternative energy device.

At this juncture, Lopi International, Ltd. will not, in no uncertain terms, endorse or continue to invest time or funds in the effort to comply with what clearly has evolved from a reasonable approach, to a combination of misrepresented figures and manipulated data by the D.E.Q. that will indeed eliminate the opportunity for the Oregon homeowner to purchase a new alternative energy appliance after July, 1988.

- To be ENTERED INTO PUBLIC RECORD -

D.E.Q. PUBLIC HEARING
May 1, 1984

MY NAME IS BILL SMITH, I LIVE @ 28645 CANYON CREEK ROAD, WILSONVILLE, OREGON.

I SPEAK AS A CONSUMER, LIKE MANY OF YOU. I SPEAK AS A USER OF WOODSTOVES LIKE SOME OF YOU, AND I SPEAK AS A MEMBER OF THE WOODSTOVE INDUSTRY, HOPEFULLY STILL LIKE A FEW OF YOU..

SINCE 1973 THE MOVE HAS BEEN TOWARD ENERGY INDEPENDENCE, WITH THE EMPHASIS ON CONSERVATION, THE USE OF RENEWABLE RESOURCES AND RECYCLING. WITH THE 110 MILLION DOLLAR SAVINGS IN POWER AND FUEL OIL USAGE FOR THE UTLITIES AND OIL COMPANIES LAST YEAR, WE FEEL WE HAVE BEEN QUITE INSTRUMENTAL IN HELPING THEM CONSERVE AND REACH THEIR REDUCTION GOALS. I ASSUME THEY HAVE REDUCTION GOALS, THEIR CONSTANT ENERGY CONSERVATION ADVERTISING SEEM TO VARIFY THIS......THEIR STOCKHOLDERS MAY NOT BE TOO HAPPY, BUT I'M SURE THE UTILITIES AND OIL COMPANY'S ARE SINCERE IN THEIR APPROACH AND WANT TO CONSERVE. .. TO ME THE TWO MOST IMPORTANT FACTORS ARE USING RENEWABLE RESOURCES AND SAVING THE CONSUMER MONEY.

IT SEEMS TO ME OUR PRIORITIES ARE OUT OF ORDER IN AREAS SUCH AS EUGENE AND MEDFORD. AUTO EMISSIONS SHOULD BE MET FIRST, AS THEY HAVE IN THE PORTLAND METROPOLITAN AREA. IF THIS IS NOT THE CASE, WHY IS THE AIR CLEANER IN PORTLAND, WHICH IS MUCH LARGER THAN EUGENE OR MEDFORD???

WHY NO REGULATION ON FIREPLACES????

I WOULD LIKE SOMEONE ON DEQ STAFF TO EXPLAIN THE REAL REASON. IF EVERYONE WOULD BE REALISTIC AND TRUTHFUL, THEY WOULD AGREE THAT FIREPLACES ARE LITERALLY INCENERATERS: THAT PEOPLE BURN ANYTHING THEY CHOOSE, FROM PLASTIC MILK CARTONS TO PAMPERS. IN OTHER WORDS, FIREPLACES ARE AN IN-HOUSE GARBAGE BURNER. I WOULD ALSO LIKE SOMEONE TO EXPLAIN TO ME HOW THEY CAN CONTROL THE EMISSIONS OF A WOODSTOVE IF THEY CANNOT CONTROL WHAT GOES INTO IT.

WITH OREGON'S MANUFACTURING ENVIRONMENT, RATED #47 NATIONALLY, AND WITH OREGON BEING THE WOODSTOVE MANUFACTURING CAPITOL OF THE UNITED STATES, I WOULD THINK WE WOULD DO WELL NOT TO THROW THE BABY OUT WITH THE BATHWATER.

IF THERE IS ANYONE IN THIS ROOM NAIVE ENOUGH TO THINK BOOTLEGGING WOODSTOVES ILL NOT BECOME A LARGE INDUSTRY, WHICH WILL TAKE PRESENT REVENUE AWAY FROM OREGON, I WOULD LIKE TO SIT DOWN WITH THEM FOR FIVE MINUTES AND EXPLAIN HOW COMMERCE WORKS, AND PARTICULARLY THE CONSTITUTIONAL RIGHT TO ENGAGE IN INTERSTATE COMMERCE, JUST SO YOU KNOW WHERE I'M COMING FROM.

GOVERNMENT REGULATIONS AND CONTROL ARE ALWAYS SO EFFECTIVE. IF YOU HAVE ANY DOUBTS YOU CAN USE THE ANALOGY OF MARIJUANA BEING GROWN IN SOUTHERN OREGON AND CALIFORNIA. AS YOU KNOW THEY SPEND MILLIONS OF OUR TAX DOLLARS STAMPING IT OUT AND THE VOLUME AND GROWTH INCREASE EVERY YEAR.

IF ANYONE THINKS PEER PRESSURE HAS ANY VALUE, YOU WOULD NOT SEE GOVERNMENT AND UNION MEMBERS DRIVING JAPANESE CARS.

I FEEL IF EVERYONE HAD DONE HIS HOMEWORK EARLY ON AND HAD ADDRESSED ALL THE POLUTERS, INCLUDING AUTOS AND FIREPLACES AND GRAVEL ROADS IN THESE FEW DIRTY CITIES, NOT ONE OF US IN OUR INDUSTRY WOULD HAVE OBJECTED TO REASONABLE STANDARDS THAT COULD BE ATTAINED WITHOUT TRYING TO PUT US ALL OT OF BUSINESS, AND AGAIN TRAP THE CUNSUMER WITH MORE COSTLY REGULATIONS INTO ONCE AGAIN TOTALLY DEPENDENT ON THE EXISTING UTILITIES AND OIL INTERESTS.

IF WE ARE DESTINED TO CALL OUR STATE "OREGON NATIONAL PARK", WHERE THE "IN" THING TO DO IS TO COME TO OREGON AND LISTEN TO THE TREES GROW, THEN WE ARE HEADED IN THE RIGHT DIRECTION.

WITHOUT APPROPRIATE STANDARDS, IT APPEARS TO ME A MOVE IS ON TO BAN THE CONSUMER FROM HEATING HIS HOME WITH A WOODSTOVE. IF ANYONE FROM D.E.Q. CAN CONVINCE ME THIS IS NOT THE CASE, HE CAN CALL ME ANYTIME TO PROVE ME WRONG, I'M A GOOD LISTENER.

ANYONE WHO KNOW ME KNOWS THAT I AM QUITE OUTSPOKEN AND I WOULD LIKE TO MAKE IT CRYSTAL CLEAR (no pun intended) THAT WE MUST VIEW JOBS, BUSINESS AND COMMERCE, AS TOP PRIORITIES. WE CAN ALL BE PHILOSOPHICAL ABOUT CLEAN AIR, BUT I HAVE NEVER SEEN A PHILOSOPHER WITH AN EMPTY STOMACH.

MY FAMILY CAME TO OREGON WHEN IT WAS STILL A TERRITORY, AND MY GREAT-GRANDFATHER'S COMPANY WAS INSTRUMENTAL IN BUILDING THE CITY OF PORTLAND, AND I AM OUTRAGED AT THE PROSPECTS OF ME AND MY BUSINESS BEING EVICTED FROM MY HOME STATE....

I WILL NOT SUPPORT THIS LEGISLATION AS IT NOW STANDS.....

THE LITTLE OLD LAYDS SYS "Where's the beef?".....I'M SAYING "HERE'S THE BEEF"

Thank you for your indulgence.

Bill Smith

FOR INCLUSION IN PUBLIC TESTIMONY

Date: April 20, 1984

To: Members of the Environment... ...ssion

From: Keith Cochran
285 S.W. Devonwood
Beaverton, Oregon 97(

Re: DEQ Woodstove Emissio...

Linda: I believe this was someone's oral testimony -- do you already have a copy?

It seemed that each time committee persons questioned the results of tests or procedure presented by DEQ staff, the commmittee member(s) was "trying to read into", whereas whatever the DEQ staff presented was to be accepted as absolute fact.

I feel that there was insufficient data compiled by DEQ staff to make any type of recommendation, let alone request, for legislation, that such data as was available was not thoroughly analyzed by enough people to see if in fact the test, results and procedure were correct.

Materials that did not fit into the DEQ staff's theme of presentation were either not handed out or were handed out when they felt like it. Example being a draft from Dr. Shelton, which I presented at the first meeting (August 17, 1983) which was not handed out until the fourth meeting (September 12, 1983) after the DEQ staff had presented all their "procedures and materials". In my opinion this was done so that the committee would not be as apt to question the DEQ staff material in an attempt to get the questions raised by Shelton answered. If those questions had been raised up front, I feel the process could have been done in a lot less time or at lest more thoroughly, due to not continually going back to try and get the answers.

Another example was the letter from Tropp which was very critical of Mrs. Hume, which was distributed by the DEQ staff, whereas the letter from Bill Bradbury was not presented by the DEQ staff but by Mrs. Hume. See Attachment "A".

Material presented on the conformation test showed a comparison of Condor Samplers 1 & 2 vs. Method 7 average, to get the same type comparison of Method 7's Samplers A & B I had to go into the report and pull the data together. As a result of comparing them this way I now question the point to point accuracy of Method 7. See Attachment "B".

In the request for authorization to conduct a public hearing, (Agenda Item # A, March 16, 1984, EQC Meeting) page 10, why was the "Oregon Environmental Council" recommendation included? If independent organizations recommendations were included, why not retailers, WHA, etc.?

Page 3 (same above document) - Five of the advisory committee members were affiliated with the Nationa Wood Heating Alliance (Hume, Cochran, Tiegs, Engle & Sparwasser). This is inaccurate, (Cochran is not affiliated with WHA), misleading, (Engle and Sparwasser were not on the committee at the same time). I feel that this was an attempt by the DEQ staff to make it sound like the committee was heavily weighted toward WHA, whereas in reality, only three at any given time were affiliated with WHA. This (putting Cochran's name as affiliated with WHA) is another example of failure to verify their information by the DEQ staff.

Note: Attachment "C" is a chart showing test data presented to the Advisory Committee in mnay sections and which I have compiled into one chart; this shows only data from 24 tests presented to the committee; 16 tests were Blaze King and 8 tests were Jotul "201", which leads me to believe the whole data base was based on a Blaze King prototype.

ATTACHMENT "A" 1

TOM THROOP
DESCHUTES AND KLAMATH COUNTIES
DISTRICT 54

'LY TO ADDRESS INDICATED:
House of Representatives
Salem, Oregon 97310

☐ P.O. Box 643
Bend, Oregon 97709

COMMITTEES
Chairman:
Revenue
Budget Balance Conference Committee
Select Committee on Property Tax Relief

HOUSE OF REPRESENTATIVES
SALEM, OREGON
97310

November 29, 1983

Bette Hume, President
Klickitat Enterprises, Inc.
1801 N.W. Upshur
Portland, Oregon 97209

Dear Bette,

I deduce from your telephone call and letter that you are looking for legislative support in your attempts to avoid the legislative intent of House Bill 2235. I may be wrong, but that is the way it looks to me.

You will not find any help here. I believe you should get on with the job of implementing House Bill 2235. You are too late if your desire is to alter the measure adopted by the 1983 legislative assembly. You will not have another opportunity until 1985.

For now, the advise I would give you is to get on with the task at hand. Quite trying to convince yourself that the Legislature really meant something else. It did not. Grasping for "jobs" and "economic development" arguments which really have little relevance to the issue at hand serves no purpose. All of that was played out in the Legislature months ago.

I was on the House committee which dealt with the issue. I followed this issue on a daily basis in both the House and Senate. I hope my comments are constructive.

Thank you for your inquiry and I hope I have answered your questions.

Sincerely,

TOM THROOP

ATTACHMENT "A" 2

RECEIVED DEC 13 1983

HOUSE OF REPRESENTATIVES
SALEM, OREGON
97310

December 8, 1983

Bette Hume, President
Klickitat Enterprises, Inc.
1801 N.W. Upshur
Portland, OR 97209

Dear Ms. Hume:

Thank you for sending me a copy of your recent remarks to the Woodstove Advisory Committee. I confess I have not been keeping up with the goings on of this Committee; so I was glad to get a little view of what is happening.

As you may know, I served on the Environment and Energy Committee which worked on the Woodstove Bill last session. In your comments to the Advisory Committee, you spoke about some new proposed standards. I am not familiar with what these standards are, but I would very much appreciate some information on what the proposal presently is.

I was not impressed with the performance or reliability of catalytics; so I am intrigued that the standards are moving in that direction (if that is what they are doing).

If you will be kind enough to let me know what the new proposed standards are, I would very much appreciate it.

My best,

Bill Bradbury
State Representative

BB:dh

ATTACHMENT "B"

Nieto C.
4/14/84

	Method 7				Condor Before Adj.				Condor After Adj.			
Run	A	B	Avg		#1	#2	Avg		#1	#2	Avg	
1	18.1	20.5	19.3	2.4	15.3	16.1	15.7	.8	18.1	18.7	18.4	.6
2	26.6	24.1	25.4	2.5	23.1	23.7	23.4	.6	23.8	24.2	24.0	.4
3	13.8	16.5	15.2	2.7	9.9	10.5	10.2	[illegible]	13.5	14.0	13.7	.5
4	~~3.3~~	~~3.8~~	~~3.5~~	~~.5~~	~~1.5~~	~~1.1~~	~~1.3~~	~~.4~~	~~5.3~~	~~4.9~~	~~5.1~~	~~.4~~
5	6.8	6.8	6.8	—	1.4	1.3	1.3	.1	5.2	5.2	5.2	—
6	41.1	36.9	39.0	4.2	65.7	66.0	65.9	.3	37.0	37.0	37.0	—
7	22.6	24.2	23.4	1.6	26.6	28.4	27.5	[illegible]	26.1	27.1	26.6	1.0
8	33.2	31.5	32.3	1.7	46.6	51.0	48.8	4.4	34.9	36.0	35.5	1.1
9	19.0	21.9	20.4	2.9	12.3	13.8	13.1	1.5	15.6	16.9	16.2	1.3
10	18.3	17.7	18.0	.6	14.2	14.8	14.5	.6	17.1	17.7	17.4	.6
11	~~4.0~~	~~4.2~~	~~4.1~~	~~.2~~	2.6	3.2	2.9	.6	6.5	7.1	6.8	.6
12	10.4	10.4	10.4	—	4.2	4.9	4.6	.7	8.1	8.8	8.5	.7
13	10.4	9.1	9.8	[illegible]	6.4	5.9	6.1	[illegible]	10.2	9.7	10.0	.5
14	1.8	2.1	2.0	.3	1.5	1.4	1.4	.1	5.3	5.2	5.3	.1
15	1.7	1.9	1.8	.2								
16	.91	.85	.88	.06								
17	.90	.86	.88	.04								
18	2.3	2.1	2.2	.2								
19												

IRONS in the FIRE

YAMHILL MARKETPLACE • 110 SW YAMHILL • PORTLAND, OR 97204 • 223-0121

My Name is Lois Renwick, and I am the owner of Irons in the Fire, a speciality retail woodstove shop located in Portland, Oregon. I purchased this on-going business almost four years ago. I have always been proud to represent and sell the finest quality woodstoves. I also provide free literature, counseling on stove selection, and advice on saftey and installation. As a retailer, I must have products that have been tested and proven. I must have manufacturers who offer a reasonable warrenty with their products. I must be able to market products with a reasonable profit margin to insure that I can continue to pay debt service and support on-going business operations. I must be able to evaluate and select products that will provide the performances my customers desire, and I must be able to do this in good consciousness. If any of these criteria is not met, I will no longer continue in business. It is that simple.

Because of these reasons I am opposed to the Woodstove Certification Rules OAR 840-21-100 through 340-21-166 as presented to the Environmental Quality Commission. As proposed, the standards are unreasonable and unattainable based on existing data and technology. After reviewing the data and test results presented to the EQC'S Woodstove Advisory Committee, it is clear to me that the DEQ, by manipulating data, is attempting to eliminate the sale of new woodstoves within the State of Oregon.

The moment these regulations are adopted, the day of the speciality woodstove retailer in Oregon is gone. Not one Oregon retailer will be able to continue to provide essential free customer service because product selection will be non-existant. The State of Oregon will continue to be labled as a state which discourages and dismembers small businesses because of government regulation.

When I close the doors of Irons in the Fire, I'm pointing my finger directly at the Department of Environmental Quality. I will no longer be in business to provide free information, literature and a showroom for the perusal of the DEQ staff. I will refer all consumer calls and inquiries on installation, saftey and service directly to the air quality division of DEQ.

I cannot in good conscience support a program that extorts consumers to finance activities for DEQ staff. Consumers will suffer for many years to come because of the action of these proposed standards and test proceedures.

RECEIVED

MAY 03 1984

PUBLIC AFFAIRS

Lois R Renwick

For inclusion in the public record.

1801 N.W. Upshur • Portland, Oregon 97209
(503) 295-0121
Importers of Kent Woodstoves

Klickitat Enterprises, Inc.

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
Hearings on Proposed Rules for
Oregon Woodstove Certification Program
Portland, Oregon

May 1, 1984
7:00 P.M.

Testimony Submitted by Bette Hume
President, Klickitat Enterprises, Inc.

Good evening. My name is Bette Hume, and I am the President of Klickitat Enterprises, Inc., an Oregon corporation that distributes Kent Heating products in the United States. I was also a member of the Oregon Woodstove Advisory Committee, appointed by the Environmental Quality Commission to review proposals for woodstove certification rules, and charged by statute to "aid and advise the Commission in the adoption of emission performance standards and testing criteria." In both these capacities, I am pleased to have the opportunity to make this presentation today.

As a distributor of woodstoves in Oregon, I was an early supporter of legislation designed to regulate woodstove emissions in the Oregon airshed. I testified in favor of such legislation before committees reviewing the legislation, and added my support to that of other members of the woodstove industry.

Our support was engendered by the assurances of the Department, as frequently reiterated in House and Senate hearings and at meetings of the Woodstove Advisory Committee, that the regulations to be proposed by the Department of Environmental Quality and promulgated by the Environmental Quality Commission would be balanced, providing for the improvement of the Oregon airshed, while maintaining a reasonable standard that woodstove manufacturers could meet. I believe that the regulations proposed by the Department fail to conform to these assurances.

During the legislative hearings, the Department indicated that the goal of the legislation was to reduce particulate emissions in the Oregon airshed by approximately 65-75 percent. Given the assumptions of air quality the Department was expounding, this goal seemed reasonable, admirable and, most importantly, attainable. As the Department asserted in its legislative fact sheet submitted to these hearings:

> "For rules that are very complex or controversial, the Commission has used detailed work sessions where point by point differences are debated between staff and opponents before the Commission. The Commission is very careful not to adopt overly restrictive rules or to impose requirements or timetables which industry cannot reasonably meet."

After the legislation was enacted, however, it soon became clear that the Department was seeking a much greater reduction of what it perceived to be the current level of particulate emissions: the number the Department suddenly began to use was 80 percent, far in excess of the number the Legislature relied upon in enacting the legislation.

The Department has proposed a mandatory, phased-in emission standard of 15 gms. of particulate emitted per hour for non-catalytic woodstoves and 6 gms. for catalytic woodstoves by July 1, 1986, and, by July 1, 1988, 7 gms. of particulate emission per hour for non-catalytic woodstoves and 3 gms. for catalytic woodstoves. The proposal for a "7/3 standard," however, was made without any prior serious discussion by the Woodstove Advisory Committee.

The Woodstove Advisory Committee, which consisted of environmentalists, health officials, scientists, and manufacturing and retailer representatives, grappled long and hard with the question of particulate emissions, utilizing data provided by the Department. At no time did the Woodstove Advisory Committee agree that a "7/3 standard" would be acceptable. In fact, the Committee initially considered a standard of 20 gms. of particulate emitted per hour for non-catalytic woodstoves and 10 gms. of particulate emitted per hour for catalytic woodstoves. After reviewing the data base provided by the Department staff, the Committee finally settled on a standard, which was based on the information then available, requiring a "15/6 standard" for July 1, 1986, and a "9/4 standard" for July 1, 1988. Since the completion of the Committee's work, however, it has come to my attention that the information supplied by the Department, and upon which the "9/4 standard" was based, was inadequate in many respects and capable of vastly different interpretations. For these reasons, the doubts I had about the "9/4 standard" when it was adopted by the Advisory Committee are now more pronounced. I am, therefore, proposing that the Commission promulgate only the "15/6 standard" for July 1, 1986, and defer any action at this time on the "9/4 standard" until further examination of the Department's data and other data can be completed.

The Department has calculated its "7/3 standard" by arbitrarily mandating a reduction in the current levels of woodstove particulate emissions it assumes to exist by 80 percent. How are these current levels calculated? The Department relies on models containing imperfect assumptions and surveys containing inadequate data to achieve a presumed current level of emissions for the average woodstove in the field. The truth is, no one really knows if these assumptions are accurate, or if the surveys relied upon represent a true cross-sampling of Oregon users. Rather than delaying the promulgation of regulations until less nebulous data is available, however, the Department has decided to propose very concrete regulations that will have the effect of eliminating the woodstove industry in Oregon.

The Department could commence hearings on the 1988 standard early in 1987, after three more years of additional research has been done on the effect of woodstoves on the Oregon airshed and on the emissions of typical woodstoves. The response of the Department to this proposed deferral is to insist on the current promulgation of the July 1, 1988 standard, but to assure the public that if the July 1, 1988 standard proves to be incorrect, the Department will consider changing it. This attitude ignores, of course, the chilling effect that the Department's July 1, 1988 standard will have on the industry as a whole, whose members can only assume that the burden of proof to change a promulgated regulation will rest on the users of woodstoves, rather than the Department.

The July 1, 1988 "7/3 standard" proposed by the Department will eliminate virtually all non-catalytic woodstoves utilizing existing technology from the Oregon market, with the only prospect of continued operation dependent on some unknown and unforeseen technological change in the future. No new technology is either in existence or planned, however, which would enable non-catalytic woodstoves to meet the "7/3 standard" required by July 1, 1988. The attitude of the Department is that if the "7/3 standard" eliminates non-catalytic woodstoves, so be it: the Department will mandate an Oregon catalytic future. There is nothing in the legislative history, however, that indicates that the Legislature either contemplated, or condoned, an exclusively catalytic woodstove industry.

Overly restrictive standards will only worsen the potential defects of the regulatory program. Many arguments were raised in the legislative hearings regarding these defects, including, for example, the increase in cost to consumers of these regulated woodstoves, the ability of Oregon consumers to purchase nonconforming woodstoves in other states for unrestricted use in Oregon, the failure to regulate used woodstoves, and the continuance of airshed pollution caused by open fireplaces.

The Department's proposed "7/3 standard" will have its most severe economic impact on small business. Small manufacturers, distributors and retailers in Oregon will be put out of business or will flee across state lines to Washington, Idaho, or California for their only hope of continuing in business.

I urge the Environmental Quality Commission to consider the promulgation of a "15/6 standard" by July 1, 1986, and to defer the promulgation of any standard for 1988 until additional data has been accumulated and carefully examined.

Thank you very much.

May 1, 1984

BEFORE THE
OREGON ENVIRONMENTAL QUALITY COUNCIL
PROPOSED WOODSTOVE CERTIFICATION RULES
Comments of Paul B. Stegmeir
Counsultant, Lecturer, Writer
St. Paul, Minnesota

Ladies and Gentlemen (Mr. - Madam) Hearing Officer and all those gathered. My name is Paul Stegmeir. I am an independent consultant working in the midst and around the fringes of issues related to the wood heating, wood energy, forest management field. I have long been involved with issues of wood heating, starting in the early 1970's as a faculty member of the University of Minnesota's Agricultural Extension Services, as a Vice President of Technical Operations for a retail-wholesale firm in the late 1970's and since 1980, exclusively as a consultant, lecturer and writer in this field. During all of those years, I have served at various times or continously as a member of various committees in the industry, such as Safety Standard Committees at U.L., WEI-WHA technical committees, various state and regional biomass utilization and planning boards, etc. Additionally I have served as consultant and/or advisor to such groups as NFPA's 211 Committee, the Federal Trade Commission, the Consumer Products Safety Commission, and various insurance, model code, and fire safety groups. I have also authored numerous articles concerning proper, safe and clean use of wood heating equipment. My work has long been identified as that of raising the consiousness and improving the focus of the wood heating industry toward safer, cleaner, more responsible development of products and practice as related to the proper use of wood heating systems.

My concern as a supporter and as a follower of the Oregon proceedings is that the final intent - to provide cleaner air for Oregon through improved products brought forth to the market place because of this legislation may well be washed aside by creation of a test protocol that is too unrealistic and an emission standard that is too stringent. In effect, if a rule is too stringent to follow, its result will not be fruitful.

The arduous efforts of DEQ over the past several years, and the intense work and committment of the Woodstove Advisory Committee over the past eight months, have demonstrated to the nation and the world the intent and seriousness of Oregon's concern for improving air quality. Beyond a doubt, this work has been necessary, and the problems identified have far reaching implications for other states throughout the land.

Even with all of the research, study and work that has taken place, it remains readily apparent that many gaps exist in the chain of assumptions and proofs necessary to objectively accomplish the task at hand - to firmly set in motion now the machinery that will control and regulate future emissions from wood stoves. In its attempts to solve long range problems, Oregon DEQ's solution may prove to be self-limiting.

The proposed DEQ protocol and 7/3 standard has, as its potential, the probability of discouraging the development of product beyond the 1988 window. If this becomes the result, and if few, if any, products which meet the intent of the certification program are available in the marketplace, consumers will be loathe to give up their old stoves in favor of new improved products, will be more likely to repair than replace those stoves, and may be just as likely to purchase their new replacement products out of state, or to build their own stoves. The long term effect of this scenario would be to limit the effectiveness of the air quality improvements mandated under the law.

If in fact few complying products are available, dealers who are currently serving the wood heating public would be significantly disadvantaged, perhaps to the point of their economic failure. With fewer knowledgable dealers available to serve the public, consumer support would be lessened. The ensuing turmoil, expressed in terms of unsatisfactory dealer support of existing product in the field, lack of proper education and advice on safety and clean wood heating, and a general disintegration of the professional distribution-retail support base that has matured over the past ten years in this industry, will serve only to remove farther from fruition the ability of the certification program to work.

My purpose here is not to discourage the EQC, the DEQ or the State of Oregon from moving forward with regulatory procedures, but to encourage you to find an objective and viable position that will allow the professional dealer base to exist, to encourage manufacturers to produce improved products, and to encourage the consuming public to buy and use those products soon and properly. For this to occur, the window of opportunity must be wide enough to allow the industry to economically justify research and development expenditures for the creation of products that can comply. Competition has always been a force to create improvement in products made available to the consuming public. With a wise decision on the part of EQC, Oregon can marshall the best of both worlds - a marriage of reasonable legal and regulatory activity with the competitive forces of the marketplace to create an environment which will allow for better and safer product to be systematically introduced to the consumer market place - with the result being a significant decrease in the problems of wood stove emissions.

In conclusion, it appears that the 15/6 grams per hour figure for 1986 will provide <u>at least</u> a 50% reducton in emissions from wood burning appliances. It allows several technologies to be used in meeting the goal. It affords a broader base of consumer choice, supports a more viable marketplace and encourages manufacturers to shoot for an attainable target. To go beyond this level of requirement is frought with many unknowns and potential pitfalls. There may be a more stringent regulatory limit that is assurably attainable and objectively possible, but there is not enough support or concurrence on this potential in existence in the scientific community dealing with wood stove emissions issues today. My advice is to set forth a 15/6 standard, let the marketplace and time work for you in Oregon, and provide a clean atmosphere of cooperation to meet your goals rather than a cloud of confrontation that could serve to defeat them.

ALL-WAYS WARM CO.
Woodstoves, Accessories & Fireplace Shop
"Rockwood Plaza"
2236 SE 182nd
Portland, OR 97233
(503) 661-5990

May 1, 1984

To whom it may concern:

I have been asked to make a statement on the impact of the present legislation on the wood-stove industry.

First of all, I would like to state that the legislation in question is another example of bad legislation running business out of Oregon. The legislation that was passed will support cleaner stoves. However, the stoves available will be limited in choice, and very high-priced. This will promote out-of-state business, markets for mail-order and homemade stoves, and encourage consumers to hold onto their older, poorly designed wood stoves.

The impact that this legislation will immediatly have upon the industry is obvious: it will effectively put out of business the retail outlets that specialize in woodstoves, and indirectly affect the manufacturers, suppliers, and contractors that are the lifeline of the retailer.

Since the goal of this program is to replace "dirty" burning stoves with "clean" burning stoves, I feel that the main concern now is in determining wether or not this legislation will accomplish what it was intended to do.

The answer to that, in my opinion, is an emphatic NO!

There seems to be a consensus within the industry that as consumers are educated, they will gradually replace their stoves with cleaner burning, more efficient models.

Does this legislation guarantee education of wood stove users? There are so many variables concerning the use of wood stoves. Certainly, the fact that the fuel being used is unrefined,therefore difficult to control as far as quality is concerned, (as opposed to refined fuel), is a major concern. The question I wish to raise is this; Though a consumer may possess a DEQ approved, "clean burning" stove, if not used according to the rigid testing procedures used in aquiring it's rating, what then will the rate of emmission be? In testing, DEQ used a cleaner burning fuel then is normally used in Oregon homes[1], thus obtaining a lower emmission rate.

Does this legislation provide for the regulating and testing of the fuel used in woodstoves?

A great deal of comment has been made on the 1988 emmission standards. My questions here are, "Are they realistic?, and do they in fact reflect what is actually needed to bring the airsheds in question within the guidelines?" And is it fair to attribute contributions made by other sources, i.e., fireplaces, etc., to woodstoves during the fingerprint period? And if EPA is in acuality going to re-evaluate he standards, would not current standards be acceptable?

Will the legislation and quidelines under consideration actually improve the air quality in the airsheds in question?

ALL-WAYS WARM CO.

Woodstoves, Accessories & Fireplace Shop
"Rockwood Plaza"
2236 SE 182nd
Portland, OR 97233
(503) 661-5990

In the four and a half years since we have been in business, we have seen consumers gradually change from owning dirty, inefficient stoves, to cleaner, efficient stoves. But there are still a lot of dirty-burning stoves in use. It is only a matter of time before they fall into disrepair and disuse, and the consumer starts shopping around for a replacement. If we, the specialty woodstove retailers, are still in business, we can then educate the consumer as far as woodstove choice, the importance of properly prepared fuel, correct burning tecniques, and correct chimney installation. With proper incentives to manufacturers, and increased consumer education, in time, the goal of improved air quality will be realized.

If legislation is supported that will in effect put us out of business, where then will the consumer go to replace his stove? Very few will be willing to pay the exorbiant prices that "approved" woodstoves will have. Despite market surveys that the DEQ boasts of, we, who have daily direct contact with the public, know better. There are very few, despite concerns for better air quality, that will stand for an increase in stove prices. Since the airsheds that the legislation was originally intended for, Medford and Portland, are within driving distance of state-lines, I predict a boom in the woodstove businesses in those areas. And as stated earlier, this will only promote out of state businesses, and at the same time, deprive Oregon of out-of-state business. A high percentage of woodstove retailers inthis area sell to out-of-state consumers. While they are in Oregon, they also buy food, gas, frequent restraunts, and other stores. Like the ripples when a stone is dropped in a pond, so will this legislation be-only the ripples it causes will be detrimental, rather then beneficial.

So in essence, legislation has been passed that does nothing more then put Oregonians out of of jobs, and justifies once more DEQ's existence.

We would like to go on record as supporting the policies of the Wood Heating Alliance, and the Wood Energy Institute West.

I would like to remind those involved that one of the hallmarks of a democracy is freedom of choice. It is only in a dictatorship that laws are mandated and inposed on citizens. Which are we?

Ron H Buchholz
Ron Buchholz

Robin Fellenger
Robin Fellenger

Willamette
WOODSTOVES

1055 Commercial St. S.E. • Salem, Oregon 97302 • (503) 370-7286

April 30, 1984

Mr. Fred Hansen, Director
Department of Environmental Quality
State of Oregon
Box 1760
Portland, OR 97207

Dear Fred:

Enclosed is a copy of my testimony on the DEQ recommendations for implementation of HB2235, 1983 Oregon legislature. I hope that you will carefully consider my testimony in formulating your recommendation to the Environmental Quality Commission.

Sincerely,

Tim Nissen
Owner

TN:rhe

Enclosure

I may qualify as one of the stupidist people in Oregon, because I invested a substantial amount of money to open a specialty woodstove store after HB2235 had been passed by the Oregon State Legislature. My assumption was that the implementation of the standard would be reasonable and that it represented a marketing opportunity for a retailer selling higher quality, higher efficiency, lower emissions stoves and inserts. It appears that I was a fool; the DEQ recommendations are not reasonable.

Please consider the following 5 points:

~~1) The Woodstove Advisory Committee lacked even one retail merchant despite the fact that this bill affects the retailer more than anyone else. The retail outlet is the sole point of control in the regulatory process. Bette Hume who was appointed to allegedly represent the retail interest is in fact an importer and distributor of a small and expensive line of stoves. She is not a retailer as she sells no products to end users and she cannot represent the retailer's interests.~~

1) The DEQ claim that an 80% reduction in woodstove emissions is required to meet federal clean air standards in the Portland and Medford airsheds is based on an air quality model that contains naive and even stupid assumptions about consumer behavior, supply and demand economics, and growth.

These are the same sort of assumptions that Bonneville Power Administration and other regional power planners used in predicting the absolute necessity of WPPSS 1, 2, 3, 4, and 5. It seems that these models fail to recognize that when price goes up, consumption goes down: for electricity, gasoline, caviar, houses or woodstoves.

The DEQ asserts that Oregonians will purchase 20,000-30,000 stoves per year at prices 20-60% higher over the next 14 years. Well, if that happens, then I am going to sell about $10 million dollars worth of woodstoves over the next 14 years and can retire a millionaire at age 49.

What happens if stove sales continue to decline as they have for the past four years? And what happens if people in Portland travel five miles to Vancouver to buy a stove? And what happens if woodburners don't replace their catalysts because $80 will buy a cord of wood, and the catalyst isn't going to save you that much?

Air quality models have the same weakness as economic, political, stock market, interest rate and other forecasting models. About the only thing we can be sure of is that they are going to be wrong.

2) The DEQ seems to be tying reduced woodstove emissions to economic growth stating: "Reduction in particulate pollution violations should help to increase the airshed capacity that would be available for growth and development, resulting in estabishment of industries with a potential of 19,000-24,000 new jobs in the state by the year 2000." At best this is unsubstantiated. At worst it is deceitful. At present a clean environment is one of the <u>only</u> things Oregon has going for it. There is not one shred of evidence that airshed capacity is limiting economic growth.

3) Woodstoves are currently sold in two places: one, by large hardware or building supply places that offer little information or service. Outlaw stoves and they will simply sell something else in that space. Second, by specialty stores offering a wide variety and lots of information and service.

To survive, the specialty store needs a variety of products ranging from room heaters that produce 10,000 btus/hour at a medium high burn rate to large stoves that produce 50,000 btu's. They must sell products that meet a variety of needs at a variety of prices.

What happens in 1986 when our product line goes from 30 models to 5? Or in 1988 when it shrinks to 1? We go out of business.

If you assume that manufacturers can develop a variety of products to meet the proposed 1986, much less the 1988, standards, then you probably bought WPSSS bonds and in both cases you are wrong. The proposed 1986 standard comes close to outlawing woodstoves and the 1988 standard does so. The assertion that in 1988 20,000-30,000 Oregonians are going to buy a product that currently does not exist is nonsensical.

4) As I stated, Willamette Woodstoves tried to look at the Oregon Woodstove Bill as a marketing opportunity, not as a market problem. We worked hard to identify the cleanest burning stoves and were successful in getting the Jotul 201, Arrow ATS catalytic, Intensifier catalytic retrofit and Lopi T-380 to sell. Our sales to date:

Ø Jotul 201
Ø Arrow ATS catalytics
1 Intensifier
25 Lopi T-380's

Why? Because our customers are rational people who will not pay $1000 for a stove that is slightly more efficient, more difficult to use, and slightly cleaner burning. The Lopi T-380 at $600 does make economic sense. It is very efficient at a high burn rate, easy to operate, and has features customers want, e.g.

glass doors. It also has no chance of passing the proposed emissions standard. The standard discriminates against conventional stoves that are clean burning at high burn rates.

5) Economic Development

My partner and I invested $36,000 to open our business. This investment allowed us to hire three employees--we created three jobs. Two of the people we hired were on unemployment, the other one was replaced by his former employer.

In our first year of operation our sales will be just shy of $200,000. This means $140,000 in expenses for our suppliers, $30,000 for our employees, $7,000 for our landlord, $8,000 in advertising and $17,000 for other expenses. It even means a little bit of profit for us to spend or reinvest as we see fit.

The sales of these stoves mean thousands of dollars worth of business for wood suppliers, masons, installers and chimney sweeps.

The economic benefits of our small business are substantial. What are the costs? First, recognize that Salem is not out of compliance with federal clean air standards. We are being regulated out of business to correct a problem that does not exist in our market area. Second, we take considerable pains to properly size our stoves to the customer's needs and stress the importance of a high burn rate, seasoned wood and regular maintenance. As the overall air quality in Salem in the past three years has improved significantly, I doubt that our stoves have had much adverse impact at all.

The DEQ states that the economic impact of the bill on my small business may be beneficial, "assuming there would be no decrease in stove sales, and assuming that cleaner-burning appliances would cost $100-300 more than present generation appliances, there could be the benefit of an overall increase in dollar sales for the industry." Well, that $10 million in sales I mentioned may be $15 million; and I'm willing to sell right now for my original investment. That's how sure I am of these assumptions.

As far as I'm concerned the economic impact of HB2235 with the proposed emissions standard is catastrophic to my business and my employees.

<u>Summary-</u> The Oregon Air Quality model is based on worst case assumptions about worst case airsheds. The proposed emissions standard is based on best case assumptions about stove sales, and technological development, and worst case assumptions about the economic rationality of the woodburning public. As proposed, the Oregon Woodstove Bill will have catastrophic effects on an important Oregon industry--and because of this it will have little or no impact on airshed quality. Outlawing the sale of new woodstoves will not improve air quality in Portland or Medford. I urge you to develop a test method that does not discriminate against conventional stoves, and to approve an emissions standard that will impact air quality favorably while not stifling development or a viable Oregon industry.

Oregon Lung Association

Inc., Since 1915

319 S.W. Washington, Suite 520
Portland, Oregon 97204
(503) 224-5145

May 1, 1984

STATEMENT TO ENVIRONMENTAL QUALITY COMMISSION
PREPARED BY JOSEPH WELLER, STATE PROGRAM DIRECTOR
OREGON LUNG ASSOCIATION

If air quality, as measured by compliance with federal clean air standards, is the main goal of a woodstove emission standard, then the department's staff report errs in its recommendation to this commission.

Look carefully at the report, and separate economic and political arguments from the air quality discussion. Allow me to quote out of context, a few sentences from the staff report.

> "The 7/3 standard is the only one that appears to insure achievement of the needed 80% airshed emission reductions". "A staged standard could delay achieving airshed reduction goals by a few years".

To me, these are the most important statements in the report.

DEQ staff has done a remarkably thorough job of identifying necessary clean up requirements. However, I believe they err in supposing that no wood stoves will be available to the public in two years if a 7/3 standard were adopted right now. Test data show that one stove design already achieves an emission rate 100% below the toughest standard proposed. In addition, stove kits now on the market and sold nationally, if used as the manufacturer suggests, would help current stove manufacturers meet the 3 gram catalytic standard.

I don't believe consumers choices will be as wide as they are now if the 7/3 standard is adopted, but the commission's job is not primarily to ensure consumer choice. Assume that no catalytic stoves meet the 1986 7 gram standard. If the industry has shown good faith efforts to design and market very low emission stoves which still do not meet the 7 gram standard, then in 1986, the commission may want to adjust the standard so that some of the best stove designs are certified.

However, the word needs to get out that the 7/3 standard is the one to shoot for, and that the industry needs to set its sights on that standard to begin on July 1, 1986.

The commission should realize that even a 7/3 standard may not meet necessary airshed reductions unless a lot of assumptions turn out to be true. Here are some of the assumptions:

1. Consumers will replace old stoves on the time line assumed by the staff.

2. Consumers will burn wood at home in ways that minimize emissions.

3. Consumers will maintain stoves properly.

4. There will be relatively few new wood stove installations.

If any combination of these assumptions occur, even a 7/3 standard will leave us short of compliance with clean air standards.

In summary, I support a single stage 7/3 emissions standard because:

* It is necessary to meet health related air quality standards.

* A two year or more delay in meeting these standards is unacceptable.

* It still allows stoves on the market which emit particulates at a rate 90 times that of natural gas heaters.

Keith Cochran
5-1-84

As a member of the Wood Stove Advisory Committee I heard hour after hours Testimony, debate and information. While it appear that the Committee was in general agreement, this in truth was not the case. We were continually told - time limit, you must act, time limit - the final emissions standard recommendation was reached only to try to get a unanimous vote. ~~I still believe that my motion for a standard of 20 non catalytic/10 catalytic in 1986 and 14 non catalytic/6 catalytic in 1988 was Right~~ I Support The WHA Position The Reason for this is that there are to many unanswered questions: 1- Is Method 7 valid? Paul Tiege admitted that there were times it plugged, the dual samples taken during Conformation tests showed variation that worry me, it is expensive. The discussion of the variation was left out of the minute of

the final meeting although it took 150 ft of recording tape. 2- Is the test procedure valid as to Real World activities? 3- ~~Is~~ the Procedure workable, during the final meeting it was said (minute Pages 4, 5, 6 + 9)
Now it is my understand that Paul is finding it much more difficult to do.
I recommend not setting a standard to low as it can be set however later if our studies prove we are not getting enough reduction and the industry is able to do better than it appears now to be able to do regarding emissions, but if the standard is to low it would do no good to raise it later because the industry would already be crippled or ~~[illegible]~~ Destroyed.
It must be remembered that wood heat

~~is~~ an alternative to non renewable expensive energy sources. We were under a mandate to reduce our dependency on forgein oil, by burning wood we have helped in that regard.

Economically we must consider not only making room for new industry to create new jobs if in return we destroy the wood heat industry and the thousands of jobs it provides.

It must be remembered that we on the Committee were required to work with very limited data, materials that I feel were slanted to make the DEQ look good but was questionable in text and/or presentation.

We now know that there Are problems with the procedure and we do not know what

affect any changes to it might have
on the emissions. Therefor I Recommend
ExTReme Moderation at This Time.

Thank You!

ATTACHMENT "C"

Run #
DEQ Run #
Date Run

Fir
Oak

Split Cord Wood
2X4 Crib

Hot Start
Cold Start

High
Medium
Low

Single Burn Cycle
Multi Burn Cycle

Moisture

Kg/hr
Lb/hr

ug/Joule
g/Kg

Sec 2 - P-5
Sec 2 - P-4
Sec 2 - P-3
Sec 2 - P-2
Sec 2 - P-5 Amend 9-19-83
Sec 2 P-5 Amend 9-19-83 Back Page
Sec 2 P-5 - Amend 9-26-83
Sec 2.0 - Table III

BEND

May 2, 1984

Overview

The Department held two separate hearings in Bend. One hearing was held in the afternoon and another in the evening. Each hearing was conducted in two parts: 1) A question and answer period followed by; 2) A public testifying period. This summary not only includes information given during the testifying period but also includes comments gleaned from discussion during the question and answer period. The summary combines the testimony from both hearings.

Testimony

The first person to testify was Ms. Gertrude Goldsmith who represented the Bend Chamber of Commerce. She read from a written statement which was submitted and is included with this report. The Chamber of Commerce supports the woodstove rules based upon the need for clean air. Their statement assumes that the rules will not affect the economy.

The second person to testify was Mr. Dave McCowen, OSU Energy Extension Service. Mr. McCowen believes people are looking for clean stoves because they are growing more sensitive to woodstove smoke. Dealers should take advantage of this. He feels the Department should provide information to manufacturers showing design considerations for lowering emissions from stoves. He likes the efficiency labeling on woodstoves. He believes the woodstove emission standards will benefit Oregon stove manufacturers because they will be a step ahead of the competition.

Mr. McCowen favors Bend being included in the area required to have woodstove certification. He has added a catalytic combustor to his 1934 furnace and is pleased with its performance. He had the following criticisms:

a. Forced air furnaces should not be exempted.

b. The Department should weight the emission testing to the lowfire segment to the test.

c. He prefers setting emission standards based on grams of emission/ BTU as opposed to grams/hour.

d. He is concerned about consumers overriding the low setting stop on stoves.

e. DEQ's estimate of catalyst replacement is too high.

f. He supports clean air. The Department should not allow pollutant reductions to be refilled by industry.

Finally, Mr. McCowen presented a picture taken in Bend showing the impact of woodstove smoke. The picture is attached.

The third testifier was Mr. Bob Robinson who favored woodstove certification. He wants to maintain clean air in order to maintain a high quality of life. He is concerned about health hazards associated with woodstove smoke. He believes we are approaching the capacity of Bend's airshed. He is also concerned about future wood shortages which could be helped by more efficient stoves. He does not believe added costs will curtail the woodstove market.

The fourth testifier was Mr. Don Ring. He supports woodstove regulations for improving clean air. He does not think the rank and file appreciate the impact of the strict standards, which he believes are too tight. The Department should not adopt a standard without the knowledge that they can be achieved. The Department should wait for manufacturers to develop technology before setting a standard. Mr. Ring was afraid that if too strict standards were established, the rules would be circumvented by garage-styled manufacturers or out-of-state sales. Finally, Mr. Ring was concerned about the reliability of catalytic combustors and the belief that these units will not be properly operated or maintained. The Department should set reasonable and realistic standards so that noncatalytic stoves can be used.

The fifth and last testifier was Mr. Gerald McCormack. He stated that the woodstove smoke problem was not a toxicity problem but rather an aesthetic nuisance. Consequently, the Department could give more time to meet woodstove standards. A rapid implementation of woodstove standards will disadvantage the small guys. The small guys will be unable to afford the expensive research and development costs.

Mr. McCormack is afraid the technical direction of the Department seems to emphasize catalytic combustors. Catalytics have problems and the Department should not eliminate noncatalytic stoves.

Mr. McCormack is also concerned about expensive duplication in woodstove testing. Manufacturers of woodstoves tested by accredited laboratories should not have to pay fees to have the Department review the source test results. Work from accredited laboratories should stand.

Mr. McCormack believes woodstoves have helped the economy by reducing demand on foreign fuels. He believes that stoves should be cleaned up but that the upgrade should be more gradual. Otherwise, tight standards will shrink the available inventory to a few catalytic stoves and force people to install bootlegged, noncertified stoves.

The following points were made during the question and answer period:

a. There was concern about smoke from slash and field burning. Is there similar concern about these sources of smoke?

b. There was concern about allowing industry to use capacity in airsheds made available by clean burning woodstoves.

c. There was concern about the economic impact caused by the strict standards. Some feared that the cost of buying such stoves may be prohibitively expensive. If the woodstove cost goes up, folks will switch to alternative energy which will cause the costs of these fuels to rise.

d. Some thought the $1,600 fee for DEQ to review testing results was duplication of costs. DEQ should let accredited laboratory results stand.

e. The Department should adopt reasonable and realistic standards. The Department should slow down implementing these standards to reduce research and development costs.

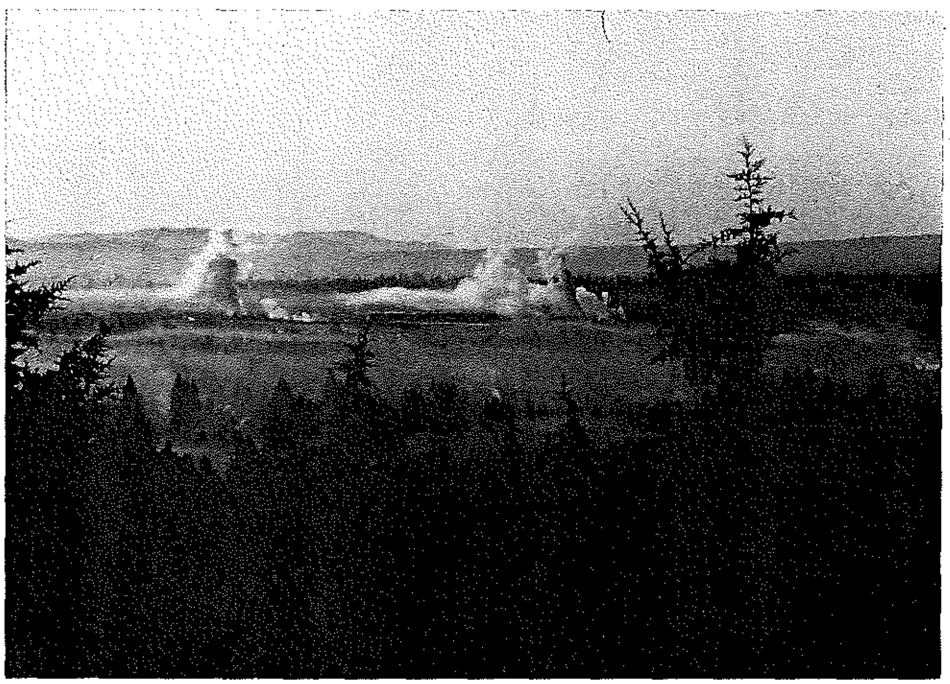
f. Many of the stove dealers were highly concerned that there was no noncatalytic stove available that can meet the 1988 standards.

g. There was much conern about the reliability and performance problems with the catalytic combustors. Some wondered if they combustors would be replaced after they were spent.

h. Many were concerned about the strict standards restricting the available stoves to a very few models. This will encourage out-of-state sales, backyard fabrication and bootlegging.

BEND FROM AWBREY BUTTE

Submitted by Mr. Dave McCowen



BEND CHAMBER OF COMMERCE
164 N.W. Hawthorne · Bend, Oregon 97701 · (503) 382-3221

PRESENTED TO:

DEPARTMENT OF ENVIRONMENTAL QUALITY COMMISSION
HEARING: BEND, OREGON MAY 2,1984

The Bend Chamber of Commerce is aware of the importance of clean air and is proud of the air quality tradition in this area. The Chamber is highly supportive of maintaining this tradition. Clean air contributes to Central Oregon's reputation as an aesthetically beautiful area and as a place of healthy living. Further, clean air aids our economy by providing an environment which strengthens tourism and makes possible continued industrial expansion.

It is our understanding these proposed regualtions will not have a significant economic impact on the many users of wood heat. We encourage D. E. Q. to remain sensitive to this issue.

GERTRUDE GOLDSMITH,
1984 Chairperson
Natural Resources Committee

EUGENE

May 3, 1984

Overview

The Department held two separate hearings in Eugene on May 3, 1984 to gather public testimony on proposed Woodstove Certification Rules (OAR 340-21-100 through OAR 340-21-166). The hearings began at 2pm and 7pm. The following summary combines testimony received at both hearings.

Testimony

Ron Crasilneck, representing National Steelcrafters of Oregon, Eugene, spoke first. He indicated his company manufacturers woodstoves, has a retail store in Eugene and markets stoves in 6 western states. He advised the EQC to not believe all facts presented by the Department, as he didn't believe everything was true. He thought questions in surveys done by the Department dealing with how much more people would be willing to pay for clean stoves were too simplistic. He thought airshed models might be flawed. He felt a 15 gram/hour standard could give the needed 80 percent reduction. If a mistake were made in setting the emission standard and it turned out too loose, he thought air quality would improve anyway, due to naturally improved products. If the standard were to tight, he felt the industry would be strangled.

He felt there was no evidence available that any practical, reliable stove can be built to meet a 7/3 or 9/4 standard. He felt only a first stage standard should be adopted now and that the Woodstove Advisory Committee should reconvene in January 1987 to study whether a stricter standard should be adopted. Mr. Crasilneck also felt there may not be enough labs to do the testing. A copy of Mr. Crasilneck's notes regarding his testimony are attached.

Mr. Robert Chapman representing Sweet Home Stove Works, Sweet Home, Oregon, spoke next. He read a prepared statement into the record which is attached. In summary, Mr. Chapman pointed out that he attended all the Woodstove Advisory Committee meetings. He felt the first stage 15/6 emission standard was a reasonable recommendation. He felt more information was needed before a second stage standard is adopted.

Brian Vik representing Fisher Century Corporation, Eugene, Oregon, read a prepared statement into the record which is attached. In summary, Mr. Vik pointed out that he followed the woodstove legislation intently as he represented the Wood Energy Association of Oregon during the 1983 legislative session. He indicated support of the program in spirit but he took violent exception to the proposed rules. He felt the proposed rules violate the spirit of representation made to the 1983 legislature and that they will unreasonably injure, if not eliminate the woodstove industry in Oregon. In regard to the emission standard, he felt the DEQ was going beyond the 65-75 percent reduction portrayed to the legislature. He felt technology was not available to meet the 7/3 standard. He felt catalytic combustors replacement should not be relied upon. His main final point was that he supported the National Wood Heating Alliance testimony on proposed rules.

Don Arkell, Director of the Lane Regional Air Pollution Authority, read a prepared statement into the record which is attached. In summary, Mr. Arkell notes studies done by the Authority which identified air pollution problems related to residential wood burning. He noted the authority supported HB2235. Mr. Arkell indicated that the Authorities Board of Directors and Advisory Committee came to a consensus on 3 areas related to the proposed rules. They were: 1) that an effective public education program must accompany the certification program which includes information on the economic and safety benefits of catalysts; 2) that the Woodstove Advisory Committee life should be extended and that it should periodically review the program and report to the Commission; and 3) that the value of a financial incentive should not be forgotten in relation to the possibility of accelerating woodstove pollution cleanup.

Mr. E. Braaten, a Portland resident, indicated he felt DEQ should have evaluated emissions from woodstoves using different wood types. He also felt we should investigate the possibility of cleaning up smoke with water sprays in the stack.

Luata VanderVeen, Business Manager for Innerwarmth, Eugene, read a prepared statement into the record which is attached. In summary, Ms. VanderVeen believes DEQ may be asking people to take a risk with catalytic technology. Specifically, she was concerned about secondary pollutants forming in catalysts, like hydrogen cyanide and ammonia. She felt more testing of catalytic converters was needed.

Edward Deardorff opposed the proposed rules on the basis of being another bureaucratic action. He was opposed to the increased cost of woodburning that will result from the program and didn't feel the air would be cleaned up.

Dan Solitz supported the proposed rules. He did feel they may fall short of what the legislature required. He wanted to be sure the program would result in a net improvement in air quality.

Dan Melcon, an independent woodstove sales representative indicated a survey had been done at considerable expense to quantify woodstove use and other factors. He indicated the results would be submitted at a later time. A copy of the survey questionnaire was submitted for the record and is attached.

John Bergland indicated he didnt see an education program in the proposed rules. He felt educating was very important and suggested that education information be put on the labels covering such things as burning hot and burning seasoned wood.

AS63

Craft Stove™

Manufactured by:
National Steelcrafters
of Oregon, Inc.
1875 West Sixth • P.O. Box 2501 • Eugene, Oregon 97402 • Phone 503-683-3210

Craft SECURITY Doors™

May 4, 1984

Comments of: National Steelcrafters of Oregon, Inc.
To: Environmental Quality Commission
Manufacturer, Retailer, Distributor - Craft Stove

Changes From Woodstove Advisory Committee Recommendations

1. Particulate Emission Standard:
   July 1, 1986 15 grams/hour non-catalytic
   6 grams/hour catalytic

   Jan. 1, 1987 Reconvene Woodstove Advisory Committee to study, evaluate and make recommendations on state of technology and air quality at that time.

   Purpose: To determine if a stricter standard is necessary.

2. Certification Fee: $1600.00 per application, not model. Limit three models per application.

3. No requirement for product drawings or other proprietary information be submitted with application, since test lab already has it.

Reasons For Our Suggestions

1. Many facts, surveys, studies relied upon are not corroborated. Most were commissioned by those with an interest in making "the problem" appear severe.

2. Consequences of too strict a standard are worse than too loose.

   a. Too Strict
      1) Severe strain on industry
         Financially- $10,000+ for testing plus R & D, plus lost sales due to higher prices.

         Time Frame - Too few test labs, DEQ overload as deadline approaches.

      2) Bootlegging from out-of-state, home-built stoves, lack of replacement when needed, thus more fires, damage, injury.

Reasons For Our Suggestions (cont.)

b. Too Loose - Air quality will still improve
   1) Better consumer burning habits caused by increased awareness.
   2) Better products already available.

3. Standards can later be made more strict, but not looser. It will be too late if industry is already in shambles.

4. HB2235 only works if people replace dirty stoves with clean stoves. If industry can't provide products to meet standards, no stoves available with which people can replace dirty stoves.

5. NO EVIDENCE AVAILABLE THAT ANY PRACTICAL, RELIABLE STOVE CAN BE BUILT TO MEET A 7/3 OR 9/4 STANDARD.

RECEIVED

MAY 07 1984

PUBLIC AFFAIRS

TESTIMONY PRESENTED
to the
ENVIRONMENTAL QUALITY COMMISSION
May 3, 1984
Eugene, Oregon

My name is Robert Chapman, representing the Sweet Home Stove Works. We manufacture a complete line of woodstoves which are marketed primarily in the western states.

Beginning early in October of last year, I attended every meeting of the Woodstove Advisory Committee and was generally pleased with the care with which that committee carried out its duties. However, on the evening when they voted to recommend an emission standard of 15/6 gram/hour in 1986 and 9/4 gm/hr in 1988, it was quite evident that several members supported that motion with great reluctance. The test data available at that time demonstrated that meeting the proposed 1988 standard would be extremely difficult for all manufacturers. Since that final meeting, several issues have surfaced which have caused those members to withdraw their support for the 1988 portion of that standard (their comments are included elsewhere in the record of these hearings). In light of these developments, the recent decision by the DEQ to recommend an even tighter emission standard in 1988 is indefensible to me.

In contrast, an interim standard of 15/6 gm/hr beginning on July 1,1986 appears to be a reasonable choice. Under this standard, virtually no appliances now sold in Oregon could be sold here after that date. Consequently, that standard will force industry to design, test and market clean burning woodstoves. Furthermore, it should be possible to meet that standard using available technology, which was a strong selling point to the legislature during testimony presented during the last session. For these reasons, this standard enjoys wide acceptance throughout the industry and is the official position of the Wood Heating Alliance.

On the other hand, many people strongly support a much stricter standard beginning as early as 1986. I urge the Environmental Quality Commission to carefully scrutinize each such proposal to insure that it meets the following tests:

1. Has the need for a stricter standard been clearly demonstrated?

2. Will such a standard actually produce, with high probability, commensurate improvements in air quality?

While both criteria may seem obvious, it is my belief that neither has been met by any of those supporting a more stringent emission level. Because that is a rather strong assertion, I will briefly defend it.

Before one can argue persuasively for any reduction beyond 15/6 gm/hr, there must exist widely accepted reference standards for measuring both the emission level and efficiency of woodburning appliances. Unfortunately, no such standards exist. For this reason, the American Society for Testing and Materials, which is the consensus standard-writing body in this country, has formed two subcommittees to formulate those test methods. At this time, there are at lest three candidate measurement techniques for each area. Of the emission test methods being considered, only one is based on the physical principles underlying the DEQ's Modified Method 7 protocol.

This situation clearly undermines the foundation on which the proposed certification procedure rests. Specifically, if it is agreed that an 80% reduction in emissions is absolutely essential, one must have a reasonable idea of the emission level of those appliances now used by Oregonians in order to set the new standard. While DEQ staff members argue that the average emission level for those appliances lies in the range of 30-34 grams/hr, considerable controversy remains. For example, during confirmation tests of the proposed test protocol, a generic stove was found to emit 31 gm/hr using the Oregon MM7 test procedure. Simultaneously, that same appliance emitted 47 grams/hr when measured with the Condar tester - a difference of 38%! On the other hand, emission levels from a large catalytic appliance were virtually identically at about 6 gm/hr when measured simultaneously by those two methods. In my conversations with several members of the ASTM Subcommittee on Emissions, the Condar method is presently a much stronger candidate than Oregon MM7.

A similar situation exists with efficiency testing. Because heat output is required in order to determine the average emission level of a woodstove, its efficiency must be known accurately. For the past two years, the Wood Heating Alliance has been attempting to select a reliable test method for efficiency and has not yet resolved the issue, in part because different laboratories typically get different answers. Furthermore, Dr. Stockton G. Barnett of Condar Corporation has developed a simple procedure which looks very attractive in tests conducted at both the Tennessee Valley Authority and at Shelton Energy Research. (His submissions are found elsewhere in this record.) Until a reference standard is chosen for woodstove efficiency, uncertainty will remain here also.

Let me emphasize that I am not arguing that the DEQ and the Wood Advisory Committee adopted the wrong test methods. Rather, it is that a tight emission standard cannot be supported until reference test methods are available for both emission and efficiency testing. For example, using Oregon MM7 the large catalytic appliance appears to emit about 80% fewer particulates than does the generic woodstove. If the Condar is a more accurate test, the improvement is on the order of 90%, a not insignificant difference.

Turning now to the question of whether tightening the standard will actually improve air quality, replacement of existing woodstoves with clean-burning models has always been a cornerstone of the DEQ's strategy to improve air quality. That position was strongly reaffirmed by the Association of Oregon Industries during testimony at the public hearing in Portland on May 1, 1984. Clearly, any regulatory action which significantly reduces the industry's ability to replace those appliances is counter-productive. If was for this reason that the DEQ reassured the legislature on numerous occasions that many appliances would meet the proposed standard.

Unfortunately, those assurances have apparently been forgotten. To my knowledge, only four production appliances have been tested which can meet the 15/6 gm/hr standard being proposed for implementation in 1986. Of those, only one satisfies the 9/4 gm/hr level recommended by the Wood Advisory Committee, and none meet the 7/3 gm/hr level being supported by DEQ and the Oregon Environmental Council, among others. If replacement of existing woodstoves is essential - and I believe it is - then setting the standard lower than 15/6 gm/hr is premature at best.

In summary, it is my belief that the best strategy for significantly improving air quality in Oregon is comprised of the following steps:

1. Set an interim standard of 15/6 gm/hr beginning on July 1, 1986.

2. Beginning immediately, assist the ASTM in adopting reference test methods for both emissions and efficiency.

3. Using those reference methods, gather data both on existing baseline appliances currently owned by Oregon residents and on clean-burning appliances. (This need not be the sole responsibility of the DEQ.)

4. Once a solid data base has been established, it will be apparent whether further tightening of the interim standard is both needed and prudent.

I strongly believe this is the only strategy which can guarantee significantly reduced emission levels from wood-burning appliances. The absence of sound scientific data in several areas can only be dealt with by taking the time to resolve those uncertainties. The fundamental difference between the above approach and the one recommended by the DEQ is that my plan gives everyone time to learn what is technically possible before the standard is finalized. In particular, it will enable those of us in the industry to learn how to design and market appliances which are clean burning as well as being attractive to consumers and reasonably priced.

TESTIMONY PRESENTED TO THE

ENVIRONMENTAL QUALITY COMMISSION

May 3, 1984

Eugene, Oregon

BRIAN L. VIK
President
Fisher Century Corporation
P.O. Box 10605
Eugene, Oregon 97402

(Mr.) (Madam) Hearing Officer, ladies and gentlemen. My name is Brian Vik. I am the president of Fisher Century Corporation. We manufacture and sell Fisher Woodburning Appliances in Oregon and throughout the United States. I was the president of the "Wood Energy Association of Oregon" during the 1983 legislation and represented many woodstove manufacturers, distributors and retailers. Therefore, I have followed this issue very intently since the beginning.

In the fall of 1982, when DEQ notified the Association of the possible proposal to the 1983 Legislative Session regarding the regulation of woodstoves, we generally believed it to be a positive step for the industry. We supported the spirit of the bill in that it would contribute to the maintaining of a managed air shed, while promoting more efficient woodburning appliances.

However, when HB2235 was presented, we noticed there were no standards or test protocol mentioned in the bill. In testimony during the 1983 legislative session, we opposed the passage of HB2235 on the merits of its lack of content. In reality, passage of this bill would grant DEQ a "blank check", so to speak, to establish standards and test methods. We felt very uncomfortable about being placed at the mercy of this process.

HB2235 passed, and that is what brings us here today.

In order to keep my testimony as brief as possible, I have elected to refrain from the technical information. I am sure you will receive that information from the more technically prepared testimony.

I take violent exception to the proposed rules and emission standards under consideration. These rules violate the spirit of representations made to the 1983 legislature, and if adopted by the EQC, will unreasonably injure, if not eliminate, the woodburning appliance industry in Oregon.

I feel the legislators in 1983 were misled and the industry members betrayed by the current actions and proposed rules by the DEQ. My fears have been confirmed. Take note of the inconsistencies:

1. The legislature was assured that the technology to meet standards is currently available and on the market.

Considering the test methods the DEQ used then, perhaps there were stoves that qualified. However, those test methods were found to be inconsistent with practical consumer operation and were changed. With new testing methods, these very same units will not even approach the proposed standards.

2. The legislature accepted assurances that many of the clean burning stoves on the market today will meet the standards.

It was said on the house floor that a dozen models were tested that meet the standards or what is likely to be the standards.

However, test results now indicate that the proposed standard eliminates most existing woodstoves by 1986, and all but a prototype of combustor technology by 1988. No non-catalytic stove meets the proposed 7 grams/hour standards and only one prototype with a catalyst approaches 3 grams/hour.

3. The legislature was told that this regulation would reduce woodstove emissions by 65-75%.

It is clear that there exists dramatic inconsistencies. The legislature was told and believed that the technology existed, and at least a dozen models currently on the market would meet these proposed standards. The legislature was also told that a statewide certification program would reduce emissions by 65-75%. The rules today mandate an 80% reduction.

It is obvious the rules today are not representative of the information presented to the legislature.

4. These rules definitely direct the woodburning appliance industry to a catalytic technology. To eliminate non-catalytic technology may impair air quality and reduce consumer interest.

Most recent test data does not make it reasonable to assume non-catalytic stoves will be capable of meeting the standard.

Consumers prefer non-catalytic stoves for price and ease of maintenance. Combustors must be replaced when destroyed or their normal life span ends, air quality improvements depend on the user replacing the combustor on a regular basis. I question, do we depend on the user replacing the combustor, since it will require substantial cash outlay and the removal and installation of a new combustor, to maintain air quality? If only those consumers who choose to purchase catalytic technology do so, perhaps better maintenance could be excepted. However, the proposed rules will not give the consumer a choice.

DEQ says a $75 import that is a non-catalytic is on the market and will meet the proposed standards. However, I question the practicality of its use as an alternative for home heat as it has an hour and a half burn cyle which is not even close to practical use, which requires anywhere from 6 to 12 hour burn cycles.

I would like to finish my testimony by asking the Commission to understand the value of wood energy. I think Gov. Atiyeh summed it up the best in proclaiming September, 1983, as "Wood Energy Month" and said, "Wood as an alternative energy source can make a significant contribution toward meeting Oregon's present and future energy needs. Wood residues in Oregon forests have the potential to supply approximately 200 trillion BTU's of energy on an annual basis, or an estimated 30 million barrels of oil."

I urge the EQC to structure the regulation of woodstoves in a manner that will continue to provide reasonably priced wood heating appliances to Oregon consumers.

I also believe it is possible to set emission standards that will substantially reduce the emission from woodstoves without the devastation the proposed rules will cause to the consumer and the industry. A reasonable standard will promote replacement of existing dirty woodstoves and improve air quality more rapidly than the proposed rules by the DEQ.

I support our national association, The Wood Heating Alliance, in their recommendation that has been presented to the commission in writing and in testimony.

T E S T I M O N Y

WOODSTOVE CERTIFICATION AND TESTING RULES

Environmental Quality Commission
May 3, 1984
Eugene City Hall
777 Pearl Street
Eugene, Oregon

FOR THE RECORD, MY NAME IS DON ARKELL. I AM THE DIRECTOR OF THE LANE REGIONAL AIR POLLUTION AUTHORITY AT 1244 WALNUT STREET, EUGENE. I APPRECIATE THE OPPORTUNITY TO EXPRESS THE AUTHORITY'S VIEWS REGARDING THE PROPOSED REGULATIONS WHICH IMPLEMENT OREGON'S WOODSTOVE LAW. THE AUTHORITY HAS A VERY ACTIVE INTEREST IN AIR POLLUTION PROBLEMS ASSOCIATED WITH RESIDENTIAL WOOD COMBUSTION IN A NUMBER OF COMMUNITIES IN LANE COUNTY. WE COMMEND THE OREGON LEGISLATURE AND THE EQC FOR THEIR EFFORTS TO REDUCE THE GROWTH OF WOODSTOVE AIR POLLUTION IN OREGON.

HERE IN LANE COUNTY THE AUTHORITY HAS MONITORED AIR QUALITY FOR MORE THAN A DECADE AND THROUGH THAT TIME OUR COMMUNITIES HAVE EXPERIENCED GENERAL IMPROVEMENT IN AIR QUALITY, PRIMARILY THROUGH THE EFFORTS OF INDUSTRIAL SOURCES TO INSTALL AIR POLLUTION CONTROL EQUIPMENT AND IMPROVE THEIR OPERATION. WE ARE STILL, HOWEVER, NOT IN COMPLIANCE WITH FEDERAL AMBIENT AIR QUALITY STANDARDS. LATELY, AIR QUALITY ANALYSES BY THE AUTHORITY HAVE SHOWN AN INCREASE OF AIR POLLUTION RELATED TO THE INCREASED USE OF WOOD AS A FUEL FOR HEATING HOMES.

THIS APPARENT GROWTH OF AIR POLLUTION FROM RESIDENTIAL WOOD BURNING, IN A PERIOD OF REDUCED EMISSIONS ELSEWHERE, HAS CAUSED SOME CONCERNS. THIS IS PRIMARILY BECAUSE THIS FACTOR CAN PRESENT A MAJOR CONSTRAINT IN ACHIEVING THE STATED GOAL OF BROADENING THE LOCAL INDUSTRIAL BASE TO PROMOTE A MORE STABLE ECONOMY WHILE MAINTAINING SUITABLE AIR QUALITY.

WE AT LRAPA HAVE ENGAGED IN A VIGOROUS PUBLIC EDUCATION CAMPAIGN ABOUT PROPER USE OF WOOD HEATING APPLIANCES. ALSO, THE AUTHORITY HELD EARLY PUBLIC HEARINGS ON, AND SUPPORTED HB 2235. WE ACTIVELY PARTICIPATED IN THE WORK OF THE EQC'S WOODSTOVE ADVISORY COMMITTEE IN CRAFTING THE PROPOSAL BEFORE YOU TODAY. IN GENERAL, WE VIEW NEW STOVE DESIGN CHANGE AS ONE COMPONENT OF A LONG-TERM IMPROVEMENT PROGRAM.

THE BOARD OF DIRECTORS AND THE LRAPA ADVISORY COMMITTEE HAVE CONSIDERED THE CURRENT REGULATION PROPOSAL IN SOME DETAIL AND, WHILE WE HAVE ELECTED TO FORGO A DETAILED DISCUSSION OF THE MERITS OR DEFICIENCIES OF PARTICULAR FINE POINTS. WE HAVE A CONSENSUS OF GENERAL SUPPORT FOR THE PROGRAM. THERE ARE A FEW COMMENTS WE WOULD MAKE IN THIS REGARD, AS FOLLOWS:

1. THE CLEAREST CONSENSUS WE HAVE FOUND IS THE NEED TO EMPHASIZE, AS A COMPANION PROGRAM TO CERTIFICATION, AN EFFECTIVE PUBLIC EDUCATION PROGRAM DESIGNED TO INDUCE HOME OPERATORS OF WOOD BURNING APPLIANCES TO MANAGE STOVE OPERATION ACCORDING TO MANUFACTURERS' RECOMMENDATIONS. EVEN AS CERTIFIED STOVES BEGIN ENTERING THE MARKET WITHIN THE NEXT FEW YEARS, INCORRECT OPERATION WILL SURELY NEGATE THE EFFORTS MADE TO DATE TO DESIGN BETTER EQUIPMENT. ONE ASPECT, FOR EXAMPLE, INVOLVING THE CATALYST TECHNOLOGY, IS THAT NOTHING IN THE STATUTE OR IN THE PROPOSED RULE COMPELLS OR INTICES REPLACEMENT OF A WORN-OUT CATALYST. WE RECOMMEND THAT DEQ DEVELOP AND INCLUDE IN THE EDUCATION EFFORT FACTUAL INFORMATION ON ECONOMIC AND SAFETY BENEFITS OF GOOD GENERAL MAINTENANCE AND REPLACEMENT OF CATALYSTS IN THOSE STOVES WHICH HAVE CATALYSTS AS ORIGINAL EQUIPMENT.

2. WE CONTINUE TO HEAR THAT THERE ARE STILL SUBSTANTIAL UNCERTAINTIES ABOUT APPROPRIATE STRINGENCY OF THE 1988 CERTIFICATION STANDARDS, CERTAIN FEATURES OF THE TESTING METHODS, AND THE BASIS UPON WHICH THESE STANDARDS AND METHODS ARE PROPOSED. WE OURSELVES HAVE SOME DOUBTS--IN VIEW OF ALL THE UNPREDICTABLE VARIABLES--THAT WE WILL BE ABLE TO DETECT, IN THE YEAR 2000, PRACTICAL DIFFERENCES IN AMBIENT AIR QUALITY BENEFIT BETWEEN THE 1988 STANDARD RECOMMENDED BY THE WOODSTOVE ADVISORY COMMITTEE AND THAT PROPOSED BY DEQ. WE THINK IT IS VERY IMPORTANT, HOWEVER, THAT WE NOT GET STUCK ON THAT ISSUE. A 1988 TARGET STANDARD SHOULD BE SELECTED NOW, WHICH WILL RESULT IN THE EVENTUAL APPLICATION OF THE BEST PRACTICABLE WOODSTOVE TECHNOLOGY. THESE CRITERIA SUGGEST THAT EQC SHOULD PICK THE TIGHTEST STANDARD WHICH CAN BE MET AND MAINTAINED BY COMPETENT MANUFACTURERS WITHIN THE TIME ALLOTTED. THE BEST ARBITER OF THIS AND OTHER QUESTIONS IS EXPERIENCE OVER TIME, AND IT IS APPROPRIATE TO CONTINUE TO EVALUATE THE ADVANCEMENT OF WOODSTOVE TECHNOLOGY AND TESTING METHODS. WE THINK THE BEST MECHANISM FOR THIS IS TO <u>EXTEND THE LIFE OF THE WOODSTOVE ADVISORY COMMITTEE AND CHARGE IT WITH PERIODIC PROGRAM REVIEWS AND TECHNICAL REPORTS TO THE COMMISSION</u>.

3. FINALLY, ONE OF THE LARGER ASSUMPTIONS IN THIS PROGRAM IS THAT THERE WILL BE A COMPLETE TURNOVER IN THE WOODSTOVE POPULATION BY THE YEAR 2000 AND THAT THOSE STOVES WILL BE MAINTAINED AND OPERATED IN ACCORDANCE WITH RECOMMENDED PROCEDURES. WE COMMENTED EARLIER ON THE NEED FOR AN AGGRESSIVE PUBLIC EDUCATION PROGRAM TO HELP ASSURE, THROUGH VOLUNTARY ACTION, CONTINUING GOOD OPERATION AND MAINTENANCE.

IT MAY BE NECESSARY AT SOME TIME TO PROVIDE SOME ADDITIONAL INDUCEMENT FOR MAINTAINING CERTIFIED STOVES. WE THINK THE IDEA OF A FINANCIAL INCENTIVE, WHICH WAS BRIEFLY CONSIDERED DURING THE '83 LEGISLATIVE SESSIONS, STILL HAS SOME MERIT. IN THIS DAY AND AGE, THIS NOTION MAY NOT BE VIEWED WITH MUCH POPULARITY. HOWEVER, IF THE NEED IS APPARENT, THIS APPROACH SHOULD BE REVIEWED ONCE AGAIN.

IN SUMMARY, LRAPA CONTINUES TO MAINTAIN SUPPORT FOR THIS EFFORT TO REDUCE A PROBLEM WHICH FOR US IS REAL AND OF GROWING SIGNIFICANCE. WE THINK DECISIONS SHOULD BE MADE ON ALL THE DISPUTED POINTS, SO THAT FIRM GOALS AND TARGETS ARE ESTABLISHED. WE INTEND TO REVIEW DEVELOPMENTS AND WILL COMMENT AS APPROPRIATE. THANKS ONCE AGAIN FOR THE OPPORTUNITY TO EXPRESS OUR VIEWS.

DRA/mjd
05/03/84

Testimony of
Luata VanderVeen , Business Manager
Inner Warmth, Eugene Oregon
May 3, 1984

Regarding PUBLIC HEARING ON WOODSTOVE CERTIFICATION RULES.
OAR 340-21-100 through 340-21-166

I have many concerns about the proposed catalylitic convertors for woodstovs. In the EQC Agenda Item No. A under Emission Standards you tell us: and I quote:

> Since catalytic technology is now available on a limited basis to meet a 7/3 standard, it is reasonable to expect that the industry would be able to provide a good selection of models with this technology within a four year time by July 1, 1988.

This statement leads me to believe that the department is asking the people of Oregon to take a risk with catalytic technology. I feel that I need to be satisfied as well as the people of Oregon, that catalytic technology is far enough along in testing to guarentee it will help eliminate emissions produced by wood burning appliances with No Harmfull Side effects.

Three years ago a point was brought up about the catalytic convertor that causes me a little concern and it should you too:

Reading from Residential Solid fuels book, Enviromental Impact and Solutions, published by the Oregon Graduate Center in Beaverton, Oregon.. Proceedings of the 1981 International Conference on residential solid fuels Enviromental Impacts and Solutions.

On page 832, Catalysis of Woodstove effluent by Dennis R. Jaasma
Department of Mechanical Engineering Virginia Polytechnic Institute
and State University Blacksburg, Virginia 24061 USA

Further tests probably have been done...I am not aware of them. I do welcome more test results concerning the formation of secondary products. I wish to know what extensive tests the Division has done on the catalyst. These toxic products, hydrogen cyanide, ammonia, and other nitrogen containing compounds frighten me. I understand that we are dealing with evils of pollution created by woodstoves and I am for seeking ways to help eliviate this problem. I do feel very strongly that our Wood Stove Manufactures are not complete idiots and neither are the people of Oregon. Attempts are being made to educate people in how to burn thier wood safely and to lessen pollution. We've come a long way and I know we have ~~a~~ an even longer ways to go. Please give us all the benefit of the doubt in trying to think of other ways to solve the woodstove emissions problem. I ask that you do further ~~studys~~ and more thorough investigation with the catalytic convertors.

Just think, 300,000 fires burning for 5 to 6 hours, the catalytic is on the stove, its the 2000 we never looked in to the problem of these toxic emissions produced by the catalitics. What would be happening to people then? What amount of hydrogen cyanide, ammonia etc. would be in our air and would we be around to find out? Are we tradinglproblem for a worse one? I believe we need more that a few devices to solve our problems. We need to all work together even more closely than we have and work for better air to breath in Oregon. We need to test the catalytic convertor further. I forsee to many problems coming up in the future, if a clearer, and closer look, is not taken into what this OAR 340-21-100 through 340-21-166 now states. THANK YOU.

COPY OF SURVEY CONDUCTED APRIL 29 & 30, 1984
RESULTS TO FOLLOW

Submitted by Dan Malcom

INTRODUCTION

HELLO, I'M ________________ FROM MANNING RESEARCH ASSOCIATES. WE ARE A PORTLAND BASED MARKET RESEARCH COMPANY. TODAY WE ARE CONDUCTING A STUDY ABOUT WOOD STOVES.

SCREENING

1. (ARE YOU) (MAY I SPEAK WITH) EITHER THE MALE OR FEMALE HEAD OF THE HOUSEHOLD?

   Male - 1
   Female - 2 (1)

2. DO YOU USE EITHER A WOOD STOVE OR FIRE PLACE INSERT?

   Yes - 1
   No - 2 (2)

3. IS IT YOUR PRIMARY OR SECONDARY SOURCE OF HEAT?

   Primary - 1
   Secondary - 2 (3)

4. DO YOU BURN YOUR FIRE OVERNIGHT?

   Yes - 1
   No - 2 (4)

5. FROM OCTOBER TO APRIL WHAT PERCENTAGE OF THE TIME DO YOU BURN YOUR WOOD STOVE OVER NIGHT?

   0 - 25% - 1
   26 - 50% - 2
   51 - 75% - 3
   76 - 100% - 4
   Not stated - 5 (5)

6. WE NEED TO KNOW HOW MUCH WOOD YOU BURN IN ONE HOUR DURING THE PEAK HEATING SEASON. PLEASE ESTIMATE HOW MANY ONE FOOT PIECES OF 2 X 4's THIS WOULD EQUAL IN ONE HOUR.

   Less than 1 - 1
   2 - 2
   3 - 3
   4 - 4
   5 - 5
   6 - 6
   7 - 7
   More than 8 - 8
   Not stated - 9 (6)

7. WOULD YOU BE WILLING TO NOT BURN YOUR STOVE DURING PERIODS OF POOR AIR QUALITY?

Yes - 1
No - 2
Maybe - 3 (7) *** Skip to #11

8. DO YOU PLAN TO PURCHASE A WOOD STOVE OR INSERT?

Yes - 1
No - 2 (8) *** If no, skip to #22

9. HOW SOON DO YOU EXPECT TO MAKE THIS PURCHASE?

Within 90 days - 1
In 3-6 months - 2
Within 1 year - 3
Over 1 year - 4
Not stated - 5 (9)

10. APPROXIMATELY HOW MUCH DO YOU INTEND TO SPEND?

Under $400 - 1
$400 - $600 - 2
$600 - $800 - 3
Over $800 - 4
Not stated - 5 (10)

*** <u>11 Starts Here</u>:

FOR EACH OF THE FOLLOWING ITEMS, PLEASE TELL ME IF THEY ARE (1) VERY IMPORTANT, (2) SOMEWHAT IMPORTANT, (3) NOT IMPORTANT IN THE PURCHASE OF A WOOD STOVE.

		Very	Somewhat	No Important	
11.	Safety	- 1	- 2	- 3	(11)
12.	Cost	- 1	- 2	- 3	(12)
13.	Ability to See Fire	- 1	- 2	- 3	(13)
14.	Pollution	- 1	- 2	- 3	(14)
15.	Appearance or Design	- 1	- 2	- 3	(15)
16.	Ability to Hold Fire Overnight	- 1	- 2	- 3	(16)
17.	Heating Capacity (area)	- 1	- 2	- 3	(17)
18.	Efficiency	- 1	- 2	- 3	(18)

19. DO YOU KNOW WHAT A CATALYTIC WOOD STOVE IS?

Yes - 1
No - 2 (19)

*** If yes, go to $2Ø. If no, provide the following explanation:

"A CATALYTIC STOVE LOWERS THE TEMPERATURE AT WHICH SMOKE WILL BURN. THEREFORE, LESS SMOKE WILL BE EMITTED THAN FROM A CONVENTIONAL WOOD STOVE, AND THE EFFICIENCY MAY BE HIGHER. HOWEVER, IT COSTS MORE AND THE CATALYST DOES NEED TO BE REPLACED ON A REGULAR BASIS."

2Ø. WOULD YOU PURCHASE A CATALYTIC STOVE?

Yes - 1
No - 2
Don't know - 3 (2Ø)

21. IF ONLY CATALYTIC STOVES WERE SOLD IN OREGON, WOULD YOU CONSIDER BUYING A CONVENTIONAL WOOD BURNING STOVE IN ANOTHER SITE, PROVIDING THAT IT WAS NOT ILLEGAL TO BUY, INSTALL OR USE IT?

Yes - 1
No - 2
Don't know - 3 (21)

22. ARE YOU FAMILIAR WITH DEQ's PROPOSED REGULATIONS FOR WOOD STOVES?

Yes - 1 *** If yes, go to #23
No - 2 (22) If no, go to close

23. PLEASE BRIEFLY STATE DEQ's POSITION.

WRITE IN RESPONSE
Do not evaluate the response

Well Understood - 1
Partially Understood - 2
Minimal Understanding - 3
Uninformed - 4

(23)

MEDFORD
May 3, 1984

Overview

A total of ten people testified at the afternoon and evening hearings in Medford on May 3, 1984. Nine persons primarily opposed the Department's proposed action and one person primarily favored the proposed action. The major reasons for opposition were concern about the increased cost to consumers and woodstove manufacturers and concern that the second phase standard (1988) was too stringent.

Testimony

Jr. Milligan is a manufacturer (Sun Fire Woodstoves) of noncatalytic woodstoves in the Medford area. He agrees that some woodstove certification program is needed and believes that the first phase standard is realistic, but he believes that the second phase standard would put his company out of business. Mr. Milligan estimates that the proposed woodstove certification program would cost his company about $50,000 over the next three years. He is opposed to the $1,600 certification fee to DEQ; he recommends that a surtax be charged at the retail level instead of the certification fee on the manufacturers. Mr. Milligan is also concerned about the proposed laboratory accreditation procedures; he does not believe that it is appropriate to decertify woodstoves if a laboratory loses its accreditation. His written testimony is attached.

Don Fitzgerald is opposed to the strictness of the proposed rules for a woodstove certification program. He believes that other ways to reduce woodstove emissions (more education and voluntary measures) are better.

Charlie Mapel believes that EPA and DEQ are coming out to strong, especially in Southern Oregon. He points out that wood heating is an important part of the local energy picture. Mr. Mapel believes that the emission reduction requirements in the proposed rules are too strict.

Kathy Gordon represented the League of Women Voters of the Rogue Valley. She primarily favors the Department's proposed woodstove certification program. Mrs. Gordon supports the concept of cleaner burning woodstoves but questions the ability of woodstove manufacturers to meet the second phase standard proposed by the Department. Her written testimony is attached.

Paul Runquist is a woodstove manufacturer in Ashland and a member of the Oregon Woodstove Advisory Committee. Mr. Runquist is concerned about the assumptions and uncertainties upon which the proposed emission standards are based. He believes that the first phase standard is reasonable but he is opposed to the second phase standard. He is concerned that a too stringent second phase standard would result in less air quality benefit than a less stringent standard. He believes that the proposed second phase standard is not the optimum since it would discourage replacement of existing woodstoves with cleaner units and would encourage the bootlegging of non-certified woodstoves. His written testimony is attached.

David R. Jencks is affiliated with Orley's Manufacturing Company, a woodstove manufacturer in the Medford area. He is opposed to the proposed woodstove emissions standards. Mr. Jencks believes in clean air and believes that a standard is needed, but he is concerned that the proposed standard is too rigid and technology-forcing. He doesn't believe that catalysts will be maintained or that stoves will be replaced as fast as the Department believes. Mr. Jencks points out that the woodstove certification program needs woodstove manufacturers to make it work; he believes that if the Department comes out with workable standards, then the manufacturers would go forward with it.

Randy Howerton is affiliated with the Cascade Block Plant in Medford. He is opposed to the proposed second phase emission standard. He is not aware of any woodstove marketed at this time that would meet the proposed 1988 standard of 7/3 grams per hour. Mr. Howerton believes that a too stringent standard would encourage the sale of noncertified woodstoves and would have a reverse affect on air quality. He supports the first phase standard and supports the comments and recommendations of the Wood Heating Alliance and Wood Energy Institute West.

Howard A. Cusic is opposed to the Department's proposed action. He is concerned about fireplaces and backyard burn barrels which are not addressed in the proposed rules.

Jim Sevcik spoke as a concerned citizen and a woodstove user. He believes that the Department's proposed rules would put the cost of woodstoves out of the reach of consumers. He believes that more reasonable standards are needed.

Philip DaCosta believes that woodstoves are necessary due to the high cost of other fuels. He is concerned about the possible effects of the proposed rules on home heating costs.

AS60

Jr. Milligan

SunFire
by RAINBOW RESEARCH, LTD.

May 3, 1984

Woodstove Manufacturers
vs
DEQ - House Bill HB2235

Based upon 7½ years of prior experience in the woodstove manufacturing industry and in all phases of woodstove marketing, the manufacturer of SunFire stoves began in 1980. From its inception Sun Fire woodstoves has been at the forefront of continuous state of the art engineering and development.

EMISSION STANDARDS

The longevity and success of any woodstove manufacturing company is directly related to the market-proven heating efficiency and cost effectiveness of its product. And because heating efficiency by its nature effects air pollution emissions, it is the conviction of SunFire management that we can now meet the 15 gram per hour emission limit for conventional or non-catalytic woodstoves. In fact we believe that our stove achieved this capability some few years ago and indeed has achieved an even better capability today. In the public interest, as well as that of my company, we congratulate the EPA and its departments for a pragmatic and realistic 15 gram standard for conventional woodstoves.

It will be obvious to knowledgeable engineers that once a conventional woodstove achieves the 15 gram standard its performance over its lifetime remains constant subject only to gross abuse by its operator. Constancy is not the case however with catalytic equipped stoves whose converters deteriorate with use and therefor perform over a period of time with diminished efficiency and increasing pollution emissions. This has well been taken into account with the acknowledgement that a 6 gram emission catalytic will escalate to 15 gram emissions over the life of the ~~stove~~ combustor. The 15 gram figure is, however, speculative and could rise dependent upon the catalytic converter replacement practice of the stove operator.

4820 Crater Lake Ave., Medford, Oregon 97504, Phone (503) 772-3094

Neverless, we would not at this point argue the case for a catalytic equipped stove emission standard. We do believe that a great deal more home use and data recording is required to arrive at pragmatic solutions beyond the 15/6 proposal as now applied to the differing stove types.

It is our hope, indeed our insistance, that a strong and practical distinction be drawn between conventional stoves and those equipped with catalytic devices and that these distinctions be taken into most serious account before arriving at any 1988 standard below that of the 1986 standard for conventional stoves.

In its attempt to make a case for lowering the 15 gram standard DEQ has led itself astray. It cites a $75.00 discount store stove with a 12 gram emission performance. That may be found true of any non-airtight woodstove. But because such stoves are not only fuel-cost prohibitive but require the inconvenience of almost hourly refueling, they have all but disappeared from the market. In short, such testing as that cited is of a most highly deceptive nature and constitutes an apples and oranges scenario. It is just such a scenario that we urge be avoided in fixing 1988 emission standards for conventional woodstoves as compared with catalytic equipped stoves.

CERTIFICATION FEES

The proposed manufacturer's certification fees bear ill omen for the woodstove industry in Oregon. The $1600. first certification fee with its subsequent $800. fee for additional models is discriminatory against manufacturers and ducks the issue of increased cost to consumers. Worse, however, would be the consequences to Oregon woodstove exporters who do a $100. million interstate business. Based upon earlier experience a reasonable assumption may be drawn that other states will save time, trouble and money by following Oregon's lead in this as well as other air quality matters. Such is the esteem for Oregon held in other capitals. No especial bookkeeping skill is required to discover that a repetition of such fees imposed state by state upon Oregon, stove exporters would preclude them from out-of-state markets. To assess the loss in jobs and gross state product might however require a computer.

The E.P.A. has in the past taken courageous steps. It could further burnish its image in this instance by taking another. To cover D.E.Q. administrative costs and more equitably distribute the burden of paper work a sur-tax at the retail level should be given serious consideration. In the last analysis, E.P.A. is performing a public service by imposing woodstove emission standards. It is something less than a free enterprise proposal that the woodstove industry should, in this case, pay a public service administrative tab.

LABORATORY ACCREDITATION

It is of course essential that D.E.Q. establish, implement and monitor testing laboratory accreditation regulations. It does not follow that manufacturers should bear the penalty of forbidden sales for laboratory violations. Such a position would presuppose conspiracy between laboratory and manufacturer to circumvent the law. We do not believe it is D.E.Q.'s intention to make such a supposition. Nevertheless, to penalize manufacturer's for laboratory violation is to put the cart before the horse and charge the manufacturer for hitching it up wrong. We believe D.E.Q. can do better than that.

Kathy Snyder

PUBLIC HEARING BEFORE THE OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY MAY 3, 1984

WOODSTOVE CERTIFICATION PROGRAM

While Jackson County continues to exceed the health standards for carbon monoxide and particulate pollutants, the League of Women Voters of the Rogue Valley continues its efforts for cleaner, healthier air. This testimony addresses the woodstove certification program being presented by the Oregon Department of Environmental Quality.

Over the past several years, the use of woodstoves, as the primary source of heating homes, has increased substantially. With the continued air quality improvement gained from industrial controls, emissions from woodstoves has become the largest source of particulate air pollution. Also, while automobiles continue to be the greatest source of carbon monoxide pollution, the next highest contributor is woodstoves. Another important fact concerns the size of the particulates found in woodstove smoke, which are the smallest kind, or respirable particulates, which pose the greatest threat to one's health. A program to control emissions from woodstoves is certainly in order.

Most of the proposed rules governing woodstove certification seem reasonable. We support the dual implementation approach as a fair plan to give the manufacturers enough time to produce cleaner burning woodstoves. The first emission standard of 15/6 grams (of smoke) per hour to begin in 1986 is acceptable to us.

The League of Women Voters believes very strongly that citizen involvement is an important part of the decision-making process. Citizen cooperation with industry is necessary for making rules which are prudent and reasonable for all represented parties. We support continued research and progress for designing cleaner-burning woodstoves; however we question whether the woodstove manufacturers will be able to produce woodstoves capable of meeting the second stage, or 7/3 grams (of smoke) per hour, emission standard as proposed by the DEQ.

(back)

To:Environmental Quality Commission 5/3/84

From: Paul W. Runquist, Member, Woodstove Advisory Committee

Re: Woodstove Certification Program

As I am sure you are aware, I have been involved with the concept and development of the woodstove certification program since 1980 and supported the need for improved appliances in the legislature and in the development of the clean burning Genesis.

Throughout the meetings of the Advisory Committee we asked a recurring question:
Where's the data?

Questions concerning ...how people use stoves in the field
...how many do and when?
...what proportion of the problem is identifiable as woodstove contributed?
...the adequacy of test methods and procedures
...what can technology supply

and most important,
...will the public make it work?

I attach a list of more than 20 areas of assumption I have itemized and used in the recommendations at hand.

With this level of uncertainty, and in consideration of the available data the Woodstove Advisory Committee could not agree with an extreme standard until these and other questions could be answered.

The simple thought process is this:
If we need particulates reduced by 30% in the Rogue Valley, stoves must emit 80% less. That's fine if it can be done ... and people will buy it.

Unfortunately, if people do not REPLACE their dirty stove the air won't be any cleaner. If the proposed standards are implemented, consider:

NO production stoves are known to meet the proposed 1988 standard

Stove prices will increase 50-100%

Only catalyst stoves which require replacement every few years would possibly be salable and if they are not replaced they are no better than the stoves currently in use.

Bootlegging, blackmarket, and home-made stoves and the safety problems they create will be encouraged.

And yes, the industry in Oregon will close up and along with it the research necessary to improve the technology.
I for one am closing my business.

So why not choose the lowest possible numbers?

The answer is simple:

We won't clean up the Rogue Valley if there are no clean stoves to replace the dirty ones.
(The recent I & M vote by the public of 75% AGAINST should illustrate that degradable catalysts are no solution by themselves. Will 75% not maintain them? My experience virtually guarantees that they will NOT ... especially when people must pay to replace them.) (Catalysts would average near 20 grams/hour!!)

The Advisory Committee could not accept the simple DEQ calculation simply because the data does not exist for a responsible decision. Technological diversity as promoted to the legislature recommends a 15 gram/hour standard. That is as much as we can safely recommend now - not the 7 gram/hour that DEQ calculates.

The OPTIMUM must be sought and the public will determine what that is.

The new test method which is known to be unrealistic
The lack of FIELD data on old and new stoves
and
The uncertainty that people will REPLACE

...demand caution.

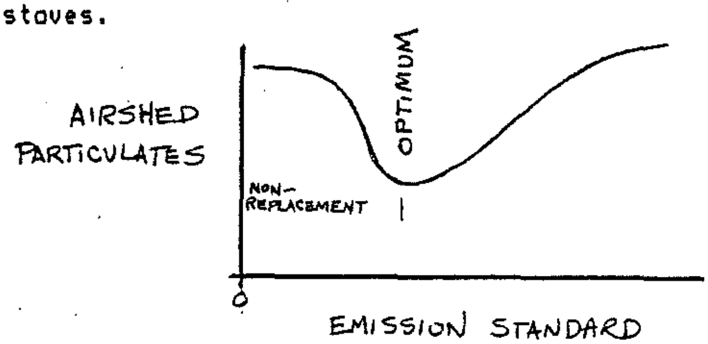
The optimum is not zero
The optimum is not a BAN of woodstoves

Only when the data is available can we make a responsible decision that will improve air quality.

We all want clean air. I've worked 10 years for it.
A 15/6 standard in '86 is all that we can be sure of now.
Cutting emissions by more than half is a major technological step, and all of those will be necessary to tempt the public to replace.

ONE stove won't work ... unless you want to ban the solution:

Affordable clean woodstoves.



Paul W. Runquist, 4/84

ASSUMPTIONS and UNCERTAINTIES
in
DEQ WOODSTOVE CERTIFICATION RECOMMENDATIONS

Weighting of woodstove usage and burn rate matches that of weather data.
The bell curve used here indicates that stoves are operated above 20,000 BTU/hr almost never and that stoves are operated continuously starting October 1 and go out April 30. Survey data indicates a substatial batch heating tendency rather than continuous.

What is the actual down-time of stoves in use?

Correlation with real world fuel types.
Survey data indicates that hardwoods may be the more dominant fuel in use. The emissions of hardwoods are known to be lower than Douglas fir.

What was the actual number of stoves in use in 1980 when characterization studies were performed?
There is apparently some contradiction here between what DEQ has used and what ODOE has recorded.

The accuracy of fingerprint distributions of other sources.
Is a different fingerprint derived from the use of different samplers? (e.g. ambient air samplers, MM5, dilution samplers...)

How does sampling instrumentation relate to environmental impact? Are dirty stoves and clean stoves measured in the same relationship by all methods?

What actual contributions attributed to woodstoves were actually caused by other sources such as fireplaces during the fingerprint period and is this relationship still true?

Were the ambient air samplers appropriately placed and weighted in importance?

Is it fair and/or possible for woodstoves to over-compensate for the contributions of other sources.

What are the emissions of the predominate species "used in the field" in 1980 when tested under the suggested test protocol and what are they under protocol corrected for field use factors? (Baseline)

Is an 80% reduction an accurate statement of need for reductions in view of:
Improved air quality in airsheds since 1980.
Impending re-evaluation of standards by EPA which would relieve pressure to seek a ban of woodstoves.

Are the projections of growth in the use of woodstoves accurate and how are they influenced by a standard which discourages or eliminates their sale?

What is the catalyst lifetime in the field?

What will the catalyst replacement rate be in the field?

What will be the effectiveness of catalysts in the home (lit off or not)?

What is the fair and proper relationship between the field performance of catalytics and non-catalytics "in the field" and do the proposed standards reflect this?

The precision of the method is assumed to be more important than accuracy. The test protocol is assumed to relate to field use. The fuel characteristics and the excessive coals base have little or no relation to field use conditions.

It is assumed that manufacturers will design their appliances around cordwood instead of 2x4's to meet the emmission standards despite the lack of correlation this may have with field performance.

The impact on small business has not been adequately considered as required by Oregon statute.

The DEQ assumes that "any" standard is achievable in a practical appliance.

The lowest standard numbers are assumed to generate the greatest air quality improvements despite the fact that counteracting forces develop below a optimum standard:

* It is assumed that the public will accept any cost impact resulting from a ban or any market regulation which greatly inflates the price or eliminates selection. It is likely that:
  - Bootlegging will be stimulated.
  - Offensive stoves will be retained longer aggravating a fire safety problem due to non-replacement.
  - The public will be unconscious of the failure of catalytics and will not place economic priority on replacement above food and fuel etc.

* Technological diversity which assures active research progress is destroyed by technological mandate or a ban ..thus further delaying development of appropriate solutions.

"The DEQ assumes that the woodstove industry is unconcerned with air quality and will resist product improvement. Some may have done so, however, most are actively seeking to unlock practical solutions to a difficult yet crucial problem of utilization of renewable solid fuel. The alternatives are equally unkind in environmental impact.

The utilization of these fuels is ultimately essential".

PWR

PENDLETON
May 3, 1984

Overview

The Department held two separate public hearings in Pendleton. One hearing was held at 2:00 p.m. and another at 7:00 p.m. The hearings were held at the Blue Mountain Community College Morrow Lecture Hall. Each hearing was conducted by a Hearings Officer, Steve Gardels, Manager of the DEQ Eastern Region. Two members of the DEQ Air Quality staff were present at each hearing to make an introductory statement explaining the development of the rules, and to answer questions from those citizens in attendance. The two DEQ staff members were Barbara Tombleson and Philip Ralston.

Materials made available to the public at the hearings included: the complete proposed rule package (3/16/84), two fact sheets summarizing the program, and the Notice of Public Hearing (3/20/84).

Each hearing was conducted in two parts: 1) A public testifying period followed by, 2) A question and answer period. No one wished to testify at the 2:00 p.m. hearing, thus this summary only includes testimony offered during the 7:00 p.m. hearing. However, a 1-1/2 hour question and answer session developed during the afternoon session after the formal testimony period ended. Throughout the question and answer period, the Hearings Officer offered to reopen the hearing to accept testimony from anyone. All offers were declined by the seven people in attendance.

Ten people testified at the 7:00 p.m. hearing; seven people testified as "primarily in favor of the Department's proposed action", and three citizens testified as "primarily opposed". A summary of the oral testimony follows. Written testimony, when offered to complement or clarify oral testimony, has been photocopied and attached to this report.

Testimony

Mr. Robert Landauer, Jr., Umatilla, OR, is opposed to the program. He feels the DEQ is the real problem; its overrunning us, overriding us, and controlling us where it shouldn't. He added the state doesn't want us to burn wood, coal, or oil, but does want us to use natural gas and electricity. He feels that kind of control is taking free enterprise away from us and limiting our choice of fuels. In turn, he said, his fuel prices will go up. He offered a personal example of his heating cost increase: during the winter, he switched from electricity at \$140/month to wood at \$70/month. He feels the whole program "is a big joke." He added that he has smoked for 40 years and the State of Oregon didn't tell him anything about health risks, but did tax him on cigarettes.

Dr. Donald Guenther, Pendleton, OR, is primarily in favor of the proposed action, but believes a strong public education program is at least as important as regulatory efforts. Dr. Guenther has practiced pediatrics in Pendleton during the last ten years. He has subjectively linked increased amounts of woodsmoke in the atmosphere with an increase in the number of children with respiratory diseases; and linked an increase in the severity of the diseases with the increased concentrations of the smoke. Dr.

Guenther then cited two cases from his clinical practice that illustrate his impressions. From a medical point of view, he believes there is ample justification to reduce woodsmoke emissions in Pendleton. He also believes that the economic benefits of heating with wood are less advantageous than commonly believed. Therefore, Dr. Guenther feels, the DEQ should put as much effort into educating the public about the real cost of woodburning as is being put into restrictive regulations. (Written testimony is attached).

Mr. David J. Kilmer, Milton-Freewater, OR, owns and operates Farm Boy Sales, a woodburning appliance retail shop. Mr. Kilmer is primarily opposed to the proposed rules, although he agrees with the basic intent of the law to clean up the airshed. He feels the DEQ is ignoring the wood heating industry's emission research data. He feels the proposed standards are unrealistic and unattainable and will result in the loss of hundreds of jobs, including the loss of small retailers like himself. He also feels proper stove operation is more important than stove design or technology in reducing emissions. Mr. Kilmer questions the accuracy of the figures describing woodstove emissions in the air because he doesn't think the DEQ's figures describing the number of stoves in use and sold annually are accurate. He believes other sources of air pollution should be controlled. He feels test costs are too high, 80% net cleanup cannot be achieved because inefficient and unsafe home-made stoves will be used, and that industry needs some realistic and attainable goals. (Written testimony is attached).

Mr. Alfred Nelson, Jr., Pendleton, OR, is in favor of the proposed program, but feels that the problem should have been addressed sooner. He is a retired farmer that moved to Pendleton in the fall of 1983. He said he wouldn't have moved there if he'd known it was so smoky in the winter. He has a woodstove in his home, but burned it only 3 times this past winter until he decided burning was the wrong thing to do. Smoky air also comes into his house through the furnace air intake. He and his wife left Pendleton for a week this past winter to get out of the smoke. He states his major concern being that the attention to the problem is five years too late, "like locking the barn door after the horse is stolen." He is in favor of catalyst equipped stoves because he's heard they're cleaner, cheaper, and safer. Mr. Nelson believes the "quality of life is as important as anything."

Dr. George Nelson, Pendleton, OR, is in favor of the proposed program. He has practiced internal medicine for the last 9-1/2 years in Pendleton. He says he has seen a decrease in the air quality in Pendleton over the past 9-1/2 years. He believes the common use of woodstoves during the period has been "accompanied by air that is almost easier to cut than it is to breathe." This, he says, is not a laughing matter to many people. Dr. Nelson believes that "air quality is a common resource affected by the actions of all of us", unlike cigarette smoking that generally affects mostly the smoker. He cited a study conducted in Missoula, Montana that showed a decrease in the lung function of healthy children as exposure to woodsmoke increased. The lung function improved as air quality improved. Locally, he said people with pre-existing lung conditions find it difficult to breathe during the cold winter months when smoke concentrations are high, but when they follow his suggestion to leave town during smoky periods, they experience a dramatic clearing of pulmonary problems. Dr. Nelson's greatest concern is the long-term health affect that may not be seen until 20-30 years from now because of lag-time in developing symptoms. He suggests that woodsmoke is contributing significantly to increased health care costs.

Mr. Charles W. Jones, La Grande, OR, is in favor of the proposed regulation and would support a nation-wide regulation. He owns a woodstove but is appalled by the woodstove smoke in La Grande, and especially by the increase in the last 6-8 years. Mr. Jones cited how woodstove smoke effects him: he has changed his pattern of walking from work, he now walks to and from work during hours when woodsmoke is less dense; he is not able to open windows in his home during the winter, he smells like smoke after walking outdoors; and the visibilty is obscured. Economically, he gives more consideration to the long-term health affects of his family than to short-term fuel savings. He is in favor of statewide and national regulations controlling woodstove smoke, believing that everyone should share in the solution. He is scared of the long-term health effects (30-40 years) if nothing is done now. As an example, he cited the rapid destruction of the Black Forest (Germany) by air pollution as a problem that wasn't foreseen; but the problem became obvious only after rapid and dramatic symptoms appeared.

Ms. Chloe Larvik, La Grande, OR, approves of the proposed regulation, but feels they are only a small step toward solving the problem. She says the air quality problem in La Grande is very bad, especially in the fall when field burning, slash burning and woodsmoke combine with air inversions. She cited visibility obstruction, breathing difficulties, and respiratory illness amongst children during the winter months as results of the high concentration of woodsmoke in La Grande. She fears for the children if the problem of woodsmoke is not controlled now. Ms. Larvik believes this regulation is a very small step that will take many years to show its effect. But she does feel this regulation will provide some guidance for the social responsibility we must face.

Ms. Priscilla Coe. La Grande, OR, testified in favor of strict woodstove regulations as an individual citizen and as a representative of the Grande Ronde Resource Council. Ms. Coe does not own a car and "gets around town by the use of my lungs." She adds that since it is difficult enough to breathe the air in La Grande during the cold winter months, and contend with the auto exhaust, she doesn't need to breathe the woodsmoke too. She cited the "tragedy of the commons" as a reason to regulate woodstove smoke. In other words, she said, she has learned that the "marketplace doesn't take care of our environment very often." She stated that the woodsmoke causes her clothes to smell after being outside in the winter. Ms. Coe reiterated that she is in favor of more strict regulations and "hopes they'll be as tough as we can get them."

Mr. Ron Larvik. La Grande, OR, testified in favor of regulating woodstoves, but feels the proposed standard is not tough enough or quick enough. regulations. Mr. Larvik says he has heard woodsmoke is a problem mostly in Western Oregon as opposed to Eastern Oregon. He believes the DEQ reports identifying Pendleton and La Grande as having the second and third worst air in the state respectively. He believes the problem in La Grande is due more to woodsmoke than dust. He feels the proposed standard is not tough enough or quick enough because many of the stoves sold now are sold on the basis of being airtight and lasting 25 years. That means, he says, many of the stoves sold now will be smoking away for the next 25 years. He believes to wait four more years before we have clean stoves is too long.

Mr. Robert Teichart, Lewiston, Idaho, is opposed to the proposed regulations, not because of its intent, but because of serious gaps he sees in the regulations. He is a woodstove manufacturer. Mr. Teichert believes that the DEQ claim that these regulations will provide room for economic growth and development is erroneous because the law allows bootlegging of stoves across borders. He states that heavy industry (Potlatch Corporation in Lewiston) burns more wood in its boilers than all of the firewood burned in Lewiston homes. He feels that the law is not totally wrong, but has serious gaps in it. For example, large wood-chip burning industries need to be controlled. He encourages the DEQ to educate people in proper burning techniques. He believes proper operation of a stove is more important than proper design. He also feels that high cost stoves will result from this regulation and that will encourage the use of inefficient and unsafe home-made woodstoves. That, he believes, will result in improper installation and more housefires. He states that the second-stage of the standard is too tight and the DEQ should listen to the industry when setting the standard. The DEQ should also look toward controlling all pollutant sources, not just woodstoves.

Phil Ralston
5/8/84
229-5181

COPY BACK TO DR GUENTHER

My name is Dr. Donald Guenther. I practice pediatrics at 1100 Southgate, in Pendleton.

In my 10 years in Pendleton, I have observed an increasing amount of smoke in the atmosphere associated with the increased use of woodstoves. I have had a subjective impression that there has been an increase in the number of children with respiratory diseases, as well as an increase in severity associated with the intensity of the smoke. I cannot document this in any scientifically valid manner. Rather, I would like to give some examples of children who have given me this impression.

One child who has no underlying respiratory disease has had increasing frequency of colds during the last few years. Her parents have noticed a daily increase in symptoms whenever she is sick, just about dinnertime. Every day she would get worse at dinner time. We worried over this curious timing until her father once noticed on his day off that the smoke in the neighborhood noticably increased at dinnertime when people were arriving home and lighting up their woodstoves.

Another boy, who has asthma, has had much less wheezing this past winter after his family moved from one part of town with heavy smoke concentration to another part of town where the intensity of smoke is usually much less.

There is a scientific literature to document the adverse effects of environmental smoke on respiratory diseases in children. These cases and many others have caused me to make it a standard part of my management of respiratory diseases in children to take into consideration the presence of a woodstove in the home, and also whether the family home is in a part of town with heavy concentrations of wood smoke.

Therefore, from a medical point of view, I believe there is ample justification to look critically at methods to reduce the woodsmoke emissions in the city of Pendleton.

On the other hand there are those who will argue the economic burden to those who have found it necessary to rely on wood stove heat. Without being insensitive to the economic factors which have led many to turn to wood heat, I would suggest that for the average employed family wood heat is no bargain. I believe many people would be surprised to learn how little they are saving by heating with wood when they consider the cost of either cutting their own wood or buying it. This does not even take into account the additional medical expenses which I believe result.

Therefore I ask whether it would be as reasonable to put as much effort into public education as being put into restrictive regulations. I believe that public education regarding the true cost of a cord of wood, even if you cut it yourself, along with some critical data regarding the true medical consequences of woodsmoke would persuade many people to convert back to other forms of heating, while allowing those few with a real economic advantage in using wood heat to continue un-impeded by restrictive regulations.

Thank you for allowing me to speak my mind.

WOOD HEATERS
AND
FIREPLACES

FARM BOY SALES

DAVE KILMER
PHONE 938-5394
ROUTE 3 BOX 158-A
MILTON-FREEWATER, OREGON 97862
HIGHWAY 11—2 MILES SOUTH OF STATELINE

ANTIQUES
AND
WATCHES

D.E.Q. HEARING MAY 3, 1984 PENDLETON, OREGON

MY NAME IS DAVE KILMER OF ROUTE 3, BOX 158-A, MILTON-FREEWATER, OREGON. MY WIFE AND I OWN AND OPERATE FARM BOY SALES, A WOOD BURNING APPLIANCE RETAIL SHOP IN MILTON-FREEWATER.

BASICALLY MOST OF US AGREE WITH THE INTENT OF THE OREGON LEGISLATURE'S LAW TO CLEAN UP THE STATES AIR SHED. THERE IS HOWEVER A CONSIDERABLE DIFFERENCE OF OPINION AS TO HOW AND WHEN THIS IS TO OCCUR.

YOU AS DEPARTMENT OF ENVIRONMENTAL QUALITY WERE, I BELIEVE, TO SET UP TEST AND FINAL RESULT STANDARDS FOR WOOD STOVES. SOME OF THE BEST TECHNICAL AND MOST QUALIFIED PEOPLE IN THE WOOD ENERGY INDUSTRY GAVE OF THEIR TIME AND TALENTS TO HELP YOU DO YOUR JOB. AFTER MUCH DELIBERATION AND PRESENTATION OF SOLID USABLE DATA, YOU HAVE FOR THE MOST PART, TOLD THESE PEOPLE AND THE INDUSTRY THAT YOU CARE LITTLE OR NOTHING FOR THEIR EFFORT OR EXPERTISE.

THE STANDARDS YOU ARE PROPOSING DO NOT SERVE THE PEOPLE OF OREGON BECAUSE THEY ARE UNREALISTIC AND UNATTAINABLE WITH PRESENT TECHNOLOGY. FUTHERMORE, THESE UNATTAINABLE STANDARDS WILL FORCE THE WOOD STOVE INDUSTRY OUT OF THE STATE AND PUT HUNDREDS OF PEOPLE INVOLVED IN THAT INDUSTRY OUT OF WORK, INCLUDING SMALL RETAILERS LIKE US.

EFFICIENT WOOD BURNING IS VERY MUCH DEPENDANT ON PROPER OPERATION OF THE PRODUCING UNIT. ALL OF THE DEVICES, GADGETS AND TECHNOLOGY AVAILABLE WILL NOT MAKE GRANDPA OR LADY JANE PRODUCE EFFICIENT CLEAN WOOD ENERGY UNLESS AND UNTIL THEY ARE EDUCATIONALLY MOTIVATED TO DO SO.

YOUR FIGURES CONCERNING NUMBERS OF WOOD BURNING UNITS IN USE AND SOLD ANNUALLY ARE, IN MY MIND, VERY MUCH IN QUESTION AS TO THEIR ACCURACY. THUS, WOOD STOVE EMISSION IN THE AIR SHED IS ALSO IN QUESTION.

PURGING AND PRESERVATION OF CLEAN AIR IS A NOBLE AND WORTHWHILE PROJECT, BUT LETS WORK ON THE REAL PROBLEMS LIKE COAL FIRED GENERATOR EMISSIONS, ORCHARD SMUDGE POTS THAT REDUCE VISABILITY TO A FEW FEET, ALFALFA FARMS WHOSE BURNING FIELDS BLOCK THE SUN LIGHT FOR DAYS ON END, GRAIN FARMS WHOSE STUBBLE FIRES UNNECESSARILY PUT TONS OF PARTICULATES IN OUR AIR, FACTORIES WHO HAVE MADE MINIMAL EFFORTS TO CHECK THEIR EMISSIONS, AND AUTO SALVAGE YARDS THAT BURN HUNDREDS OF OLD CARS PRODUCING SMOKE SO BAD AS TO BE AN IMMEDIATE HEALTH HAZARD.

IN SHORT, EITHER LISTEN TO WHAT INDUSTRY EXPERTS TELL YOU AND ACT ACCORDINGLY OR FORGET THE WHOLE THING.

Written Testimony

The Department received 50 letters postmarked on or before May 4, 1984, which was the close of the hearing record. Since then we have received approximately 5 letters, which are also included for your information.

Sixteen of the letters received by the close of the record were from Oregon woodstove manufacturers and retailers; 6 were from out-of-state manufacturers and retailers; and 8 were from other woodstove related businesses: primarily catalyst manufacturers and testing laboratories. An industry association, the national Wood Heating Alliance, and a trade journal, Wood 'n Energy, submitted comments. Also, 16 individuals and 4 community groups submitted testimony.

Most of the woodstove industry's comments criticized the proposed second stage of the standard as being too restrictive. They stated the standard will: reduce or even eliminate stove selection; raise prices; force consumers to buy homemade or out-of-state stoves; drive the woodstove business out of Oregon; chill research on noncatalyst technology; and create a catalytic mandate. Several said no known technology can meet the standard. Wood 'n Energy submitted a survey showing manufacturers' concerns about the catalyst technology.

Several industry representatives recommended the EQC delay adoption of a 1988 standard until monitoring shows reductions are needed beyond the 1986 standard. One manufacturer, Martenson Industries of Canby, says it believes it already has catalyst stoves able to meet the 1988 standard.

Industry representatives also questioned the validity of DEQ's modeling assumptions and criticized basing the standard on Medford's airshed, which is assumed to be the worst case in Oregon. Some commented that DEQ's population projections for Medford are incorrect, meaning less woodsmoke reduction is needed.

Other industry recommendations included:

- Changing the test method to better reflect real-life operating conditions;
- Substituting the less expensive Condar Test Method for Oregon Method 7;
- Allowing some information to remain proprietary;
- Having testing laboratories, rather than DEQ, review design plans and modifications;
- Having testing laboratories, rather than DEQ, certify stoves;
- Allowing manufacturers and/or retailers one year to have stoves recertified if the laboratory loses its accreditation;
- Changing the catalyst warranty from two-year full replacement to five-year pro-rated;
- Eliminating the requirement that stoves be retested every five years.

Concern was also expressed that the rules will prohibit the manufacture and sale of Oregon stoves intended for out-of-state purchase. One manufacturer said the certification fee schedule places a proportionately heavier burden on small manufacturers. Others criticized the Department for not regulating fireplaces and woodfired furnaces.

A Montana testing laboratory (#43) provided suggestions for changes to laboratory procedures. Attorneys representing the Wood Heating Alliance (#10) and Klickitat Enterprises (#11) submitted detailed anaylses of the rules and suggested changes to the rule language.

Condar Company (#49)(a designeer and manufacturer of catalytic combustor units presently used in the cleanest woodstoves tested by the Department, and developer of the Condar Emission System of testing woodstove emissions and efficiency) submitted detailed documentation supporting: 1) The use of the Condar Emission System as an alternative to Method 7; and 2) The use of the Condar for efficiency determinations as equivalent to stack loss and calorimeter room methods. Condar Company suggests the use of its test methods will provide test results at a savings of $4000 per stove, compared to Method 7 costs.

The Condar Company suggests the Department's proposed second-stage standard for catalytic-equipped stoves (3 grms/hour) is "technology forcing" and is too stringent, thus causing serious obstacles to an effective program. The Condar Company offers a 5 grms/hour standard as one that would allow the use of "best practical technology" by manufacturers developing cleaner stoves.

Corning (a manufacturer of catalysts) and one manufacturer recommended the EQC adopt the same standard for both catalyst and noncatalyst stoves.

The Department received letters from the Sierra Club, the League of Women Voters of Oregon, and the League of Women Voters of Central Lane County saying the EQC should adopt the strictest possible standard in 1986. They said there is a danger the second phase would never occur, that we need the greater cleanup now, and that the technology is available.

The Sierra Club, as well as some industry persons, commented that because testing costs are expected to be quite expensive, fewer tests should be required.

The Department received 21 letters from individuals who are concerned about the health effects of woodsmoke and who encourage the Department to regulate woodstoves. Some criticized the Department for not being strict enough or for not regulating existing stoves. Thirty-one individuals criticized the program as being too restrictive and for forcing them to potentially buy homemade or out-of-state stoves.

One local government, the City of Union, asked that it be exempted from the rules.

1

In regards to the D.E.Q. hearing on HB2235 held in Medford Ore. May 3rd, 1984.

The D.E.Q. went to the trouble of getting together an advisory committee to help set the standards called for in the above mentioned bill, then totally ingnored them.

It looks to me like the D.E.Q. is going to set up their standards the way they wanted to in the first place regardless of what the advisory committee suggests.

I would strongly erge the D.E.Q. to take a strong look at the standards proposed by the advisory committee and the Oregon Environmental Council.

Sincerely,

Robert G. Fields Jr.

Robert G. Fields Jr.
3025 Maple Ct.
White City, OR 97503

Blaze King **WOODCUTTERS MFG., INC.**

May 4, 1984

RECEIVED

MAY 07 1984

PUBLIC AFFAIRS

Fred Hanson, Director
Department of Environmental Quality
Box 1760
Portland, OR 97207

Dear Mr. Hanson:

Please include this letter in the record of the public hearings over the proposed Oregon Woodstove Certification program.

We would like to congratulate DEQ for doing an admirable job within the time constraints imposed by the legislature.

First, there is the question of inspection.

1. The proposed rules should be changed to allow a manufacturer or importer to withhold particular design information to protect trade secrets.

2. The proposed rules should allow testing labs (UL, etc.) to inspect for design compliance at the factory. Independent review by DEQ is duplicative and wasteful.

3. Recertification is unnecessary at any time. If the original certified design is inspected periodically, recertification only adds to governmental burden and consumer cost.

Second, we believe that the 15/6 (non-catalytic/catalytic) standard is an undesirable catalytic mandate.

1. DEQ has named only one home heater (the Jotul 201) as capable of passing the 15 g/h standard and that stove was removed from the market as being unsalalable. It is highly unlikely that there will ever be a non-catalytic stove capable of producing usable heat, for any period of time, below 15 g/h.

2. The DEQ assertion that conventional stoves will be "available in some inexpensive versions ($99)" may be true but those stoves will not be acceptable to consumers. Consumers will not purchase, for home heating, a stove with a 1-1/2 hour burn time. Nor are manufacturers or importers likely to spend $7,600 to certify a stove retailing for $99.

3. The catalyst stoved works well in the lab, and consumers are pleased with the catalytic performance in their home. But these consumers, so far, have purchased the catalytic willingly. Now, if every consumer <u>must</u> purchase a catalytic stove - because nothing else is available - we see two possible scenarios: many of those stoves will be operated in an inefficient, dirty mode; or bootleg, non-compliance stoves will be made or purchased.

In summary: Oregonians prize their independence. The proposed standards, severely limiting stove choice, will result in the bootlegging of vast numbers of non-compliance products. This will seriously reduce the anticipated emission gains.

A less stringent standard would potentially increase the model availability and greatly reduce the use of non-complying appliances.

Sincerely,

Hal Larson

Hal Larson
President

3

RECEIVED

MAY 07 1984

PUBLIC AFFAIRS

D.E.Q. Public Affairs Section
P.O. box 1760
Portland Ore. 97207

Regarding: Comments on the D.E.Q.'s proposed emission standards and associated rules for new wood stove certification, (HB2235)

Sirs/Madam:

Orley's Manufacturing Co. Inc. welcomes a wood stove emission standard and certification program.
However; D.E.Q. has not listened to the manufacturers or the majority of the people who have testified against the proposed rules as they now stand. The rules are technology forcing, will be expensive to the manufacturers, the public and the State of Oregon; and in the end, they will not benifit Oregon's air quality because of their stringency.

There are to many things that can and will go wrong with a catalitic stove. For this reason, we feel the standard should be non-catalitic achievable, the 1988 standard is not. Also the 1988 rules require the manufacturers to retest their woodstoves two years later, doubling their testing costs. For this reason we feel there should be one achieveable standard for 1986.

If the certification fee must be charged consider doing it at the retail level in the form of a surtax when the woodstove is purchased.

In conclusion; we believe the D.E.Q.'s woodstove emissions standard for July 1, 1988, will go the same way as the E.P.A.'s 1972 leaded gasoline phase out program. It will not work because to many variables can go wrong, most notably is the human element.

Sincerely,

David R. Jencks
Plant Engineer
Orley's Manufacturing Co. Inc.

2160 N. Pacific Hwy
Medford 97504

4

AIR SCIENCES INC.

12687 West Cedar Drive
Lakewood, Colorado 80228
303/988-2960

May 3, 1984
Project #019-001

Mr. Fred Hansen, Director
Oregon Department of Environmental Quality
P. O. Box 1760
Portland, OR 97207

RE: Commentary on the air basin justification for proposed Oregon regulation of woodburning stoves

Dear Mr. Hansen:

Air Sciences Inc. has been retained by Wood Energy Institute West to assist them in reviewing the DEQ's technical justification of the proposed woodstove regulation. Air Sciences is an air quality firm with expertise in air regulations and air basin analyses. Our comments are limited to these areas of the development of the Oregon woodstove emission regulations. We request that these comments be entered into the hearing record for the Environmental Quality Commission on the proposed woodstove regulations. Our comments follow.

1. The proposed DEQ woodstove regulation is in response to an EPA mandate (Clean Air Act of 1970, Section 110 and 1977 revisions) for all air quality maintenance areas (AQMA) to meet secondary standards expeditiously. Sufficient controls must be placed on the sources of particulates in Medford and other Oregon particulate nonattainment areas to meet the national secondary standards. The mix of controls on the various source categories in the Medford air basin and the degree of control on woodstove emissions in particular needed to make up the estimated 40 percent air basin improvement in 2000 are state and local decisions, not EPA decisions.

2. DEQ and local AQMA authorities have based their decision to control woodburning devices rather than fugitive dust or industrial or transportation sources on a study of the relative cost per ton emission decrease from various source categories. From their analysis, it appears that

costs associated with woodstove cleanup are much lower than those for other source categories. It is possible that this analysis is not valid when woodstove reductions approach the 80 percent level. At this high level the stoves may be much more expensive, may require substantial maintenance and may have the social drawback of requiring constant care while burning.

3. The proposed woodstove regulations for the entire state are based on technical analysis for Medford, the area with the worst particulate problem. The potential benefits of the regulation have not been quantified nor the need justified in any technical manner for Portland or the remainder of the state. It is likely that other airsheds can be brought into attainment without controls on woodstove emissions as strict as being proposed.

4. The DEQ has stated to the EPA (Medford-Ashland SIP for particulate matter, 1983; page 30) that "...the emission rates (#/ton of wood burned) from some new woodstove designs are 70 to 80 percent lower than from the average woodstove. Wood Energy Institute West is submitting industry data which disputes this statement when burning at the protocol test conditions and using presently available control technology. This 70 to 80 percent reduction is a key element in the DEQ demonstration of probable attainment in Medford. EPA should not accept the Medford SIP element for attainment of the secondary particulate standard (currently being proposed to EPA) if they are assessed of this issue. DEQ has stated in clear terms that they will not propose a technology forcing regulation.

5. The logic used to arrive at an 80 percent decrease in woodstove emissions in Medford appears to be reasonable. We have not studied the various reports used by the DEQ sufficiently to comment on the technical quality and any possible bias in their results. However, there are large uncertainties built into the 80 percent number. We suggest that when the degree of control is so uncertain for the DEQ, and small differences in that degree of control are so important to the health of the woodstove industry and public use of woodstoves that consideration should be given

to selection of a degree of control which will not cause substantial disruption in the industry and community. The uncertainty in the required 80 percent emission reduction number is discussed below.

The 80 percent estimated needed improvement in wood stove emissions is based on many assumptions, each of which is associated with some uncertainty. The more important assumptions with substantial uncertainty include:

- o contribution of wood stove emissions to the Medford air basin concentration in 1980, the year of the MACS study;
- o prediction of changes in per capita wood consumption in wood stoves between 1980 and the year 2000;
- o prediction of changes in airborne fugitive soil dust between 1980 and 2000.
- o prediction of changes in population between 1980 and 2000;
- o prediction of effectiveness of controls placed on fugitive dust emissions;

Taking the imprecision, uncertainties or ranges listed by many of the studies, we have generated the uncertainty in the 80 percent control value. As we do this, it should be noted that published uncertainties by investigators are often too small because they rarely take into consideration all the elements of uncertainty in their experiments. Therefore, the resulting uncertainties we have calculated are also likely to be too small.

A model (which is a set of equations) is used by DEQ to define the percent reduction in woodstove emissions needed to bring the Medford area into attainment of the annual and 24-hour secondary particulate standard by the year 2000. We will address only the annual model since input information to the 24-hour models makes the 24-hour results extremely imprecise, to the extent of being arbitrary. The annual model uses as inputs, data from the MACS study and many assumptions of control efficiencies, population projections and changes in social habits. Applying a Monte Carlo statistical technique to a simplified annual model, which is explained in greater detail in the attachment, it is apparent that the 80 reduction number has a standard deviation of 25 percent (this is equivalent to 32 percent of the 80 percent reduction). In other words, there is a 17 percent probability that the woodstove emission reduction should be less than 60 percent, a 33 percent probability that the reduction should be less than 70 percent, and a 12 percent probability that even a 100 percent woodstove emission reduction (all stoves shut down) would not bring the air basin into attainment.

A sensitivity analysis shows the effect of a change in one or more input values on the model results. In this case we will show the change in estimated percent woodstove emission control resulting from changes in population projection and from possible biases in the MACS study results. Assuming all the DEQ suggested input values are correct, the model shows that woodstove emissions should be decreased by about 80 percent. If the population increase between 1980 and 2000 is a factor of 1.31 instead of the DEQ best estimate of 1.40, a change well within the precision of long term population projections, then the model shows that woodstove emissions need only a 66 percent decrease. Recent Oregon Population Center estimates have been revised for Jackson County from a value of 1.40 to 1.31. Thus there already is evidence that a 66 percent reduction is more appropriate than an 80 percent reduction.

Consider now the effect of bias in the 1980 MACS results. If 10 percent of the woodstove contribution to the airshed concentration were incorrectly attributed to the "other source" category and the woodstove contribution should have been higher by 10 percent, then the model would show that only a 67 percent woodstove emission decrease would be necessary. The reverse is also true, if the 1980 woodstove contribution were 10 percent smaller than the MACS study indicates, then an 88 percent reduction would be indicated.

These changes in model input are well within the precision of the input data yet they result in a substantial change in the woodstove emission control required to bring the Medford air basin into compliance. These small changes have a substantial effect on the design of woodstove appliances and may have a major effect on the community.

The purpose of this letter is to provide some perspective to the air basin justification for the proposed woodstove emission regulation. Additional support for these arguments is available and we would be happy to supply it at your convenience.

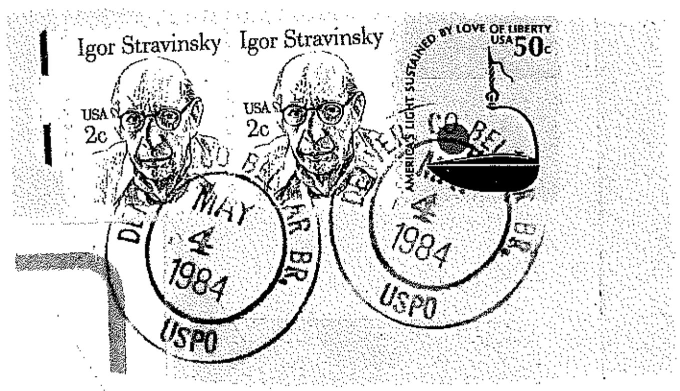
Sincerely,

Rodger G. Steen

Rodger G. Steen
Principal Meteorologist

tlc

Enclosure



ANALYSIS OF IMPRECISION IN THE PERCENT CONTROL CALCULATION FOR WOODSTOVES

The following is an analysis of the imprecision in the DEQ estimate of the necessary woodstove emission reduction. The DEQ has based their estimate on a study of the Medford airshed and the emission reductions necessary to bring that area into attainment of the secondary particulate standard of 60 ug/m3. The DEQ procedure for estimating the necessary emission reduction is intricate but can be simplified for purposes of calculating the imprecision. The simplified model is presented below and it incorporates only the major steps in the emission reduction calculation. The DEQ emission reduction calculation is based on the results of the 1980 Medford Aerosol Characterization Study (MACS) by DeCesar and Cooper,1981. DEQ then estimates the changes that will occur between 1980 and 2000 for the emissions of the various source categories, estimates a resulting air basin concentration and calculates the reduction in woodstove emissions necessary to reach the annual standard of 60 ug/m3.

There are four source categories in the DEQ analysis, woodstoves, industry, fugitive soil dust, and others; and the projection of emissions of each is based on different types of information. These projections are outlined in the Medford-Ashland Air Quality Maintenance Area State Implementation Plan For Particulate Matter, April 1983. Woodstove emission projections are primarily based on expected population increases, expected change in per-capita wood consumption, and the effect of public education about proper woodburning habits and no-burn days. Industrial emission projections to 2000 are based on an assumption of no change in industrial activity and the effect of process emission controls recently put on the industries. Fugitive soil dust, primarily from streets, is projected by estimating improvement due to some paving of streets, changes in sanding practices and others, plus estimates of changing amounts of traffic. In our uncertainty analysis we have assumed changing amounts of traffic is a linear function of changing population. Other sources are assumed to increase only as a function of population increases.

Uncertainties have been attached to the various inputs generally from information available in the various reports from which the input data are taken. Normal distributions are assumed for the uncertainties in the results of the MACS results. Step functions are assumed for the remaining uncertainties. Step functions are assumed because there is no particular reason to consider any one value within the range more probable than another. In the case of the population distribution, the step function ranges from 1.24 to 1.48, the span of the four studies used by DEQ to determine their best estimate of 1.40. Wood consumption span, taken from the Del Green Task 3 Study, is based on the projected wood cost increase estimate range of 0 to 5 percent per year. The non-standard controls on woodburning from population education and fugitive soil dust controls are assumed to have a range of +/- 50 percent.

The Monte Carlo technique used here maps random numbers onto the frequency distribution curves of each input variable and inputs these variable values into the model. Five thousand simulations were run to generate the distribution of the percent woodstove control (R). Presumably, 5000 values of each input variable is sufficient to accurately regenerate the distribution for that variable. The model is initiated with a random seed number. Different seed numbers were used and the R distribution was the same for each so 5000 was assumed sufficient. The model equations and input values are listed on the following pages.

UNCERTAINTY MODEL

Projected woodstove emission reduction is R.

$$R = \frac{\Psi_{2000T} - \text{Standard}}{\Psi_{2000W}}$$

where:

$$\Psi_{2000T} = \Psi_{2000W} + \Psi_{2000S} + \Psi_{2000I} + \Psi_{2000O}$$

$$\Psi_{2000W} = \Psi_{1980W} \times P_W$$

$$\Psi_{2000S} = \Psi_{1980S} \times P_S$$

$$\Psi_{2000I} = \Psi_{1980I} \times P_I$$

$$\Psi_{2000O} = \Psi_{1980O} \times P_O$$

$$P_W = WC \times PP \times NSC \times K_W$$

$$P_S = PP \times FC \times K_S$$

$$P_I = IC$$

$$\text{standard} = 60\ \mu g/m^3$$

$$P_O = PP \times K_O$$

subscript w refers to woodstove component
subscript s " " fugitive soil "
subscript I " " industrial "
subscript O " " other "
subscript T " " total
subscript 1980 " " the year 1980
" 2000 " " " " 2000

the P values represent change between 1980 and 2000
" γ " " ambient concentrations
" K " " calibration constants used to calibrate our model to the DEQ results

input values assumed:

$\gamma_{1980w} = 30 \mu g/m^3$, $\sigma = 7.5$

$\gamma_{1980s} = 29$ ", $\sigma = 0.0$

$\gamma_{1980I} = 24$ ", $\sigma = 3.6$

$\gamma_{1980O} = 14$ ", $\sigma = 2.1$

$K_w = 1.0378$

$K_s = 0.7882$

$K_O = 1.0714$

$WC = 1.3$, range 0.95 to 1.65

$NCS = 0.6$, range 0.4 to 0.8

$PP = 1.40$, range 1.24 to 1.48

$FC = 0.75$, range 0.63 to 0.87

$IC = 0.292$, no range

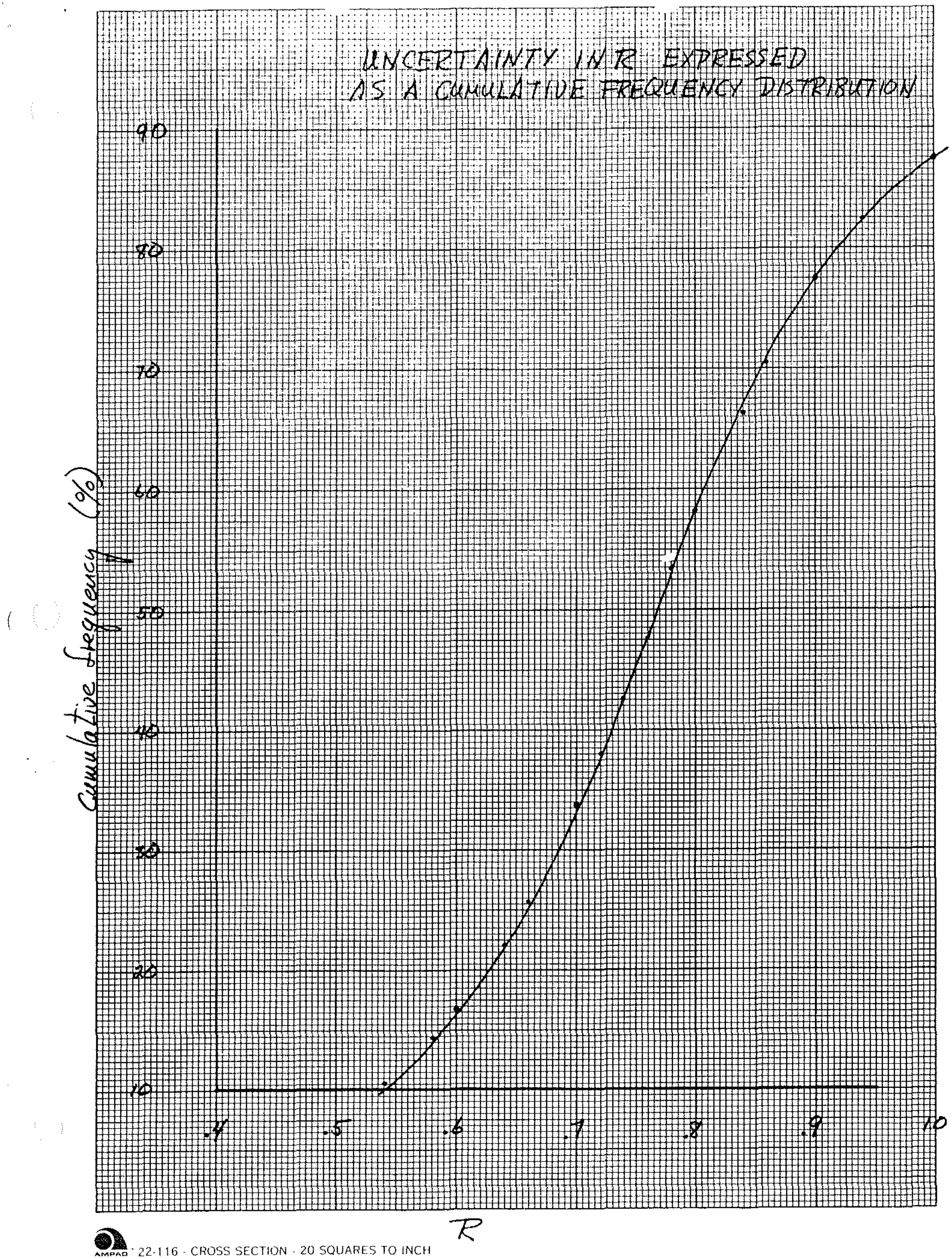
Constraints:

$$\psi_{1980W} + \psi_{1980S} + \psi_{1980I} + \psi_{1980O} = 97$$

where ψ_{1980W} is first selected, ψ_{1980S} is fixed at $29 \mu g/m^3$

and $$\frac{\psi_{1980I}}{\psi_{1980O}} = 1.7143, \sigma = 0.34$$

all normal distributions were clipped at $\pm 3\sigma$ to avoid instability in the model


UNCERTAINTY IN R EXPRESSED
AS A CUMULATIVE FREQUENCY DISTRIBUTION
Cumulative frequency (%)
90
80
70
60
50
40
30
20
10
.4
.5
.6
.7
.8
.9
1.0
R

R UNCERTAINTY DISTRIBUTION
DEQ AIR BASIN JUSTIFICATION
FOR PROPOSED WOODSTOVE EMISSION REGULATION

R Class Interval	Count	Class Percentage	Cummulative Percentage
Min. to .000	5	.1000	.1000
.000 to .020	1	.0200	.1200
.020 to .040	0	.0000	.1200
.040 to .060	1	.0200	.1400
.060 to .080	1	.0200	.1600
.080 to .100	0	.0000	.1600
.100 to .120	0	.0000	.1600
.120 to .140	2	.0400	.2000
.140 to .160	2	.0400	.2400
.160 to .180	7	.1400	.3800
.180 to .200	3	.0600	.4400
.200 to .220	6	.1200	.5600
.220 to .240	7	.1400	.7000
.240 to .260	7	.1400	.8400
.260 to .280	9	.1800	1.0200
.280 to .300	17	.3400	1.3600
.300 to .320	10	.2000	1.5600
.320 to .340	20	.4000	1.9600
.340 to .360	14	.2800	2.2400
.360 to .380	22	.4400	2.6800
.380 to .400	29	.5800	3.2600
.400 to .420	24	.4800	3.7400
.420 to .440	32	.6400	4.3800
.440 to .460	45	.9000	5.2800
.460 to .480	55	1.1000	6.3800
.480 to .500	56	1.1200	7.5000
.500 to .520	70	1.4000	8.9000
.520 to .540	83	1.6600	10.5600
.540 to .560	80	1.6000	12.1600
.560 to .580	112	2.2400	14.4000
.580 to .600	128	2.5600	16.9600
.600 to .620	129	2.5800	19.5400
.620 to .640	132	2.6400	22.1800
.640 to .660	176	3.5200	25.7000
.660 to .680	206	4.1200	29.8200
.680 to .700	204	4.0800	33.9000
.700 to .720	210	4.2000	38.1000
.720 to .740	225	4.5000	42.6000
.740 to .760	259	5.1800	47.7800
.760 to .780	285	5.7000	53.4800
.780 to .800	227	4.5400	58.0200
.800 to .820	221	4.4200	62.4400
.820 to .840	196	3.9200	66.3600
.840 to .860	208	4.1600	70.5200
.860 to .880	174	3.4800	74.0000
.880 to .900	175	3.5000	77.5000
.900 to .920	139	2.7800	80.2800
.920 to .940	103	2.0600	82.3400
.940 to .960	82	1.6400	83.9800

.960	to	.980	96	1.9200	85.9000
.980	to	1.000	82	1.6400	87.5400
.000	to	1.020	68	1.3600	88.9000
1.020	to	1.040	67	1.3400	90.2400
1.040	to	1.060	51	1.0200	91.2600
1.060	to	1.080	42	.8400	92.1000
1.080	to	1.100	42	.8400	92.9400
1.100	to	1.120	42	.8400	93.7800
1.120	to	1.140	26	.5200	94.3000
1.140	to	1.160	25	.5000	94.8000
1.160	to	1.180	27	.5400	95.3400
1.180	to	1.200	23	.4600	95.8000
1.200	to	1.220	10	.2000	96.0000
1.220	to	1.240	20	.4000	96.4000
1.240	to	1.260	14	.2800	96.6800
1.260	to	1.280	13	.2600	96.9400
1.280	to	1.300	11	.2200	97.1600
1.300	to	1.320	12	.2400	97.4000
1.320	to	1.340	10	.2000	97.6000
1.340	to	1.360	9	.1800	97.7800
1.360	to	1.380	5	.1000	97.8800
1.380	to	1.400	10	.2000	98.0800
1.400	to	1.420	7	.1400	98.2200
1.420	to	1.440	7	.1400	98.3600
1.440	to	1.460	7	.1400	98.5000
1.460	to	1.480	4	.0800	98.5800
1.480	to	1.500	6	.1200	98.7000
500	to	1.520	3	.0600	98.7600
1.520	to	1.540	2	.0400	98.8000
1.540	to	1.560	3	.0600	98.8600
1.560	to	1.580	6	.1200	98.9800
1.580	to	1.600	1	.0200	99.0000
1.600	to	1.620	4	.0800	99.0800
1.620	to	1.640	1	.0200	99.1000
1.640	to	1.660	1	.0200	99.1200
1.660	to	1.680	1	.0200	99.1400
1.680	to	1.700	1	.0200	99.1600
1.700	to	1.720	5	.1000	99.2600
1.720	to	1.740	4	.0800	99.3400
1.740	to	1.760	2	.0400	99.3800
1.760	to	1.780	2	.0400	99.4200
1.780	to	1.800	1	.0200	99.4400
1.800	to	1.820	0	.0000	99.4400
1.820	to	1.840	1	.0200	99.4600
1.840	to	1.860	1	.0200	99.4800
1.860	to	1.880	0	.0000	99.4800
1.880	to	1.900	0	.0000	99.4800
1.900	to	1.920	1	.0200	99.5000
1.920	to	1.940	1	.0200	99.5200
1.940	to	1.960	1	.0200	99.5400
1.960	to	1.980	2	.0400	99.5800
1.980	to	2.000	1	.0200	99.6000
~ 000	to	Maximum	20	.4000	100.0000

Average R = 0.7864   Standard deviation = 0.2512
Random seed   89749983

CORNING

Technical Products Division
Corning Glass Works
Corning, New York 14831
Tel: 607-974-9000

April 27, 1984

DEQ
Air Quality
P. O. Box 1760
Portland, OR 97207
Attn: Fred Hanson, Director

Ref: Clean Burning Woodstove Proposed Emissions Standard. We request that this letter be made part of the public hearing testimony.

Dear Mr. Hanson:

As the developer and supplier to the Solid Fuel Industry of catalytic material for clean burning and more efficient woodstove designs, Corning should be a source of technical and factual information to DEQ, committee members, and manufacturers interested in these proceedings.

We support and favor efforts to make our environment cleaner and safer, in addition to promoting the conservation of available fuels. If legislation is necessary to accomplish this, we will cooperate and, as in the past, continue to develop materials that enhance the safety and effectiveness of products available to the consumer and to our customers, the manufacturers.

I'd like to start with the use of an example of this type of development and the successful market use of a similar product concept to point out several concerns we have about the present proposal for Solid Fuel regulation. I'm referring to the automotive use of catalytic converters, which I think is an appropriate and real example. There are a number of similarities as well as some differences.

They are similar in that cleaner air is the result of the automotive catalyst application, with pollutant levels in American cities now substantially below what they would be without them. Fuel economy is also improved in automobiles, although the fuel reduction with the effective use of catalytic combustors in woodstoves can, in fact, be much higher, as high as 50%. The automotive legislation set emission level requirements in steps to give manufacturers time to develop technology, similar to what has been proposed to the woodstove industry.

There are some differences, however, that I find important. First, many manufacturers of woodstoves, at present over 60, already utilize Corning's catalytic converter in some or all of their product lines. This is before any legislation has been implemented.

In the automotive industry, vehicle emission standards were set to meet ambient air targets. The choice of technology for compliance was up to the automakers. With woodstoves, there are also, of course, immediate benefits such as the reduced creosote build-up of a clean burn stove, and, longer term, air quality standards are certainly a consideration as they relate to health hazards - as was the case with automobile emissions.

We believe a single set of performance standards is appropriate for woodstoves too, and that separate standards based on catalytic, non-catalytic technology is inappropriate.

Corning has provided life vs. activity plots to the committee showing the conversion of particulates decreasing only approximately 6.5% in 5000 hours of use for a product with an expected 6000 hour life (from 91% conversion to about 85% conversion of particulate hydrocarbons - see attachment 1).

There is no reason to believe that a non-catalytic stove will not also degrade. I'm sure from my own knowledge and in discussions with other knowledgeable people in the industry that all stoves degrade over time. We believe that the non-catalytic technology needed for sensitive secondary combustion increases the likelihood of operational degradation. This means also that proper settings will be more difficult and increase the likelihood of generating much higher emission levels, from a stove whose test rating might be adequate.

The double standards may motivate a manufacturer to use non-catalytic designs that produce a stove just able to meet the higher proposed standard. In our opinion, these stoves will degrade in a short time to produce significantly larger amounts of particulates. We feel that most catalytic stoves sold within two years will perform in the 3 to 5 gms/hour range.

Let me conclude with what we feel the market seems to be telling us today.

1. Even consumers, owning some poorly designed catalytic systems from the very first units on the market, insist on buying replacement combustors since they have recognized the value that the catalytic system gives them.

2. Greatly reduced creosote and much lower fuel usage are mentioned over and over again by consumers communicating their satisfaction with catalytic units.

3. The likelihood of future studies on air quality showing harmful effects of wood smoke emissions dictate that we make the air as clean as possible as soon as possible or the negative effect could seriously damage the marketable use of wood heating appliances.

4. Overall return rates under our 1 year replacement warranty to the stove manufacturers are less than 1% on the average.

5. Manufacturers have already given us a strong indication that our newly introduced 12,000 model combustor, with its longer life (est. 12,000 hours), will be used extensively. This product will have a 2 year replacement warranty to stove manufacturers.

We will be happy to discuss the above with interested parties and, of course, provide any additional information we can. Please feel free to contact me at (607) 974-4324.

Yours truly,

R. D. GrosJean

R. D. GrosJean
Corning Glass Works

Attachments: Catalyst Performance vs. Aging
Testimonies From Consumers
6,000 & 12,000 Model Combustor Promotional Literature

CC: J. F. Kowalczyk
B. J. Tombleson

d0967

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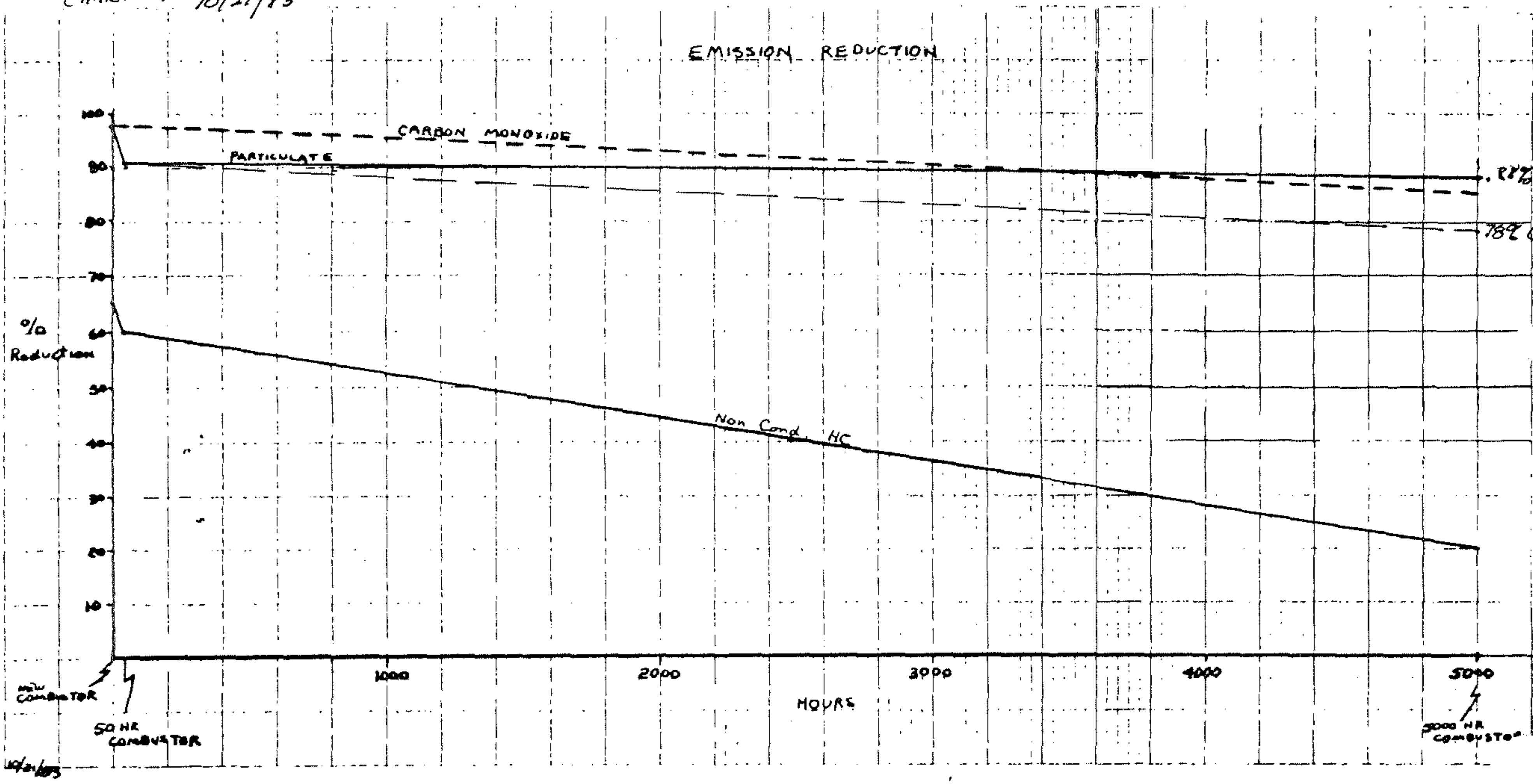
MAY 08 1984
PUBLIC AFFAIRS

CHART #1 · 10/21/83

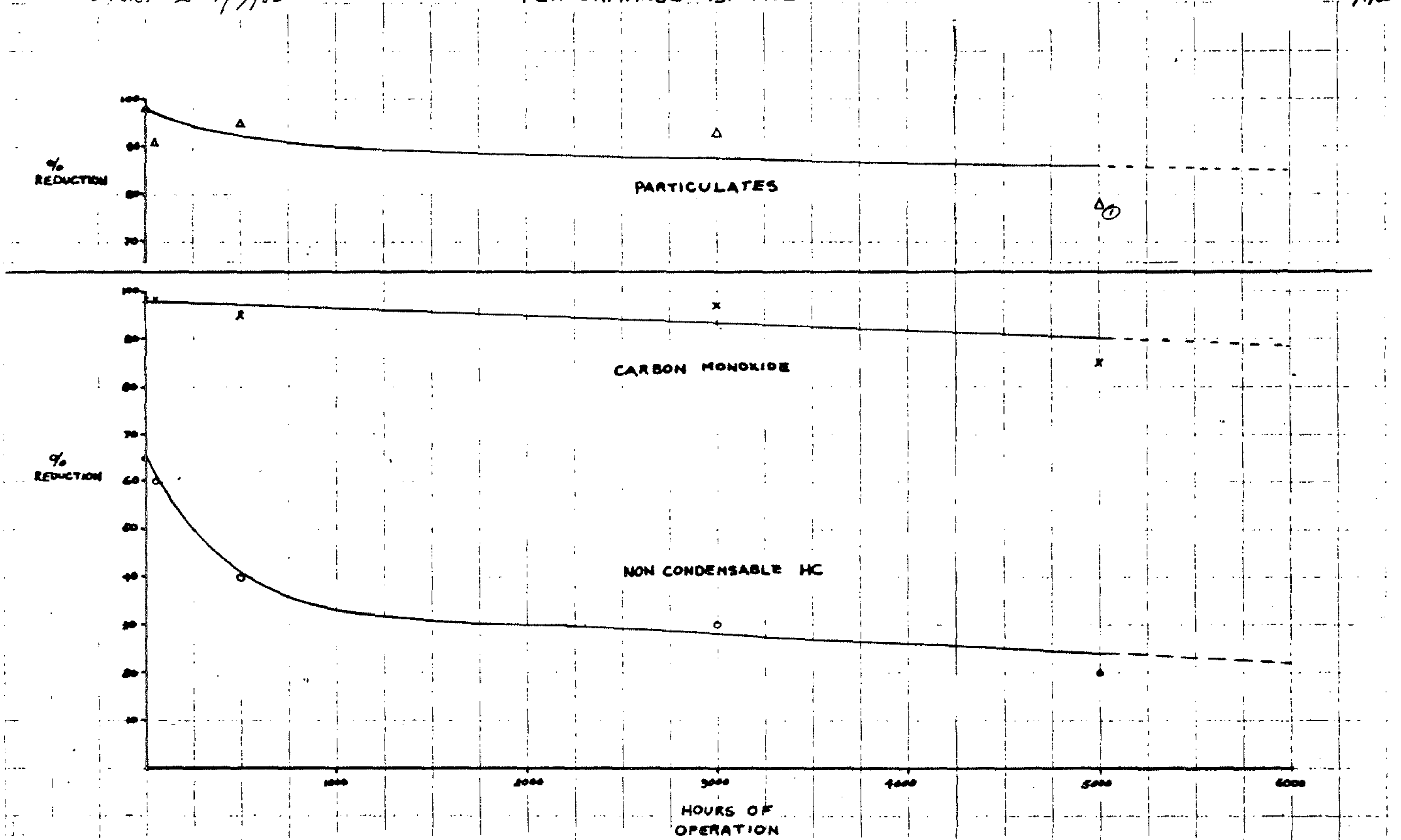


① 78% DATA POINT REFLECTS USE OF ALL DATA INCLUDING A SIGNIFICANT PERIOD OF OXYGEN STARVED CONDITION AT COMBUSTOR. EXCLUSION OF OXYGEN STARVED DATA IS REFLECTED IN 88% DATA POINT. (SEE CHART #2)

CHART #2 11/7/83

PERFORMANCE VS. AGE

11/7/83



NOTE ① DATAPOINT IS WORST CASE % FROM 10/21/83 CHART USING OXYGEN STARVED TEST RESULTS.
LINES ARE LINE OF BEST FIT SHOWING ≅ 80% REDUCTION AT 6000 HOURS. USE OF NON OXYGEN STARVED DATA WOULD RAISE THIS DATAPOINT AND LINE OF BEST FIT.

29 March 1984
Box 97, Mill Street
Bridgewater, N.Y. 13313

Corning Glass Works
Industrial Materials Department
Woodburning Devices
Corning, N. Y. 14831

Gentlemen:

Early in this woodburning season I purchased a combustor unit from Sotz for use with a Vermont Castings Vigilant stove.

It has performed as your literature indicates. I have virtually no creosote build-up after a five or six week period, at which time I clean the flue. Normally, the flue would be virtually completely plugged and primed for a fire. Your combustor has relieved me of this worry.

You have an excellent product!

Sincerely,

F. Combar

Francis A. Combar

FAC/pc

THE WOOD BOX
ANOTHER ROADSIDE ATTRACTION
P. O. Box 415
SHAVER LAKE, CALIFORNIA 93664

841-3700 841-3468

Memo
LETTER

Date 2/28/83

To VERMONT IRON STOVE WORKS

Subject

I BURNED MY 18" ELM CATALYTIC (IN THE CATALYTIC MODE) TODAY AFTER THE INITIAL 14 DAY BREAK IN PERIOD. THIS LETTER IS TO ADVISE YOU THAT IN 5 YEARS IN THE STOVE BUSINESS I'VE NEVER SEEN ANYTHING LIKE IT. PERHAPS ALL CATALYTICS WORK AS WELL BUT AFTER BURNING YOURS FOR JUST 1 DAY I'VE DECIDED TO INSTALL ONE IN MY RESIDENCE AS WELL. DO YOU THINK A 24" ONE WILL HEAT 2000 SQ FT MOUNTAIN CLIMATE? I'M PRESENTLY USING AN EARTH 301. I WANTED SO TO TAKE YOU UP ON YOUR OFFER TO BUY 2 REGULAR ELMS BUT TO BE QUITE FRANK WITH YOU I DON'T WANT TO SELL <u>ANY</u> MORE <u>REGULAR</u> STOVES! PLEASE SEND SEVERAL BROCHURES, SPECIFICATION SHEETS ON YOUR CATALYTICS. ALSO, PLEASE SEND ME A DOZEN OR SO ~~OWNERS~~ OWNER'S MANUALS FOR DISTRIBUTION TO INTERESTED CUSTOMERS - THERE'S A WEALTH OF INFORMATION CONTAINED IN THEM (HOW TO INSTALL IN FIREPLACES) THAT WILL HELP THEM DECIDE THAT THEY CAN USE A FREESTANDING STOVE INSTEAD OF AN INSERT.

NOW, IN LIEU OF YOUR SPECIAL OFFER ON REGULAR ELMS, WHAT, IF ANY, SPECIALS ARE YOU WILLING TO OFFER ~~at~~ ME SO THAT I CAN GET SOME OF YOUR CATALYTICS OUT THE DOOR? CAN I ASSUME THAT YOU WILL SEND ME A 24" CATALYTIC FOR MY RESIDENCE (FREE FRT) SINCE I'VE ALREADY GOT ONE GOING IN THE STORE? ONCE AGAIN, THE STOVE IS INCREDIBLE!

☐ Please reply ☐ No reply necessary

SIGNED William V. Palenzuar

11/18/82

Canned
Combustor

copy letter for
record

Joseph T. Gabus
P.O. Box 352
Downsville, N.Y. 13755
11/10/82

orks
4831

r the brochure "How to Keep Your Wood
rom Going Up in Smoke".

using a Catalytic Combustor in my Scanda
e for almost a year. This fall I broke
(fractured) the Catalytic Combustor during annual cleaning.

Using "wire-cloth" as a support for the many fragments, I put it all back into place, minus fragments too small to be retained by the mesh, and dumped the larger of the small fragments through the view port onto the top of the larger fragments. Upon firing the stove, the catalyst operated. In this situation, gasketing was out of the question, so there is considerable space for smoke to flow past, not through the catalytic combustor debris.

There is just no comparing the stove with/without its catalytic combustor. I am still learning how best to operate the stove. Can you imagine a secondary combustion chamber operating at 700 degrees while not enough heat to trigger a KLIXON thermal switch (150/140 degree turn-on/off) goes up the chimney? That heat is doing only thing- radiating to the room.

Now to the purpose of my letter: I would like to purchase a new Catalytic Combustor from you. The company I bought the stove from went out of business. the pipe the Catalytic Combustor fits in is slightly larger than 6" in diameter, and supports the Catalytic Combustor with two iron rods passing through two sets of holes in the "pipe". The CC rests on top of the rods.

I am located on a United Parcel Service route, as well as on a two block walk to a post office.

1-Do you sell retail?
2- How much is the unit?
3- when could I expect delivery upon receipt of payment?

Sincerely, Joseph T. Gabus
J.T. Gabus

RECEIVED

NOV 12 1982

APPLIANCE COMPONENTS

Kinney Hill Rd.
New Preston, Ct.
06777

Feb. 7, 1983

Dear Mr. Bolus,

I would like to tell you how much I like my Hearth Mate fireplace insert stove.

The catalytic combustor not only heats the stove to 600 degrees, but is burning smoke which contains creosote. (which really gives me piece of mind)

The consumption of wood varies from day to day, however I am burning at least 1/3 less wood than with my previous stove.

I just wanted you to know how pleased I am with my Hearth Mate. It is the best investment I ever made!

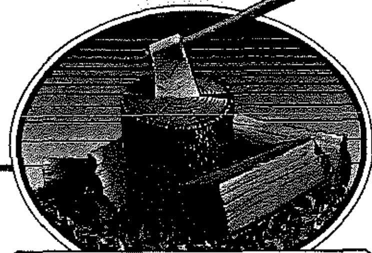
Sincerely,

Richard W. Bailey

P.S. The smoke from the chimney is so little that you can barely see it.

P.P.S. ~~I~~ have named my stove "Smoke Eater".

The Corning™ Catalytic Combustor



SAVE ONE-THIRD OF EVERY CORD

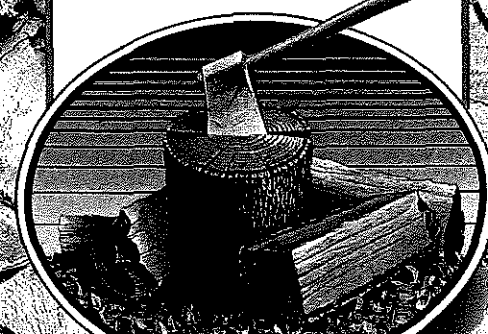
CORNING

Corning Catalytic Combustor
Corning Glass Works
Corning, New York 14831

Printed in U.S.A. Form No. CCB-84-1

SAVE ONE-THIRD OF EVERY CORD

The Corning™ Catalytic Combustor



SAVE ONE-THIRD OF EVERY CORD

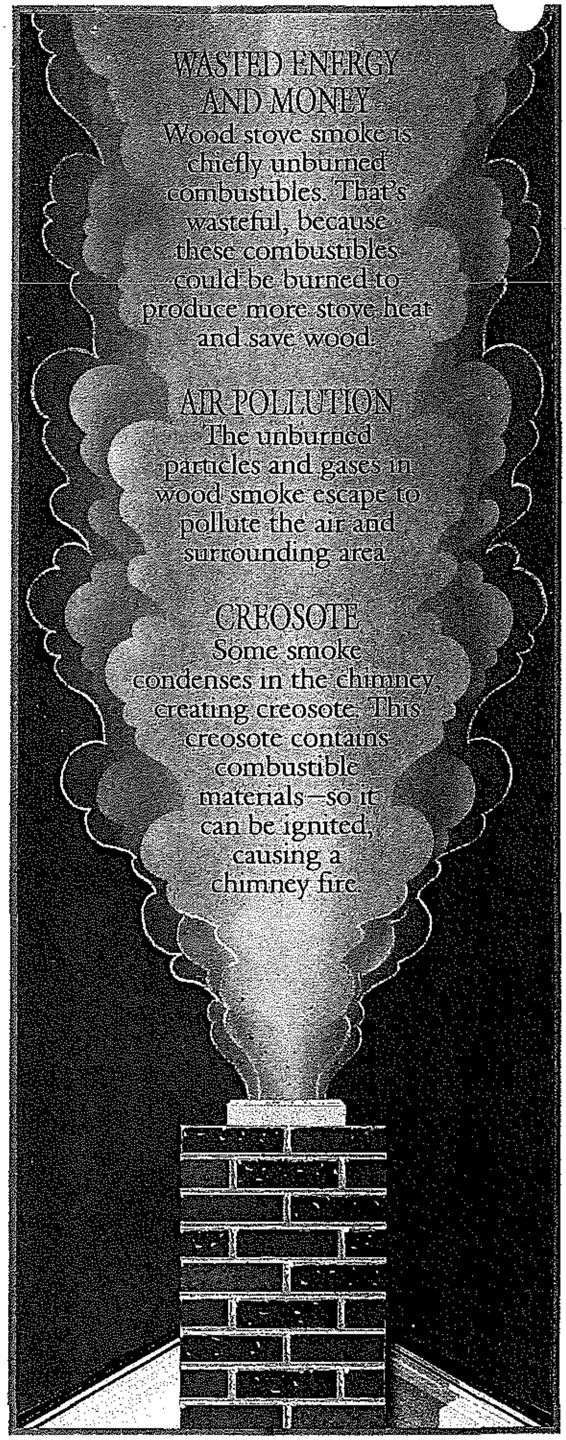
WOOD HEAT

It's a wise choice. Because compared to costs for natural gas, oil, and electricity, wood heat is an excellent value.

So, millions are switching to wood stoves as a source of heat—not only for economy, but for the aesthetic pleasures of a crackling fire.

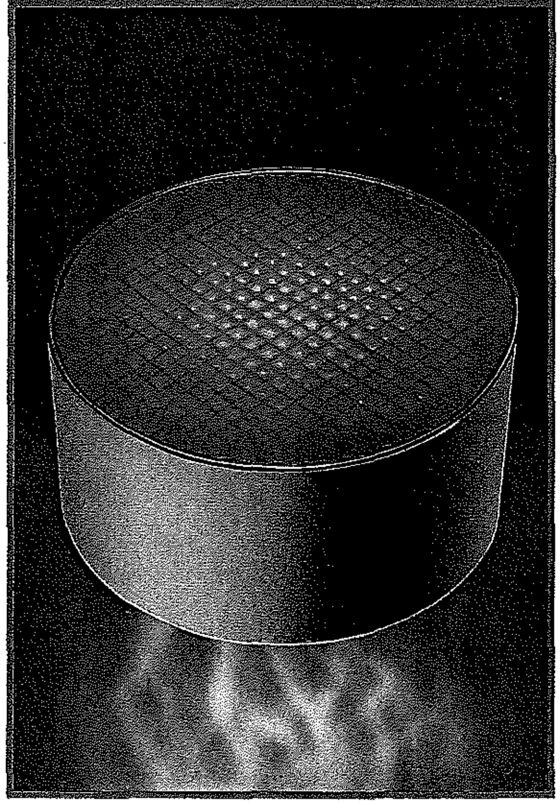
High technology wood stoves deliver heat more efficiently to the living area of your house than just about all central heating systems. However, most wood stoves are not as efficient as they might be because ¼ to ½ of the usable wood energy actually goes up the chimney as smoke.

There is now a solution to the problem: The Catalytic Combustor developed by Corning.



THE CORNING CATALYTIC COMBUSTOR

IT BURNS SMOKE INTO HEAT!



HOW THE COMBUSTOR WORKS

Burning wood smoke ordinarily requires temperatures too high to be practical in a wood stove. However, as smoke passes through a Corning Catalytic Combustor it contacts a noble metal (bonded to the combustor's ceramic base), which reduces by half the temperature at which the smoke will burn. The smoke ignites at this lower temperature and then burns efficiently to produce additional heat from every log.

Stoves and retrofit units equipped with the Corning Catalytic Combustor are available in a variety of designs. In each, however, the combustor is fitted into the smoke passage between the fire and stove flue.

SAVE ONE-THIRD OF EVERY CORD*

When you get more heat from every log by burning the smoke, you don't have to load as many logs. Independent research studies prove, in fact, you can save ⅓ of your wood. This means ⅓ of every cord, one cord out of three, three cords out of ten.

Based on a national average cost of $100 per cord, you will save $33 per cord. If your heating season ordinarily requires six cords, you save two cords—and $200! The greater your heat requirements, the more you save.

If you cut your own wood, you also save ⅓ of the cutting, splitting, stacking, carrying, and loading.

50% 

*MORE HEAT**

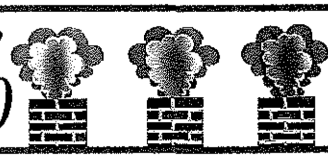
As the Corning Catalytic Combustor burns smoke within the wood stove, it creates additional heat. In fact, independent studies show that up to 50% more heat is generated from each piece of wood.

90% 

*LESS CREOSOTE**

Condensation of smoke in chimneys and flues creates creosote—the primary cause of chimney fires. The combustor reduces this danger because it burns most of the smoke and reduces creosote accumulation as much as 90%.

However, you should continue to inspect your chimney regularly for safety.†

90% 

*LESS POLLUTION**

Gases and particles in smoke cause air pollution. The combustor eliminates 90% of this pollution by burning these gases and particles before they exit the stove. The combustor, then, means cleaner air for you, your family, and your neighborhood.

*Performance results may be higher or lower depending upon stove design, operation and combustor age.

COMBUSTOR LIFE— CHOOSE FROM TWO MODELS

• Corning™ 6000 Catalytic Combustor. The standard Corning model should provide about 6000 hours of operation. Depending on frequency of stove use you can expect about two to six years of service.*

The 6000 model is sold with a one-year full free replacement and a pro-rated three-year limited warranty.

• New Corning™ 12000 Catalytic Combustor. The newest Corning combustor is built to last twice as long as the standard model—about 12000 hours. It will provide from about four to twelve years of service,* depending upon frequency of stove use.

The 12000 model is sold with a two-year full free replacement and pro-rated six-year limited warranty.

Ask your wood stove or combustor retailer for copies of these warranties, or write to Combustor Warranty Department, Corning Glass Works, Corning, NY 14831.

CATALYTIC RETROFIT UNITS

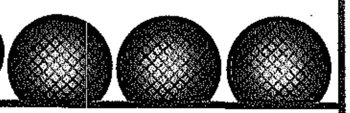
The Corning Catalytic Combustor is available as original equipment in many fine wood stoves. If you already have a wood stove, your dealer can offer a catalytic retrofit unit that can give you combustor efficiencies.

*Combustor life may be longer or shorter depending upon stove design and operation.

50% 

*MORE HEAT**

As the Corning Catalytic Combustor burns smoke within the wood stove, it creates additional heat. In fact, independent studies show that up to 50% more heat is generated from each piece of wood.

90% 

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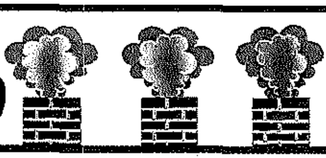
90% 

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*Performance results may be higher or lower depending upon stove design, operation and combustor age.

OPERATING THE COMBUSTOR-EQUIPPED WOOD STOVE

Your combustor-equipped stove operates like any other—only it operates much more efficiently. You load it, light it, adjust it and maintain it just as you would any wood stove.

There are a few minor considerations to remember: Burn only natural wood—soft or hardwood, green or seasoned. Don't burn painted or treated wood, artificial logs, or trash. They could affect combustor performance. The combustor is not designed to function with coal.

You need a medium-to-high burn (600°F) to initially activate the combustor. Then damp down as you normally would. If the burn gets very low before refueling, you may have to reactivate the combustor with a high burn for a few minutes after the stove is refueled.

Be aware that the amount of smoke burned by the combustor affects its temperature and appearance. When you start a fire, or refuel, a lot of smoke is created. When the combustor burns this much smoke, its temperature can rise to over 1000°F and produce an orange/red glow. As the smoke decreases, the combustor temperature drops and it gradually ceases to glow. *However, it is still operating even when it doesn't glow.*

Normally your combustor requires no maintenance. Because it generates such high temperatures it is self-cleaning. However, it should be lightly brushed for fly ash removal once a month, if needed.

COMBUSTOR REPLACEMENT

Your Corning Catalytic Combustor is an extremely useful product designed to provide thousands of hours of benefits. This translates into years of life. However, like most products, it will wear out eventually and should be replaced. You can monitor your combustor's efficiency by remembering some key facts:

- Maximum combustor life will be achieved when stove design and operation permit only minimum contact between flames and combustor—and do not allow combustor temperatures to exceed 1800°F.
- Some stoves and retrofit units have built-in combustor temperature monitoring probes. In these cases, the manufacturer's instructions will tell you the temperature performance that indicates when combustor replacement is necessary.
- Remember that performance declines gradually, rather than suddenly. When this decline becomes noticeable and excess creosote begins to accumulate in your flue, it is time for replacement.

For more detailed information, refer to the owner's manual accompanying your combustor-equipped stove or retrofit unit.

†We recommend you inspect your chimney regularly for safety—at the beginning and end of the season and once a month in between, because creosote will accumulate even with a combustor, but at a much slower rate. Also, toward the end of the combustor's life, the rate of accumulation will increase.

COMBUSTOR LIFE— CHOOSE FROM TWO MODELS

• Corning™ 6000 Catalytic Combustor. The standard Corning model should provide about 6000 hours of operation. Depending on frequency of stove use you can expect about two to six years of service.*

The 6000 model is sold with a one-year full free replacement and a pro-rated three-year limited warranty.

• New Corning™ 12000 Catalytic Combustor. The newest Corning combustor is built to last twice as long as the standard model—about 12000 hours. It will provide from about four to twelve years of service,* depending upon frequency of stove use.

The 12000 model is sold with a two-year full free replacement and pro-rated six-year limited warranty.

Ask your wood stove or combustor retailer for copies of these warranties, or write to Combustor Warranty Department, Corning Glass Works, Corning, NY 14831.

CATALYTIC RETROFIT UNITS

The Corning Catalytic Combustor is available as original equipment in many fine wood stoves. If you already have a wood stove, your dealer can offer a catalytic retrofit unit that can give you combustor efficiencies.

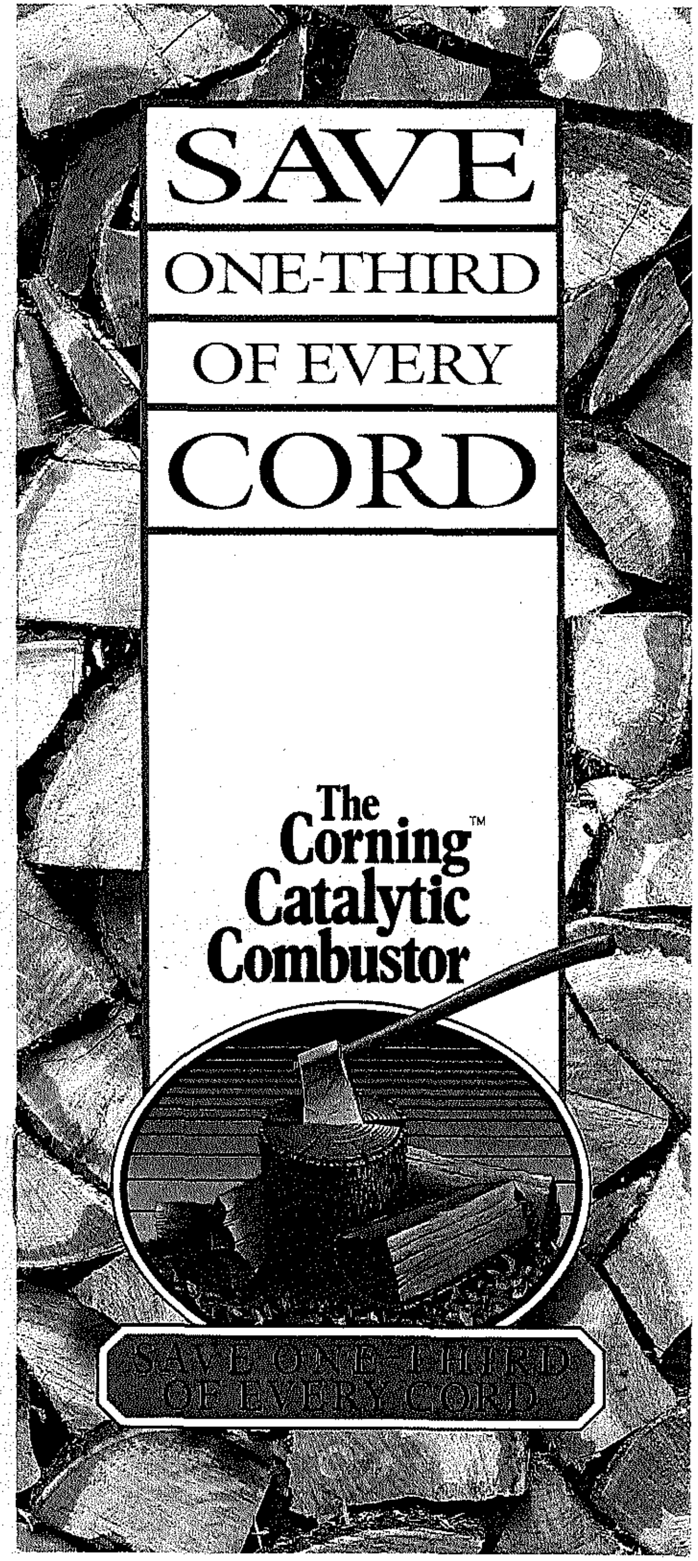
*Combustor life may be longer or shorter depending upon stove design and operation.

The Corning™ Catalytic Combustor

CORNING

Corning Catalytic Combustor
Corning Glass Works
Corning, New York 14831

Printed in U.S.A. Form No. CCB-84-1



THE SIX-YEAR CATALYTIC COMBUSTOR

NEW CORNING 12000 CATALYTIC COMBUSTOR
The same Corning technology that brought you the original wood stove combustor now scores another breakthrough: a combustor that lasts twice as long!

The 12000 model is made with new materials specially developed by Corning for exceptional durability. Sizes and shapes remain virtually identical to standard model combustors.

6-YEAR LIMITED WARRANTY, 2-YEAR FULL REPLACEMENT WARRANTY
We're so sure of the longevity of the Corning 12000 combustor, we give each a pro-rated 6-year limited warranty, and a full 2-year *free* replacement warranty. (The free replacement warranty is extended to 3 years in stoves designed to meet the new Oregon state emission legislation.)

LOOK AT THESE COMBUSTOR BENEFITS*
- One-third of every cord saved
- 50% more heat from every log
- 90% less creosote • 90% less air pollution

The new Corning 12000 combustor offers all these basic combustor benefits. The difference is those benefits now last twice as long—giving wood stoves equipped with this model even greater appeal and more value for the money.

WATCH FOR THIS TAG
You—and your customers—can readily identify stoves equipped with the new Corning 12000 catalytic combustor. Each will bear the distinctive hang-tag shown above.

Retrofit kits with the new model will also be available, in limited numbers.

FREE FIREPOWER PROMOTION KIT
To help you maximize sales of wood stoves equipped with Corning combustors, Corning has assembled an all new kit of advertising and in-store promotion aids. It will also promote your retrofit units. Send for this kit, which includes the Corning warranties. It's free. Write Corning Combustors, MP-21-1-2, Corning Glass Works, Corning, NY 14831.

CORNING

*Performance results may be higher or lower depending upon stove design, operation and combustor age.
CORNING is a trademark of Corning Glass Works.

6

OMNI ENVIRONMENTAL SERVICES, INC.
10950 S.W. 5th Street — Suite 245
Beaverton, Oregon 97005
(503) 643-3755

OMNI

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
MAY 03 1984
OFFICE OF THE DIRECTOR

Fred Hansen, Director
Oregon Dept. of Environmental Quality
P.O. Box 1760
Portland, Oregon 97207

May 2, 1984

Dear Mr. Hansen:

I have prepared this letter as an addendum to my previous comments regarding the proposed woodstove regulatory programs (letter of April 5, 1984). This letter is to be regarded as written testimony to the EQC.

As with my first letter the comments contained herein address topics I consider extremely important to the success of the proposed program objectives. Since the laboratories will play an important role in the program it is going to be absolutely necessary that the test method that they perform be workable. I firmly believe the method measures as accurately as possible the emissions from woodstoves. However, the complexity and overall tedious nature of the proposed method with its resulting high cost will present significant problems for laboratories.

The complexity itself presents a problem for training personnel and maintaining quality control. The tedious and exacting mental concentration requirements of the method with its four test runs at up to 15 hours for the low burn cycle, will invite short-cutting and inaccurate data collection. The resulting costs will reduce the number of stoves being tested. The costs along with the "7/3" may make it impossible to perform the test services for profit (The "7/3" would also reduce the number of manufacturers who would even submit a stove for testing).

In my review of the method, as presently proposed, I've concluded that a major factor contributing to the high costs is the number of test runs required. The four test runs at a range of burn rates was instituted by the Advisory Committee and by the DEQ at the request of the national trade association technical committees. The objective was to provide emissions and efficiency data over the heat output range of each stove so that jurisdictions in other geographic areas could stipulate standards to suit their own needs (other geographic areas will hve different heat demand requirements and air quality needs). Manufacturers would then need only to test once to satisfy data requirements for other parts of the country. The intentions of this approach are good but I believe that to make the full range testing a requirement may eliminate a large number of small Oregon manufacturers that only want to make stoves for the Oregon market.

I strongly recommend that the EQC adopt a rule that allows as an option, testing of woodstoves for two burn cycles instead of the four. This will not diminish in any way the information and data requirements necessary for the DEQ to regulate stove emission in Oregon. Two burn cycles performed in the 10-15000 Btu/hour range would be sufficient for determining the emissions characteristics of an appliance at the 13000 Btu/hour range which is representative of Oregon heat demand requirements. This would not change the emission standard or the procedure used for determining efficiency and emission rates.

Making two burn cycle test series an option would still allow those manufacturers with national sales goals and the financial resources to have their stoves tested over a full range of operating conditions. This two cycle concept would allow more participation in the program and more incentive for laboratories and manufacturers.

I feel that if this proposal is implemented it will be a key ingredient for a successful program.

With sincere regards,

Paul E. Tiegs

Paul E. Tiegs
Senior Principal

PT/bc

7

1705 1st Street
La Grande, OR 97850
May 3, 1984

DEQ Public Affairs Section
522 SW 5th Ave
Portland, OR 97201

Dear Sirs,

I am happy to have the opportunity to share my concerns about the wood smoke problem in La Grande. My husband, two children and I live in southwest La Grande. During the heating season, our neighborhood is polluted with smoke. Often at night, the smoke is so thick, it seems foggy outside. However, when I step outside, I realize that it is smoke. I am very concerned about the effect the smoke has on my childrens health-both short term and long term. On days when the weather would allowthem to play outside I often must keep them inside to protect them from breathing the smokey air.

I am not sure what can be done to remedy this situation-but something needs to be done. La Grande is a wonderful town to raise children in-it would be a much better place to live if something could be done about our smoke problem.

Sincerely,

Rebecca J. Turnbull

Rebecca J. Turnbull

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MAY 08 1984

PUBLIC AFFAIRS

May 3, 1984 8

Margaret McCue
Director of Public Affairs
Oregon Dept. of Environmental Quality
P.O. Box 1760
Portland, OR 97207

Re: Woodstoves Emissions Standards

Dear Ms. McCue:

Although I am a lifelong environmentalist who believes in regulation, I am forced to conclude that the D.E.Q.'s proposed woodstove emissions standards are arbitrary and punitive. This is not an environmental policy, but a one-sided vendetta against stoves, and against the public who must rely on stoves to fight rising energy costs.

Behind D.E.Q.'s proposals, I believe, is the regulators' prejudice against simple energy sources that are not connected to the power grid. This prejudice is fanned by local industries who want to reduce competition for use of the airshed in order to minimize their own pollution control costs. D.E.Q. has become the tout of protected industries.

1. Why, for example, has D.E.Q. ignored the thoughtful recommendations of its own Wood Stove Advisory Committee for a 9/4 final standard, and instead proposed a tighter 7/3 standard that most experts view as technically impractical and restrictive of innovation?

2. Why has D.E.Q. exempted fireplaces, woodburning furnaces and furnace add-ons, which equity, common sense and good environmental policy would treat equally with woodstoves?

3. Why will D.E.Q. require stove manufacturers to re-test every five years, at a heavy cost that must be passed on to consumers, when factory inspection has long satisfied UL and all other safety testing authorities as a less costly means to the same end?

4. Why does D.E.Q. propose a pollution limit <u>per stove</u> instead of <u>per unit of heat output</u>, thus requiring homeowners with large heating requirements to buy two or more stoves and chimneys instead of one, at great extra cost, but at no extra protection to the airshed?

As a woodstove importer, I believe stoves that meet the 9/4 standard will be a boon to the public, to the environment and to our industry. Oregon D.E.Q. evidently does not share this optimistic view. Behind a smokescreen of rhetoric about the environment, their real goal must be to end woodstove use in Oregon.

Yours truly,

Ronald Cohen

Ronald Cohen
President

RECEIVED

MAY 08 1984

PUBLIC AFFAIRS

14 Arrow Street
Cambridge, MA 02138
Telephone: (617) 354-1459
Telex: 921499
Cable: COHPECK

Cohen & Peck Inc.

9

APPLIED ENERGY SYSTEMS INC.

P.O. Box 1059 EAST GREENWICH, RHODE ISLAND 02818
(401) 822-4310

May 2, 1984

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
MAY 07 1984
AIR QUALITY CONTROL

Department of Environmental Quality
P.O. Box 1760
Portland, OR 97207

Attn: Mr. Phil Ralston

Dear Mr. Ralston:

Please make this letter part of the public record on woodstove rules.

I commend your department on what appears to be an excellent program to ensure cleaner air in our future. However, I would like to address two points.

The first is with reference to Section 8: Catalytic Component Certification Requirements, Paragraph 8.3.1.

Applied Energy Systems implemented a "long-term" warranty program for woodstove catalysts three years ago. Our rationale was as follows:

Our product would last (defined as remaining 70% as active as when new) for approximately four to six seasons with reasonable care. However, consumer expectations, based on then prevalent press, were that the catalysts were very easily poisoned and had an expected life of only one season.

We determined that the best way to build consumer confidence would be to provide an extended warranty. Reflecting on our own personal experiences with warranties, we felt that, if possible, the warranty should correspond with the actual expected life of the unit. Nothing is more frustrating than purchasing an appliance that you expect to use for years, and then have it fail several weeks after the 90-day warranty expires.

On the other hand, we did not want to overexpose ourselves to consumers that would either abuse the product or the system. Furthermore, because there is gradual decay in activity, we were dependent on the consumer to judge when it was time to replace the unit. Most important, activity evaluation and failure analysis (spectrographic) on a returned catalyst costs several times the value of the catalyst.

Applied Energy Systems, after analyzing numerous options, elected to implement a five-year prorated replacement warranty with a 90-day free replacement. This places the consumer's worst case annual cost at 20% of the retail value, $24.00. The Department of Environmental Quality's proposed two-year free replacement warranty has an annual worst case cost of 50% of the retail value, $60.00.

All of the returned catalysts that we have had analyzed were either poisoned through neglect or were still active. All catalysts, regardless of disposition, were replaced under warranty.

The partial payment received on a catalyst returned under warranty allows us to replace the unit without much concern as to whether it was a valid claim, and the consumer tends to keep the catalyst until he is relatively sure that it is no longer working. Yet, he has the ongoing incentive to replace the unit when necessary.

I sincerely hope that you will allow us to continue with our current warranty program without spending $20,000 and a year testing, as currently outlined as an alternative.

The second point: If you hope to see any significant improvement in air quality within the next 10 years (a good woodstove may last 20 years), you should provide some positive incentive for existing owners of woodstoves to upgrade to a cleaner burning model or to retrofit their own stove with a catalytic add-on.

Yours truly,

APPLIED ENERGY SYSTEMS

Peter S. Albertsen
President

PSA:ram

LIMITED FIVE YEAR WARRAN
AES CATALYTIC CONVERTORS

Applied Energy Systems, Inc. ("AES"), P.O. Box 1059, East Greenwich, Rhode Island, is the exclusive marketer and distributor of the catalytic convertors to which this Limited Warranty applies. AES is not the manufacturer of the ceramic substrate or the applicator of the catalytic coating.

AES WARRANTS to the original retail purchaser of a stove or retrofit incorporating an AES catalytic convertor that at the time of sale to the consumer the AES catalytic convertor is free from defects in material and workmanship which would render it unfit for normal home use. This Limited Warranty applies only to AES catalytic convertors which have been installed in a stove or accessory prior to purchase at retail.

The obligation of AES under this Limited Warranty is limited in the following manner:

1. AES catalytic convertors are warranted for five (5) years from date of retail purchase ("Warranty Period"). If an AES catalytic convertor fails to perform as herein warranted, the original retail purchaser will receive without charge a replacement catalytic convertor during the first ninety (90) days from the date of purchase. Thereafter, if an AES catalytic convertor fails to perform as warranted during the remainder of the Warranty Period, the replacement price of the AES catalytic convertor, which is Eighty Four Dollars ($84), will be reduced by a credit given the original retail purchaser. The amount of the credit depends upon how long after purchase the malfunction occurs. The newer the catalytic convertor is when it fails to perform as warranted, the larger the credit, and thus, the lower the replacement price. The following chart shows the credit given for a failure of the AES catalytic convertor to perform as warranted in each year of the Warranty Period, and the corresponding charge for replacement of the AES catalytic convertor.

REPLACEMENT COST UNDER WARRANTY

**** AES 54152020 CATALYTIC CONVERTOR WITH GASKET ****

WARRANTY PERIOD IN WHICH MALFUNCTION OCCURS	REPLACEMENT COST	CREDIT	ACTUAL REPLACEMENT COST TO PURCHASER
1 to 90 days	$84.00	$84.00	-0-
91 days to 1 yr.	$84.00	$70.00	$14.00
1 yr. to 2 yrs.	$84.00	$56.00	$28.00
2 yrs. to 3 yrs.	$84.00	$42.00	$42.00
3 yrs. to 4 yrs.	$84.00	$28.00	$56.00
4 yrs. to 5 yrs.	$84.00	$14.00	$70.00
AFTER 5 YEARS	$84.00	-0-	$84.00

2. This Limited Warranty shall not apply, and AES shall have no obligation with respect to any catalytic convertor, if the catalytic convertor has been subject to accident, abuse, alteration, misuse, or neglect or has not been installed, inspected, operated and maintained in accordance with all applicable local codes and regulations, and in accordance with the printed instructions of the stove or accessory in which it has been installed. Additionally, this Limited Warranty shall not apply if any fuel other than natural wood is burned in the stove or accessory in which an AES catalytic convertor is installed.

3. ALL IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE, ARE LIMITED TO THE FIVE YEAR WARRANTY PERIOD SPECIFIED ABOVE IN PARAGRAPH 1. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

4. THE OBLIGATION OF AES UNDER THIS WARRANTY OR UNDER ANY IMPLIED WARRANTY, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE, SHALL BE LIMITED TO THE FURNISHING OF A REPLACEMENT CATALYTIC CONVERTOR, AND AES SHALL IN NO EVENT BE LIABLE FOR CONSEQUENTIAL OR OTHER MONETARY DAMAGES INCLUDING WITHOUT LIMITATION ANY LABOR CHARGES OR OTHER EXPENSES FOR THE REMOVING, INSPECTING, REPAIRING OR SHIPPING OF ANY DEFECTIVE CATALYTIC CONVERTOR OR OF THE APPLIANCE IN WHICH THE CATALYTIC CONVERTOR IS INSTALLED AND ITS SURROUNDINGS. THE PURCHASE PRICE OF THE CATALYTIC CONVERTOR IS A CONSIDERATION FOR THIS LIMITATION OF LIABILITY. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. The above limitation of incidental or consequential damages also shall not be deemed to apply to limit or exclude recovery for personal injuries in any state action in which applicable state law prohibits the exclusion or limitation of recovery for personal injuries.

5. AES makes no warranty whatsoever with respect to any products not marketed and distributed by AES. AES neither assumes nor authorizes anyone else to assume for it any other liability in connection with the sale of the catalytic convertor or any related products therefor.

6. AES catalytic convertors are available directly to the consumer for replacement only. The damaged catalytic convertor must be returned, postage paid to Applied Energy Systems, Inc., 17 Hopkin Hill Road, Coventry, Rhode Island 02816, along with a check or money order for the appropriate "Actual Replacement Cost to Purchaser" as shown on the chart in Paragraph 1 above. There will be a $20 service charge for units tested for catalytic activity and found to still be active. Only checks or money orders will be accepted. No replacement will be provided unless the following information accompanies the returned AES catalytic convertor:
   a. Name and address of the original retail purchaser seeking a replacement catalytic convertor.
   b. Name and address of the retail seller of the stove or accessory incorporating the AES catalytic convertor.
   c. Date of retail purchase of the stove or accessory incorporating the AES catalytic convertor.
   d. Proof of purchase and proof of date of purchase.
   e. Name and serial number of stove or other accesory incorporating the AES catalytic convertor.
   f. Description of the malfunction of the AES catalytic convertor.

7. Any replacement catalytic convertor will include a 2300° F rated catalytic convertor gasket and stainless steel impingement screen. The gasket may be ordered separately at a cost of Six Dollars ($6.00) and the screen at Four Dollars ($4.00).

8. This Limited Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

USE AND CARE OF THE AES CATALYTIC CONVERTOR

1. BURN NATURAL WOOD ONLY. Other fuels, such as coal, synthetic logs, and chemical lighters can poison the catalyst. Any type of natural wood may be burned-hard or soft, seasoned or green.
   THE USE OF OTHER THAN NATURAL WOOD FUEL WILL VOID YOUR WARRANTY

2. Your AES Catalytic Convertor should be self-cleaning and maintenance free. If excessive ash collects on the face of your catalytic convertor, you may gently dust it off with a soft bristle brush.

3. Although your AES Catalytic Convertor greatly reduces the production of creosote, periodic inspections of your flue system are still recommended.

4. Your AES Catalytic Convertor should never be removed or handled, except for replacement. Due to the extreme temperatures at which the catalytic convertor operates, it may develop hairline cracks that help relieve thermal stresses. They have no effect on the catalytic convertor's performance, but do make the ceramic fragile. New gasketing must be installed whenever the catalytic convertor is removed.

ABOUT THE AES CATALYTIC CONVERTOR

To improve the efficiency and safe operation of your woodburning heater, the manufacturer has incorporated an AES Catalytic Convertor into their design. The specifically designed honeycomb-shaped ceramic is coated with a thin film of precious metal that lowers the ignition temperature of the combustible gases making up wood smoke as they pass through its structure. Normally, these gases require up to 1400°F. temperatures to be ignited, and as a result, as much as one-third of the chemical heating value of the wood may be lost up the stack in a traditional airtight heater. By catalytically lowering the ignition temperature to approximately 500°F., most of these gases are captured and burned. The results are higher efficiencies, less pollution, and a substantial decrease in the rate of creosote build-up in the flue system.

The AES Catalytic Convertor is positioned in the heating system so that shortly after the fire has started and under normal burning conditions, the convertor and the gases passing through it are at temperatures well above the 500°F. activation temperature. If the catalytic convertor is provided with enough fuel (wood smoke), heat generated from the chemical reaction taking place within its cellular structure may increase its temperature to 1600°F. At this point, the catalytic convertor will be glowing red hot. Because most of the wood gases are driven off during the first third of the burning cycle, this is the period when the catalytic convertor is the hottest. As less gases are driven off and its temperature drops, the catalytic convertor will lose its red glow. Whether the catalytic convertor is red hot or not, it will be functioning as long as its temperature remains above 500°F.

LIMITED FIVE YEAR WARRANTY
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REPLACEMENT COST UNDER WARRANTY

**** AES 54302020 CATALYTIC CONVERTOR WITH GASKET ****

WARRANTY PERIOD IN WHICH MALFUNCTION OCCURS	REPLACEMENT COST	CREDIT	ACTUAL REPLACEMENT COST TO PURCHASER
1 to 90 days	$120.00	$120.00	-0-
91 days to 1 yr.	$120.00	$100.00	$ 20.00
1 yr. to 2 yrs.	$120.00	$ 80.00	$ 40.00
2 yrs. to 3 yrs.	$120.00	$ 60.00	$ 60.00
3 yrs. to 4 yrs.	$120.00	$ 40.00	$ 80.00
4 yrs. to 5 yrs.	$120.00	$ 20.00	$100.00
AFTER 5 YEARS	$120.00	-0-	$120.00

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4. THE OBLIGATION OF AES UNDER THIS WARRANTY OR UNDER ANY IMPLIED WARRANTY, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE, SHALL BE LIMITED TO THE FURNISHING OF A REPLACEMENT CATALYTIC CONVERTOR, AND AES SHALL IN NO EVENT BE LIABLE FOR CONSEQUENTIAL OR OTHER MONETARY DAMAGES INCLUDING WITHOUT LIMITATION ANY LABOR CHARGES OR OTHER EXPENSES FOR THE REMOVING, INSPECTING, REPAIRING OR SHIPPING OF ANY DEFECTIVE CATALYTIC CONVERTOR OR OF THE APPLIANCE IN WHICH THE CATALYTIC CONVERTOR IS INSTALLED AND ITS SURROUNDINGS. THE PURCHASE PRICE OF THE CATALYTIC CONVERTOR IS A CONSIDERATION FOR THIS LIMITATION OF LIABILITY. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. The above limitation of incidental or consequential damages also shall not be deemed to apply to limit or exclude recovery for personal injuries in any state action in which applicable state law prohibits the exclusion or limitation of recovery for personal injuries.

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   c. Date of retail purchase of the stove or accessory incorporating the AES catalytic convertor.
   d. Proof of purchase and proof of date of purchase.
   e. Name and serial number of stove or other accesory incorporating the AES catalytic convertor.
   f. Description of the malfunction of the AES catalytic convertor.

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The AES Catalytic Convertor is positioned in the heating system so that shortly after the fire has started and under normal burning conditions, the convertor and the gases passing through it are at temperatures well above the 500°F. activation temperature. If the catalytic convertor is provided with enough fuel (wood smoke), heat generated from the chemical reaction taking place within its cellular structure may increase its temperature to 1600°F. At this point, the catalytic convertor will be glowing red hot. Because most of the wood gases are driven off during the first third of the burning cycle, this is the period when the catalytic convertor is the hottest. As less gases are driven off and its temperature drops, the catalytic convertor will lose its red glow. Whether the catalytic convertor is red hot or not, it will be functioning as long as its temperature remains above 500°F.

STOEL, RIVES, BOLEY, FRASER & WYSE
A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS
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WASHINGTON, D C 20036
(202) 955-4555

May 4, 1984

Oregon Environmental Quality
Commission
c/o DEQ Public Affairs Section
PO Box 1760
Portland, OR 97207

Ladies and Gentlemen:

Re: Proposed Wood Stove Certification Rules

On behalf of the Wood Heating Alliance, we are pleased to submit herewith five copies of WHA's comments and suggestions with respect to the proposed wood stove certification rules.

As the primary national spokesman for the wood stove industry, WHA trusts that these comments and suggestions will receive serious consideration by the Commission and the Department.

If you have any questions with respect to the enclosed, please feel free to contact the undersigned or Mr. Michael Sciacca of WHA at (202) 857-1181.

Very truly yours,

Richard D. Bach

RDB:twa
Enclosures
cc (w/enclosure): Mr. Carter Keithley/Mr. Michael Sciacca
Mr. John Powell
Allan Abravanel, Esq.

RECEIVED

MAY 07 1984

PUBLIC AFFAIRS

BEFORE THE

OREGON ENVIRONMENTAL QUALITY COMMISSION

In the Matter of the Adoption of Wood Stove Certification Rules pursuant to Oregon Laws 1983, Chapter 333 (H.B. 2235)	))))	COMMENTS AND SUGGESTIONS OF THE WOOD HEATING ALLIANCE

The WOOD HEATING ALLIANCE (WHA) respectfully submits the following comments and suggestions with respect to the wood stove certification rules (OAR 340-21-100 through 166) proposed by the Oregon Department of Environmental Quality (DEQ). For the convenience of the Commission, these comments are divided into seven sections. Section I is a description of WHA and its interest in these proceedings; Section II is a summary of WHA's position and recommendations; Sections III through VI are technical analyses in support of WHA's recommendations with respect to the proposed DEQ emission standards and testing procedures; and Section VII is an analysis and description of WHA's recommendations with respect to administrative aspects of the proposed rules. Appendix A attached hereto is a copy of the proposed DEQ rules with the changes recommended by WHA.

I. THE WOOD HEATING ALLIANCE.

The Wood Heating Alliance is the principal national trade association for the wood stove industry. WHA has some 850 members from all over the United States, including manufacturers, distributors, and retailers of wood stoves and wood stove-related systems and accessories, testing laboratories, consultants, chimney sweeps, and others involved in the use of wood as a fuel. WHA was founded in 1980 by a merger of the Fireplace Institute and the Wood Energy Institute, and since that time has been the primary spokesman for the wood heating industry. WHA has been extensively involved in research and development of methods used to test woodburning appliances. WHA offers these comments and suggestions on behalf of its nation-wide constituency as well as on behalf of its members in Oregon who will be directly affected by whatever rules are adopted by this Commission.

In its preliminary comments, delivered at the DEQ hearings in Portland on May 1, 1984, WHA commended the efforts of the DEQ staff, the Wood Stove Advisory Committee, and all others who participated in this rulemaking process. There is no need to repeat that commendation in these comments except to say that WHA continues to believe that, with the few changes recommended in this statement, all involved will have served the State and its citizens well.

II. SUMMARY AND RECOMMENDATIONS.

As will be noted from the preliminary comments offered by WHA's Mr. Michael Sciacca at the May 1, 1984 public hearing (which we trust the Commissioners will have read), the primary recommendation of WHA is that this Commission adopt a 15/6* emission standard to become effective on July 1, 1986, and that the Commission defer consideration of further reductions in emission limits until such later date as the data now being generated demonstrate a clear need for any such further reduction.

In addition, WHA also recommends (i) changes in the testing procedures to be utilized by DEQ in certifying new wood stoves for sale in Oregon; (ii) a provision whereby stove manufacturers can designate certain information to be submitted to DEQ in the certification process as proprietary and confidential in order to protect design and trade secrets from competitors; (iii) revisions to reflect more realistically the conditions under which wood stoves are actually operated in the home and the fuels which are actually burned; (iv) elimination of wasteful and duplicative review by DEQ of design modifications; (v) elimination of the unnecessary requirement for recertification of unmodified stoves at five-year intervals; and (vi) substitution of the "Condar" particulate emission evaluation system instead of the proposed "Oregon Method Seven."

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* I.e., 15 grams of particulate emissions per hour of operation for noncatalytic wood stoves, and 6 grams per hour for stoves equipped with catalytic converters. The lower limit for catalytic stoves reflects an assumed degradation of the catalyst over time.

A. Adoption of a 15/6 emission standard is consistent with the legislative intent, is scientifically sound, and will accomplish the desired purpose of the proposed rules.

1. The legislative intent. At the outset, we would like to reiterate that WHA has not objected to legislation which leads to the development and use of clean-burning, efficient wood stoves. WHA's members are individuals, with families, who must live in and breathe the same atmosphere as all citizens. Moreover, we recognize that the only viable alternative to effective regulation of wood stove emissions would be a total ban on wood stoves; and such a ban would be economically devastating to our members.

But HB 2235 is very broad. It simply directs this Commission to adopt "emission performance standards for new wood stoves" and offers, as guidance for such standards, a public policy to "control, reduce and prevent air pollution caused by wood stove emissions." Prevention, i.e., to keep from happening, would necessitate a ban on wood stoves and, of course, was deemed by the legislature to be socially unacceptable and politically unpalatable. Reduction was mandated by Section 4 of the Act to be accomplished by education. Which leaves control. And in the absence of any clear directive from the legislature as to what degree of control was anticipated or what goal was to be achieved by such control, resort must be had to the legislative history of HB 2235 for guidance in adopting a regulatory scheme to implement the statute.

Mr. John Charles of the Oregon Environmental Council (OEC), in his statement at the May 1 public hearing, suggests otherwise. He argues that the statute is unambiguous and that there is no need to consider the legislative history for interpretation. We must respectfully disagree. While the statute may be unambiguous on its face, it does contain the latent uncertainties discussed above. While we do not wish to turn these comments into a legal treatise on the doctrine of legislative delegation of authority to administrative agencies, we must point out that the shoe could have been on the other foot--it could most assuredly be assumed that OEC would now be advocating a resort to the legislative history if DEQ had proposed a less stringent standard than that considered by the legislature in its long deliberations over HB 2235.

Which brings us to our next point. DEQ "sold" this bill to the legislature on the concept that a 68 percent to 75 percent reduction in emissions from existing wood stoves would be necessary to achieve compliance with the State's ambient air quality standard for particulates. The legislative record is replete with DEQ references to this range of reductions, and in this regard we commend the Commission's attention to the statement of Mr. John Powell who represented Wood Energy Institute West at the May 1 hearing. We also commend to this Commission Mr. Powell's contention that DEQ engaged in "bait and switch" tactics in which it convinced the legislature of the need for HB 2235 on the basis of one level of regulation, and then proposed an entirely different level of regulation once it had the enabling tool it sought.

Another aspect of the legislative history which must be considered is the "technology forcing" issue. DEQ repeatedly assured the legislature that HB 2235 was not to be "technology forcing" and that there were (and are) wood stoves on the market in Oregon which could meet the standards DEQ had in mind. Dr. Graig Spolek, who was chairman of the Wood Stove Advisory Committee, testified to this DEQ position at the May 1, 1984 public hearing in Portland.

But you have heard exactly to the contrary from industry. Every wood stove manufacturer who appeared at the May 1 public hearing stated that stoves available at present could not meet the 7/3 standard proposed by DEQ for implementation in 1988, and that there was considerable doubt that the technology would evolve to meet that limit by that date. Once again, you have before you a far different proposal than was blessed by Oregon's elected representatives. WHA urges this Commission to consider the differences in the positions taken by DEQ in the legislative proceedings and the positions espoused by DEQ at the present time.

It is clear that the legislature believed that a 68 percent to 75 percent reduction in existing wood stove emissions, to be accomplished by mandating cleaner burning stoves as new stoves were purchased and older stoves were replaced over time, would inevitably and inexorably lead to cleaner air. In the absence of any clear and convincing evidence that a greater reduction is required, or even desirable, this Commission should not adopt a more stringent standard which does not appear to be necessary, which would have a deleterious social and economic impact, and which could very conceivably even have the opposite effect. (It has been pointed out that an unnecessarily stringent standard could cause homeowners to retain their older, dirtier stoves for longer periods, and to bootleg noncomplying new stoves, thus thwarting the goal of HB 2235.)

2. Scientific soundness. As demonstrated in Sections III through VI of these comments, a 15/6 standard is based on sound scientific reasoning and data, while the proposed DEQ 7/3 standard is based on unsubstantiated data and questionable assumptions. In this subsection, we will indicate why we believe the DEQ position to be unsupportable, and then we will demonstrate why this Commission should adopt the suggested 15/6 standard as being reasonable.

First, DEQ is now proposing an 80 percent reduction in emissions. And while that is significantly greater than the 68 percent to 75 percent reduction originally considered, it would not be totally unacceptable except for the fact that it is applied to a baseline emission rate which is significantly understated. DEQ staff suggests that existing stoves in Oregon at present normally emit at a "baseline" emission rate of 30 grams of particulate per hour of operation.

Secondly, as we demonstrate in more detail and with supporting evidence in Section III of these comments, a 30 g/h rate is far below the actual emission rate of existing stoves. That is not to say that existing stoves emit more particulates into the atmosphere than calculated by DEQ, or that air pollution is worse than we think it is; it is only stating that each stove, while it is operating, contributes to the total particulate loading in the atmosphere at a higher rate than was assumed by DEQ.

DEQ adopted the 30 g/h baseline emission rate on the basis of two approaches: (a) it conducted some tests in 1983 and 1984 on stoves using air-dried dimension lumber with wide spacing and sparse loadings, and (b) it converted airshed model emission factors (grams of particulates per kilogram of wood burned) to emission rates (grams of particulates per hour of operation) by the use of some very questionable assumptions with respect to homeowner wood stove practices and habits. Neither of these approaches will bear scientific scrutiny or could withstand serious challenge. And as we noted in our May 1 preliminary comments, there are those in the community who are prepared to challenge the regulation of what they believe to be their constitutional rights to sell their products and to stay warm. We urge this Commission to base its decision on firm, supportable, and defensible data.

On the other hand, Section III of these comments demonstrates that a baseline emission rate of 53 g/h to 63 g/h is a more supportable and accurate estimate of the actual present contribution of wood stove particulates to the ambient atmosphere. That rate is supported by (i) DEQ's own studies in 1980 and 1981 (while it was still trying to build a case for legislative action); (ii) data generated by the federal Environmental Protection Agency (EPA); (iii) data from Vermont's air pollution control program; and (iv) more realistic assumptions as to actual homeowner stove operating practices and habits for use in converting airshed model emissions factors to emission rates.

3. Accomplishment of legislative purpose. DEQ suggests that a 15/6 emission standard will achieve a 50 percent reduction in ambient loadings (based on its assumed 30 g/h emission rate), and WHA submits that this very same 15/6 standard will achieve as much as a 76 percent reduction (based on the maximum end of WHA's 53 to 63 g/h emission rate range). Because the WHA emission rate range is clearly more defensible on the basis of present data than is the DEQ-assumed rate, and because the 76 percent reduction offered by WHA is consistent with the legislative history of HB 2235, WHA confidently urges this Commission to adopt this standard now. WHA believes that this

standard will accomplish the state's objectives without serious dislocations in the industry.

WHA recognizes that there is still much to be learned and much more data to be accumulated. Adoption of the 15/6 standard at this time and deferral of any further reductions will give DEQ and the industry time to develop more data and learn how to apply those data to the real world. DEQ impliedly conceded that much more work needs to be done when it proposed staged standards.

It has been suggested that this Commission should adopt the 7/3 standard (to be effective in 1988) at the present time, with the understanding that it could be rescinded before it becomes effective in 1988 if that should prove necessary or desirable. WHA disagrees on two grounds.

First, adoption of the 7/3 standard now would shift the burden for demonstrating its undesirability to the industry. Accepted notions of fairness and due process dictate that a regulatory agency should have the burden of proving the necessity for any regulation which impinges on individual rights or causes dislocations in the economy.

And secondly, adoption of the 7/3 standard at this time would have a chilling effect on the marketplace. You have heard from a number of stove manufacturers who indicated that the costs of compliance with such a stringent standard would far outweigh the small market offered by Oregon (1 percent of the nation's population and perhaps as much as 2 percent of wood stove sales). A perception (whether real or not) that it would cost far too much to market stoves in Oregon four years from now could cause manufacturers simply to walk away from the Oregon market now or over the next four years--and this would of course lead to longer use of old stoves and bootlegging of new non-complying stoves which in turn would lead to frustration of the purposes of HB 2235.

B. The proposed DEQ test standards skew stove ratings and utilize atypical fuel loadings.

Sections IV and VI of these comments discuss, in detail and with supporting evidence, the testing methods proposed for utilization by DEQ in the wood stove certification process. It is WHA's contention that testing methods must more closely replicate actual consumer stove operational practices and habits if manufacturers are to design, build, and market the clean-burning stoves necessary to accomplish Oregon's air quality goals.

Specifically, the use of small-sized dimension lumber, with wide spacing and sparse firebox loadings, will unrealistically skew the data to the disadvantage of manufacturers of already clean-burning stoves, and will mislead consumers as to how they should operate and maintain their home wood stoves.

WHA urges that this Commission adopt the fueling procedure recommended by Mr. R. W. Braaten of the Canadian government's Centre for Mineral & Energy Technology. This procedure is well accepted by the wood stove industry and other governmental agencies, and will lead to a superior wood stove certification program for Oregon.

C. The administrative changes recommended by WHA will strengthen the Oregon wood stove certification program.

Section VII of these comments discusses the less controversial, but extremely important, administrative aspects of the DEQ proposed rules which WHA believes should be modified to ensure a sound program for Oregon. All of the WHA suggestions of Section VII revolve about one issue--the extent to which any administrative agency program should be as efficient, inexpensive, and expeditious as practicable without sacrificing its proposed objectives.

All of the WHA suggestions of Section VII (with the exceptions of the proprietary information protection rule) meet these criteria. They all attempt to eliminate wasteful, duplicative, or unnecessary administrative burdens on DEQ, and thus they continue in Oregon's tradition of efficient government, at the least possible cost, and without unnecessary bureaucratic entanglements for the public.

For instance, why should a wood stove design, once it has been certified to be in compliance with the Oregon standards, be subject to recertification at five-year (or any other periodic) intervals? If a stove has been certified, and if no modifications are made or proposed, there is simply no reason to require it to be recertified thereafter.

Likewise, once a modification has been certified to meet Oregon standards by the manufacturer and by the testing laboratory, why should DEQ expend its limited resources to make an independent review for compliance? If DEQ has faith in the competence of the laboratory (and certification of the laboratory must certainly evidence such faith), there is simply no reason to engage in duplicative reviews.

Lastly, there is ample precedent for the protection of trade secrets in both federal and state regulatory procedures, and this principle is authorized by ORS 468.095(2).

III. THERE IS SUBSTANTIAL EVIDENCE THAT TYPICAL WOOD STOVES EMIT SIGNIFICANTLY MORE THAN 30 GRAMS PER HOUR.

According to DEQ, the following reductions in atmospheric concentrations of particulates will result over a 20-year period if the alternative emissions limits are adopted.

Particulate Limit*	Reduction (%)
15/6	50
12/5	60
9/4	70
7/3	80

The key assumption made by DEQ to support its proposed standards is that the average stove now used in Oregon emits particulates at an average emission rate of 30 grams per hour

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* In grams per hour (g/h). The first number would be applicable to noncatalytic stoves while the second number would apply to wood stoves equipped with catalytic converters.

(g/h). However, there is substantial evidence from many sources, including official EPA estimates, that typical wood stoves emit at a substantially greater rate than 30 grams of particulates per hour of operation.

This DEQ-assumed rate of 30 grams per hour is simply not consistent with the data yielded by the vast majority of research which has been done on typical wood stoves. Following are summaries of such data, and estimates from many sources, which demonstrate that a rate of 30 grams per hour is far below actual emission rates:

A word of explanation is in order. Data from many stove tests are referenced in the following sections to support WHA's contention that typical stoves emit at a rate greater than 30 grams per hour. Accordingly, in order to provide the most relevant comparisons possible, data from some of the published sources have been recalculated in accordance with the rating methodology of Table 1 of the proposed DEQ rule. Table 1 embodies a rating formula which weights the emissions of a stove test by typical Oregon heating loads. Because they have been calculated according to Table 1, the stove ratings given in the following sections can be directly compared with one another and with Oregon ratings on a gram-per-hour basis. However, some of the data from published sources cover only one or two heat output (Btu) per hour ratings; therefore, those results cannot be extrapolated in accordance with the procedures of the proposed rule. This type of rating is referred to as a "single-point rating."

A. <u>1980-81 DEQ emissions tests</u>.

A typical box stove was tested in DEQ's 1980 test program (1). The major difference between the tests run at that time and the test standard embodied in the proposed rule is the fuel to be burned. Douglas fir cordwood was used, although it was somewhat drier than would be allowed under the proposed rule. The average emission rate of the single-point ratings for the four box stove tests was 91.9 grams per hour. All four results exceeded 81 g/h. The study report stated that the stove which was used for the tests was "selected as one of the most typical units used in Oregon" (2). The avowed purpose of the test program was to conduct the tests under "typical household operating conditions" and "normal" burn modes (3). The major conclusion of the 1980 report was that "a typical airtight box stove used in Oregon appears to have among the highest emissions of any unit for which test data is available" (4).

In 1981, DEQ's research consisted of 19 tests. Only two of the nineteen tests involved a typical box stove fueled with cordwood meeting the moisture specifications of the proposed rule. The single-point emission rate for those two tests averaged 48.5 g/h.

When combined, the 1980 and 1981 data from "typical" wood stoves can be used to calculate a stove rating according to the methodology of the proposed rule. The following typical stoves were used for this analysis:

Stove	Year
"Fisher box"	1980
"Earth box"	1980
"Air-tight w/ Automatic Thermostat"	1981
"Air-tight w/ Prototype Thermostat"	1981

When calculated according to the methodology of the proposed rule, the emissions from these stoves averaged 52.6 grams per hour.

B. More recent DEQ tests.

None of the 1982 DEQ tests were run on typical wood stoves. The two tested stoves were selected in order to determine the emission levels from clean-burning stoves; both were state-of-the-art designs.

Tests run by DEQ in 1983 and 1984 used a test standard which WHA believes provides skewed results for typical stoves. The maximum emmission rate for the stoves tested in 1983-84 was 31.8 grams per hour.* WHA believes that these results underestimate the emissions rate from typical wood stoves because the fuel for the tests was unlike fuels that consumers burn in their homes. Further information supporting WHA's contention

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* Wood Stove Advisory Committee Notebook, Section 18, Part F. (Weighting factors are calculated as recommended by DEQ.)

regarding the fuel used by DEQ for tests is presented in Section VI. Because the fuel used in the 1983-84 tests was too sparse, the data generated from these tests provide little information with respect to actual wood stove emissions.

C. EPA emissions estimates.

The most conclusive evidence that the DEQ standard significantly underestimates realistic stove ratings comes from EPA. In mid-1983 EPA published its official estimate of the emissions from conventional wood stoves (5). The agency's estimates are obviously scrutinized carefully before they are published in "AP-42," a document which plays an important part in federal emissions regulations.

EPA's estimate is that wood stoves emit at a rate of about 21 grams of particulates per kilogram of wood burned, and that "a burn rate of approximately 3 kilograms of wood per hour is burned under normal wood stove operation" (6). This means that the average stove, according to the EPA analysis, emits at a rate of 3 times 21 or 63 grams per hour.

D. State of Vermont.

The Vermont Air Pollution Control Program tested several typical wood stoves during the winters of 1979-80 and 1980-81. The program is extremely relevant to this analysis because the stoves were located in homes and were operated "at what the owners considered normal operating conditions" (7). The average emission rate from the stoves tested was 57.8 grams per hour when calculated in accordance with the proposed DEQ rule (i.e., with reference to Oregon heating loads, not to the Vermont climate).

The preceding information and data demonstrate that typical stoves in use today, when rated in accordance with the methodology of the proposed DEQ rule, emit at a substantially greater rate than 30 grams per hour. The range of reasonable estimates is 53 to 63 grams per hour.

E. Estimates from airshed models.

DEQ, on the other hand, contends that its assumed stove emission rate of 30 grams per hour is confirmed by airshed models.

WHA agrees that DEQ airshed models have verified, with a high degree of confidence, that the emissions factor from wood stoves (in terms of emissions generated versus fuel burned) is likely to be about 20 grams of particulates per kilogram of wood burned. This range has been verified by both DEQ and EPA studies. It must be recognized, however, that the emissions factor is a far different measure than the emission rate; and that important threshold assumptions with respect to modes of operation must be made to convert one measure to the other. It is clear that the emission rate (on a gram-per-hour basis) has not been verified to the same level of confidence as the emissions factor (on a gram-per-kilogram basis) because critical data on stove usage are lacking. This may be demonstrated in two ways: Qualitative analyses tend to support the conclusion that stoves emit at a rate in excess of 30 grams per hour, and quantitative information from Oregon wood heat surveys helps to explain the differences between DEQ's estimate of the emission rate from baseline stoves and the many higher estimates discussed above.

One qualitative way to evaluate the accuracy of DEQ's estimate of 30 grams per hour is to calculate how long woodburners would have to operate their stoves if actual average emissions were at the rate of 30 grams per hour. In order to generate 20 grams per kilogram at a rate of 30 grams per hour, the average Portland wood stove would have to be actively operating for <u>12 hours per day for every day of the six winter months</u> (8).

This obviously does not account for "burn down" times when emissions are low. Neither does it take into account high output burns which occur when homeowners return to a cold home and burn their stoves briskly (and cleanly). It does not seem reasonable to expect that the <u>average</u> Portland woodburner heats <u>actively</u> for 12 hours per day, 6 months per year, and there is no anecdotal or statistical evidence to support this assumption. By this qualitative assessment, 30 grams per hour appears inordinately low. If the average period of operation is assumed more realistically to be 8 hours per day, then the emission <u>rate</u> increases to 45 grams per hour.

The only quantitative way to verify DEQ's assumed rate of 30 grams per hour would require using the accepted emissions factor of 20 grams per kilogram in combination with empirical (not anecdotal) data on how often and at what heat outputs consumers use their stoves. Fairly high accuracy is needed because the emissions from stoves on a gram-per-hour basis depend on how long the stoves are operated and on the heat output during operation. The best source of high-quality data on this point is measurements of the heat output of stoves which are actually operating in a large number of homes. Such a study is now being conducted for the first time anywhere by the Bonneville Power Administration. Tests will be under way this winter in Hood River, Oregon.

WHA submits that there are no data to support the assumptions which were necessarily made by DEQ to convert the emissions factor yielded by its airshed models to the emission rate which formed the basis of its proposed standard. Absent quantitative data of fairly high accuracy on patterns of stove use, it is difficult to verify that typical stoves emit 30 grams per hour on the basis of airshed models, no matter how accurate those airshed models themselves may be.

There is substantial evidence that typical wood stoves emit in excess of 30 grams per hour; higher emission rates are consistently verified by stove tests and supported by survey data. If recent DEQ tests run in accordance with the proposed testing standard do tend to show that typical stoves emit only about 30 grams per hour, then it can only be because the proposed test standard itself underestimates stove emission rates, particularly for baseline stoves. This issue is discussed in the following section.

IV. THE PROPOSED TEST METHOD APPEARS TO SKEW THE RATINGS OF SOME STOVES IN AN IRREGULAR WAY.

Test data referenced in the previous section indicate clearly that typical wood stoves under actual operations emit at a rate in excess of 30 grams per hour. Since the maximum yield of the recent DEQ tests was 30 grams per hour, it is apparent that the proposed test method must have been conducted under conditions unrelated to baseline wood stoves in actual operation.

If the tests skewed all stove ratings similarly, the underestimations from these test methods would be acceptable. If, on the other hand, the test standard skews stoves which tend to burn more cleanly differently than it skews typical stoves, it becomes impossible accurately to calculate the air quality improvements which will result from the proposed rule. The projections, which are essentially ratios of the emissions from clean stoves to typical stoves, are unreliable if the ratios keep shifting because artificial test conditions affect some stoves differently than others. Also, if the artificial test fuel affects some stoves differently than others, the emission ratings disseminated by the State of Oregon will be misleading.

Only a very few tests have been run to determine the effect of the proposed test fuel on stove emissions. As described in Section III hereof, the fuel chosen appears to give low emission rates. In addition, the tests that have been run indicate that the proposed test fuel affects some stoves much differently than it affects others.

For instance, two advanced-technology wood stoves were tested under the test protocols used by DEQ in 1980-82. At that time, the stoves produced roughly equivalent amounts of emissions. The new test protocol, however, changed this relationship drastically.

In the earlier tests, the first stove tested by DEQ produced 8.0 grams per hour at an average of 23,000 Btu/hour, while the other stove produced 7.3 grams per hour at about the same heat output (9). According to recent tests with the proposed test fuel and the same stoves, the first stove would be rated at about 5 percent higher than if it were rated at the same heat output that it was rated at in 1982. However, the second stove would be rated at 2.4 grams per hour, which is less than one-third of its previous rating (10).

Reversals of this magnitude are unsettling because they may result in misleading information being disseminated to consumers by the State. WHA takes no position as to the correctness of either rating. However, WHA finds in this pattern further evidence that the widely spaced, loosely packed fuel specified in the proposed rule potentially contributes to unrealistic stove ratings. WHA's specific recommendations for a more realistic test fuel are contained in the Appendix to these comments.

V. THE EFFECT OF THE TEST STANDARD ON PROJECTIONS OF AIR QUALITY IMPROVEMENTS.

The main consequence of the distortions introduced by the proposed test standard and by the assumed "baseline" emission rate for existing stoves is that DEQ has recommended emission limits which are substantially lower than necessary to achieve the desired reductions in ambient particulate concentrations.

As described in Section III hereof, the available data verify that the typical wood stove emits at a rate substantially in excess of 30 grams per hour. WHA submits that a more reasonable and defensible estimate of the emissions from a typical stove is 58 grams per hour (when the stove is rated according to the weather-weighting scheme of the proposed rule). This is equal to the average of the realistic 1980-81 DEQ tests, the EPA estimates, and the Vermont tests.

Because the uncertainty associated with this estimate remains substantial, the following evaluation is centered around the range of reasonable results, namely 53 to 63 grams per hour.

If it may be assumed that reductions in ambient particulate concentrations are commensurate, on a straight-line, one-to-one basis with reductions in emissions, then the desired air quality improvements must be evaluated in terms of the 68 percent to 75 percent improvement which was the basis on which the legislature was urged by DEQ to adopt HB 2235. This range is firmly supported by legislative history (11).

Desired Improvement (%)*		Necessary Emission Limit (g/h)
50%		27 to 32
60%		21 to 25
68%	x 53-63	17 to 20
70%		16 to 19
75%		13 to 16

It is clear that these limits are dramatically higher than those proposed by DEQ only because the proposed test standard and DEQ's assumptions substantially underrate the actual emissions from typical existing wood stoves.

In order to make test results conform more closely to actual stove emissions, WHA recommends that the proposed rules use a more realistically dense and closely spaced test fuel. The details of the WHA proposal are contained in Section VI hereof.

WHA's contention that the emission rate from wood stoves is greater than 30 g/h is supported by independent authorities. In a letter to Ms. Barbara Tombleson of DEQ in November 1983, Mr. R. W. Braaten, a combustion engineer with the Canadian Government's Centre for Mineral & Energy Technology, advised that:

> "While it may seem that adjusting required emissions levels solves the problem with [the widely-spaced wood load], I feel this is not correct."

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* The dual limit for catalyst-equipped stoves is not included since it is derived by DEQ as a percentage (about 40 percent of the noncatalyst limit).

Mr. Braaten has tested a more densely-packed fuel which he (and WHA) recommended to DEQ.

Again, WHA recommends that this Commission adopt an emission limit of 15 grams per hour for noncatalytic stoves. The 15 gram-per-hour limit will clearly enable the Commission to fulfill its legislative mandate, while minimizing the many negative consequences of an unnecessarily stringent standard-- such as bootlegging, higher energy costs, and substantial commercial harm to manufacturers and retailers.

VI. A COMPARISON OF THE FUEL RECOMMENDED BY DEQ IN THE TEST STANDARD, AND WHA'S SPECIFIC TECHNICAL RECOMMENDATIONS WITH RESPECT TO TEST FUEL.

WHA submits that the major reason that DEQ's estimate that 30 grams of particulates per hour are emitted from "typical" existing wood stoves is unrealistically low is the fact that the amount and density of the test fuel is far too low.

Due to the use of small, widely spaced wood loads, DEQ has repeatedly lowered its recommended emissions limits in recent months. However, reducing the emissions limits to accommodate the test fuel is an unsound environmental regulatory strategy because test results no longer give reliable information to consumers, regulators, or manufacturers.

A. Typical fuel loads used by consumers.

Research results from many sources have made it clear that the amount of emissions from woodburning appliances depends to a large degree on the characteristics of the fuel being burned. Among the major variables are the size of the fuel, the density with which the wood is stacked in the appliance, and the moisture content of the fuel (12). Thus, any standardized test which purports to give consumers information on how a stove will perform in the home should use a fuel which has been shown to approximate normal home burning habits. The proposed DEQ standard fails this test because the proposed fuel is unrealistically small and widely spaced when compared with what homeowners actually use.

The proposed rule specifies a wood loading density of 7 pounds of wood per cubic foot of usable firebox volume. Due to moisture, this is only 5.6 to 5.7 pounds of actual wood per cubic foot. The wood-to-space ratio is only 15 percent to 21 percent, depending on moisture content. Information from many sources indicates that this loading is far too low.

The opinion of many experienced individuals strongly supports the proposition that the dominant stove loading habit in Oregon is to fill the stove to capacity at each reloading. Advisory Committee members made this point several times, and there was no debate or evidence to the contrary.

Guidelines published by industry authorities provide further evidence that the wood loading density proposed in the rule is far below normal. The training materials of the Wood Heating Education and Research Foundation recommend that 16 to 26 pounds per cubic foot be used as an estimate of stove capacity (13).

In order to quantify how stoves are actually loaded, WHA recently arranged to have 10 different stoves loaded with average-sized cordwood pieces. The technicians who loaded the stoves were asked to load the appliances to "consumer capacity." The average loading from the WHA tests was 20 pounds of Douglas fir per cubic foot of firebox, compared with 7 pounds under the proposed standard.

These several sources confirm that the wood loading in the proposed rule is inadequate. The key issue for the Commission to determine is whether or not the effects of differences between the test fuel and actual home fueling patterns are acceptable and reasonable.

B. The effect on emissions of sparse wood loads.

The major advantage to using sparse wood loads is that test time is reduced. Thus, sparse wood loads should be used to keep costs low, but only if test results are minimally affected. In fact, however, data from many sources indicate that the sparse wood loads that DEQ has proposed underestimate emissions significantly.

There is appreciable data published on the variation in emissions attributable to the amount of wood loaded in the stove. Following is a summary of the major research findings on the effects on emissions of the wood loading density:

In 1980 researchers from Battelle-Columbus Laboratories tested a stove with different wood loads. The loading was changed from 5 to 16 pounds of wood per cubic foot of usable firebox volume. (The proposed rule specifies 7 pounds per cubic foot.) Battelle-Columbus concluded that "although the burning rates for the two tests were essentially the same, the large charge resulted in approximately twice the emissions" (14).

In a series of more extensive tests, Butcher and Sorenson also verified that wood loading has a critical effect on particulate emissions (15). They concluded that emissions were related to loading and to combustion rate according to the model:

$$E(g/kg) = -1.18 + 10.73\ m/q$$

Where: "m" is the wood mass in kilograms
"q" is the average combustion rate in 10,000 Btu/hr.

DEQ followed up on Butcher's work in 1981 (16) and established the following formula for the same parameters, but with a higher correlation to the data:

$$E(g/kg) = 0.39 + 6.47\ m/q$$

These equations lead to almost identical conclusions about the relationship between emissions and wood loading. They both indicate that emissions and wood loading are strongly related variables. As a rule of thumb they demonstrate that doubling the wood loading density roughly doubles the emissions output. The fact that these relationships are close in result yet were independently generated lends them great credence.

There are large effects on emissions due to wood loading density. As shown above, DEQ and others have demonstrated that roughly a linear correlation exists. Evidence also indicates that users load their stoves with a density much greater than 15 percent to 21 percent, which is the density required by the proposed rule. The net effect of the low wood loading is that stoves tested under the proposed DEQ standard emit much less pollution than they do in actual home use. This conclusion is corroborated by test results from many sources, and by the remarks of Canada's Mr. Braaten.

> "[More dense fuel spacing] qives results more typical of real wood burning. This is borne out by limited testing at WHA and in the Canadian labs where closer spacing provides burn times and emissions rates reasonably close to the results with cordwood. That the 1 1/2 inch spacing is less satisfactory (than 3/4 inch spacing) is indicated by the need for Oregon to reduce the emissions requirement dramatically when using this fuel, and by the need to refuel soon[er] than Canadian (and WHA) requirements ***."

C. WHA recommendations on the test standard's fuel.

WHA recommends that the Commission adopt the fueling procedure that has been proposed by Mr. R. W. Braaten of the Canadian government. Mr. Braaten is primarily responsible for development of the emissions test standard to be published soon by the Canadian Standards Association. He has testified repeatedly that the closely spaced, densely packed fuel he uses simulates cordwood acceptably.

The details of Mr. Braaten's proposal are a part of the proposed changes to the rule presented in Appendix A, Part II.

VII. SUGGESTED REVISIONS TO ADMINISTRATIVE ASPECTS OF THE PROPOSED RULE.

A. The requirement for design plans and compliance reviews by the State.

Section 340-21-140(2)(b) of the proposed rule would require that the State receive "design plans" which include all dimensions, specifications, and makes and models of component parts. Section 340-21-145 requires prior approval by the State of any modification to the stove. WHA objects to this requirement since confidential design information and trade secrets will be subject to disclosure to competitors. It is suggested that a confidentiality provision for proprietary information be added to the proposed rule, as set forth in Appendix A, Part I.

WHA also objects because the independent review of product compliance would be duplicative and wasteful. Under the proposed rule, DEQ employees would be required to review all of the manufacturer's product changes, major and minor, and make an engineering judgment as to whether each one affects emissions. Tests may be required at the discretion of DEQ staff. This process is unnecessary, expensive, and confrontational.

Instead of requiring manufacturers to obtain prior DEQ approval of "any modification to the model, design, plans or specifications," we believe that the State should require that the independent laboratories certify that the manufacturer's products continue to be produced in a way that meets the emissions standards. Independent laboratories perform very similar tasks to certify stoves for safety, including regular inspections of the manufacturer's plant and products. DEQ plans extensively to accredit laboratories to be sure that they are truly independent, that their employees are professionally qualified, and that no manufacturer has leverage, financial or otherwise, over the lab. The laboratories must be sure the manufacturers' products conform to standards to protect their reputations and their State certifications. We believe that the burden to certify that the stoves being produced continue to meet specifications should be placed on the independent laboratories.

Of course DEQ can reserve its right at any time to ascertain that the products being sold conform to the standards. But to require that the manufacturers plus the accredited laboratory certify compliance, and then to have DEQ employees independently make engineering compliance judgments, is wasteful.

B. The requirements for recertification.

Section 340-21-140(5) would provide that the DEQ certification be effective only for five years. The apparent intention of the DEQ is to require retesting and recertification every five years.

WHA submits that this requirement introduces unnecessary effort and expense into the program. Many manufacturers, particularly smaller ones, produce identical stove models year after year. There is no rationale to support this provision other than administrative convenience, and even that is questionable. This proposed rule is unfair, unnecessarily burdensome, inappropriate, and simply unnecessary.

C. The choice of a particulate measuring tool.

There is evidence that the emissions measurement method embodied in the proposed rule is inaccurate for measuring particulate emissions from wood heaters. If the method is inaccurate, wood stoves may be unfairly compared to other sources of particulate emissions.

Two particulate measuring systems have been investigated thoroughly by DEQ, the Condar sampler and the modified version of Oregon's Method Seven. It is WHA's recommendation that of the two systems that DEQ has tested the Condar system should be chosen.

Through recent testing, the Condar system has been shown to be equally as precise as the Oregon Method Seven.

Accuracy and precision are often confused. Precision is a measure of how well a test method compares to itself. Systems that fail to give the same answer twice are not precise. High precision has been established for both the Oregon Method Seven and for the Condar sampler. Both have been shown to be more precise for testing wood stoves than most air quality measurement methods.

Accuracy is the key issue when comparing the alternative systems. Accuracy is defined as how close a measurement approaches the truth. The "truth" in wood stove testing is how well the stack testing method measures the amount of emissions which will form particulates in the atmosphere.

Neither the Oregon Method 7 nor the Condar sampler has been tested for accuracy of measuring wood stove particulate emissions. In fact, there is substantial evidence that neither sampler is accurate because neither method samples isokinetically, i.e., at a constant rate in proportion to the stack flow. Many experts emphasize that isokinetic sampling is the most important variable for accuracy. Primarily for this reason, WHA's technical committees do not fully endorse either of the systems under consideration. Research is under way to devise more accurate test methods.

Since the precision of the systems is virtually equal and the accuracy of both is unknown, DEQ should make its choice of tester on other criteria. These alternate criteria are reasonable:

(1) Which system best simulates actual physical phenomena associated with chimney emissions?

(2) Which system is most widely accepted?

(3) Which system is most convenient to use?

WHA contends that the Condar sampler is superior in all three respects.

With respect to simulation of actual chimney emissions, the Condar sampler and the Oregon Method Seven utilize substantially different physical mechanisms to collect the particulate sample. With the OM 7 system, flue gas is bubbled repeatedly through ice-cold water. The collection mechanism is condensation on the surface of the laboratory glassware. The Condar tester first dilutes the sample with air, just as happens when the sample reaches the top of the chimney. Collection is then done on a filter. Intuitively, a dilution system simulates actual wood smoke particulate formation phenomena more closely than an ice-bath condensation system. Thus, the Condar system is superior according to the first criterion enumerated.

The second criterion is wide recognition. Neither the Condar sampler nor the OM 7 is widely accepted by other jurisdictions or agencies for testing wood stoves. However, dilution-type samplers are recognized nationally by EPA to test particulate emissions from diesel automobiles.

In contrast, the OM 7 has little track record besides use as a particulate sampler for select industries in Oregon. Although the OM 7 is sometimes referred to as a modified EPA Method Five, it is not. EPA has modified the Method Five for use with wood stoves, but that system is different from the Oregon method in several important ways.

As for convenience, the third alternative criterion, the Condar system is far superior to OM 7. The OM 7 was originally designed not as a collection system but as a method to keep pollutants out of a sample collection pump. OM 7 requires a high level of skill to operate. The operator (or at the very least the operator's supervisor) must be proficient at analytical chemical techniques. Considerable handling of glassware and special chemical extractions are required. On the other hand, the Condar system can be understood and fully operated with little special training. The substantial differences in skill level between the systems mean that, if the OM 7 is adopted, testing will become that much more difficult and costly.

The Condar system has been shown conclusively to be precise, it more realistically duplicates actual atmospheric behavior, and it is more convenient.

* * * * * * *

Footnotes and References

(1) John F. Kowalczyk, et al "Particulate Emissions from New Low Emission Wood Stoves Designs Measured by EPA Method V," Oregon Department of Environmental Quality, June 1981, p. 13.

(2) Id. p. 3.

(3) Id. p. 12.

(4) Id. p. 20.

(5) Del Green Associates, Inc., "Final Report, Emissions Testing of Wood Stoves," U.S. EPA, November 1982.

(6) U.S. EPA "Emissions Factor Documentation for AP-42," Summer 1983, Section 1.10.

(7) Cedric R. Sandborn and Michael A. Blanchet, "Particulate Emissions from Residential Wood Combustion in Vermont," in Residential Solid Fuels, Oregon Graduate Center, 1982, p. 188.

(8) The 1982 Portland Survey indicates that consumers use 325,650 tons of wood per year, which is about nineteen (19) kilograms per stove household per day for the six-month heating season. This amounts to some 380 grams of emissions per stove per day. At a rate of 30 grams per hour, each stove would have to be operated for over twelve (12) hours each day.

(9) Ref. (1) p. 13.

(10) Calculated from curve fit of confirmation tests obtained from phone conversations, DEQ staff.

(11) Comments of Bill Young, DEQ, "Minutes of the House Committee on Environment and Energy," February 14, 1983.

(12) Jerome P. Harper and C. V. Knight, "Measurement of Wood Heater Thermal and Emissions Performance," Tennessee Valley Authority, 1980; and Marcus Cooke, John M. Allen and Robert E. Hall, "Characterization of Emissions from Residential Wood Combustion Sources," 1982.

(13) "Study Manual, Second Edition," Wood Heating Education and Research Foundation, 1983. (Author unknown)

(14) Ref. (12) Cooke p. 147.

(15) Samuel S. Butcher and Edmund M. Sorenson, "A Study of Wood Stove Particulate Emissions," Air Pollution Control Association Journal, July 1979.

(16) Ref. (1) p. 16.

APPENDIX A - PART I

Proposed WHA Modifications to
Proposed OAR Sections 340-21-120,
130, 140 and 145

WOODSTOVE CERTIFICATION

Chapter 340, Division 21, Sections 100-166

(2) No manufacturer or dealer shall alter either the permanent or removable label in any way from the label approved by the Department pursuant to OAR 340-21-156.

(3) Violators of any of the above rules may be subject to civil penalties pursuant to OAR Chapter 340, Division 11 and 12 or other remedies prescribed by rule or order.

Exemptions

340-21-115 (1) Wood-fired appliances that are not suitable for heating equipment in or used in connection with residences or commercial installations are excluded from 340-21-110. For example, portable camping stoves.

(2) Wood-fired forced air furnaces that primarily heat living space or water through indirect heat transfer using forced air duct work or pressurized water systems are excluded from 340-21-110.

Emission Performance Standards and Certification

REVISE

~~340-21-120 (1) New~~ woodstoves with minimum "heat output" of less than 40,000 Btu/hr advertised for sale, offered for sale, or sold in the State of Oregon ~~within the period~~ AFTER July 1, 1986 ~~to June 30, 1988,~~ shall not exceed the following weighted average particulate emission standards when tested to procedures in OAR 340-21-130.

(a) 15 grams per hour for a non-catalytic woodstove, or

(b) 6 grams per hour for a catalyst-equipped woodstove.

DELETE

~~(2) New woodstoves with minimum "heat output" of less than 40,000 Btu/hr advertised for sale, offered for sale, or sold in the State of Oregon on or after July 1, 1988 shall not exceed the following weighted average particulate emission standard when tested and measured according to test procedures in OAR 340-21-130.~~

~~(a) 7 grams per hour for a non-catalytic woodstove or~~

~~(b) 3 grams per hour for a catalyst-equipped woodstove.~~

(3) New woodstoves with a minimum "heat output" of greater than 40,000 Btu per hour, advertised for sale, offered for sale, or sold in the State of Oregon after July 1, 1986 shall not exceed an average particulate emission standard equal to the sum of 8.0 grams per hour plus 0.2 grams per hour for each thousand Btu per hour heat output when tested to procedures in OAR 340-21-130.

(4) The Department will certify a woodstove as meeting the applicable woodstove emission standard after July 1, 1984 in accordance with procedures in OAR 340-21-140.

Testing Criteria and Procedures

REVISED

340-21-130 (1) To be considered eligible for certification, a woodstove must be tested in strict conformance with criteria and procedures contained in the document Standard Method for Measuring the Emissions and Efficiencies of Residential Woodstoves dated March 8, 1983, and incorporated herein by reference and on file at the Department.

THIS DATE WILL BE CHANGED TO REFLECT REVISIONS

(2) All testing for certification purposes shall be conducted by a stove testing laboratory accredited by the Department in accordance with procedures specified in OAR 340-21-160.

(3) The Department may permit minor changes in the testing criteria and procedures which the Department believes does not affect its accuracy with respect to compliance with the emission standard providing such changes are approved in writing by the Department prior to the actual conducting of such tests.

General Certification Procedures

340-21-140 (1) Any woodstove manufacturer, or dealer, wishing to obtain certification of a woodstove shall file an application with the Department.

(2) An application for certification must include:

(a) Notify the applicant in writing within 30 days of receipt of the application, of any deficiencies in the application that cause the application to be incomplete.

(b) Notify the applicant within 60 days of receipt of a completed application whether certification is granted or denied pursuant to Sections 4 and 7 below.

(4) When all the preceeding requirements have been met, the Department will issue a certification document to the manufacturer or dealer for the specified woodstove.

DELETE

~~(5) If the Department grants certification, the certification status shall be effective for no longer than 5 years unless extended or terminated by rule or order.~~

5 ~~(6)~~ An application for a new document of certification shall be made by submitting a completed application including retests and fees at least 60 days prior to expiration of certification. The Department may waive the retest and fees if the applicant demonstrates the previous evidence used to certify the woodstove has not changed and remains reliable and applicable.

6 ~~(7)~~ If the Department denies certification of a woodstove, the Department will notify the manufacturer or dealer in writing of the opportunity for a hearing pursuant to OAR Chapter 340, Division 11.

(7) An applicant for certification may designate such information in its application as it deems appropriate to be proprietary and confidential in order to protect its design and trade secrets, and thereafter the Department will treat such designated information as confidential in accordance with ORS 468.095(2).

ADDED

AA4165

Changes in Woodstove Design

340-21-145 Certification of woodstoves shall be valid for only the specific model, design, plans and specifications which were originally submitted, tested and approved for certification. Any modification to the model, design, plans or specifications shall cause the certification to be ineffective and any so modified woodstoves to be uncertified, unless prior to making such modification the certification holder submits the proposed modification to the Department for approval, and the Department approves it. The Department may approve the proposed modification if the holder demonstrates and the Department finds that the proposed modification would not affect emission performance or heating efficiency; provided however, that the Department shall accept the certified statement of a certified testing laboratory to the effect that such modification would not affect emission performance or heating efficiency in lieu of independent verification by the Department

ADDED

Labelling Requirements

340-21-150 Woodstoves which must be labelled pursuant to OAR 340-21-110 and shall have affixed to them:

(1) A permanent label, that has been previously approved by the Department in writing as to form, content and location, that shows the test emissions and heating efficiency for the range of heat outputs tested.

Proposed WHA Modifications to Subsection 4.2 of Section 4 (Test Fuel) of Appendix I - Standard Methods

4.2 Test Charge

4.2.1 The length of each piece of test fuel shall be equal and shall closely approximate 5/6 the length of the fire chamber.

4.2.2 The usable capacity of the fire chamber is the product of the fire chamber length times width times height.

4.2.3 The fire chamber length is the longest fire chamber dimension which is parallel to a wall of the chamber.

4.2.4 The fire chamber width is the shortest fire chamber dimension which is parallel to a wall of the chamber.

4.2.5 The height of the fire chamber shall be measured from the floor of the chamber or, if one exists, the top of the fire grate. The top of the fire chamber is defined as 2 inches below the top of the chamber but not more than 2 inches above the highest passage way for loading.

4.2.6 The number of pieces of a given dimension making up the test charge shall be established in accordance with Tables 1 and 2 and Figure 1.

4.2.7 Each row of fuel pieces shall be separated by a spacer of 3/4 inch by 2 inch pieces placed at each end of the fuel charge.

4.2.8 Pieces may be separated laterally by nailing them to the spacer pieces, by nails partially driven into the pieces, or by other mechanical methods providing assurance that a lateral spacing between pieces of 3/4 inch + 1/4 inch is maintained. A maximum of four nails per piece shall be used.

4.2.9 The test charge may be composed of a number of individual pieces or layers, provided all the subsections to make up a complete charge are added at the same time during refuelling.

4.2.10 Appliances of unusual or unconventional firebox design shall load the fuel in a configuration which maintains air space intervals between the lumber and is in conformance with the manufacturers published written instructions. Any appliance that will not accommodate the loading configuration specified in this section must obtain DEQ loading configuration approval prior to testing for certification purposes.

4.2.11 Appliances that are designed to provide continuous feed pelletized or chipped fuel must prearrange an equivalent test criteria agreement with the DEQ prior to testing for certification purposes.

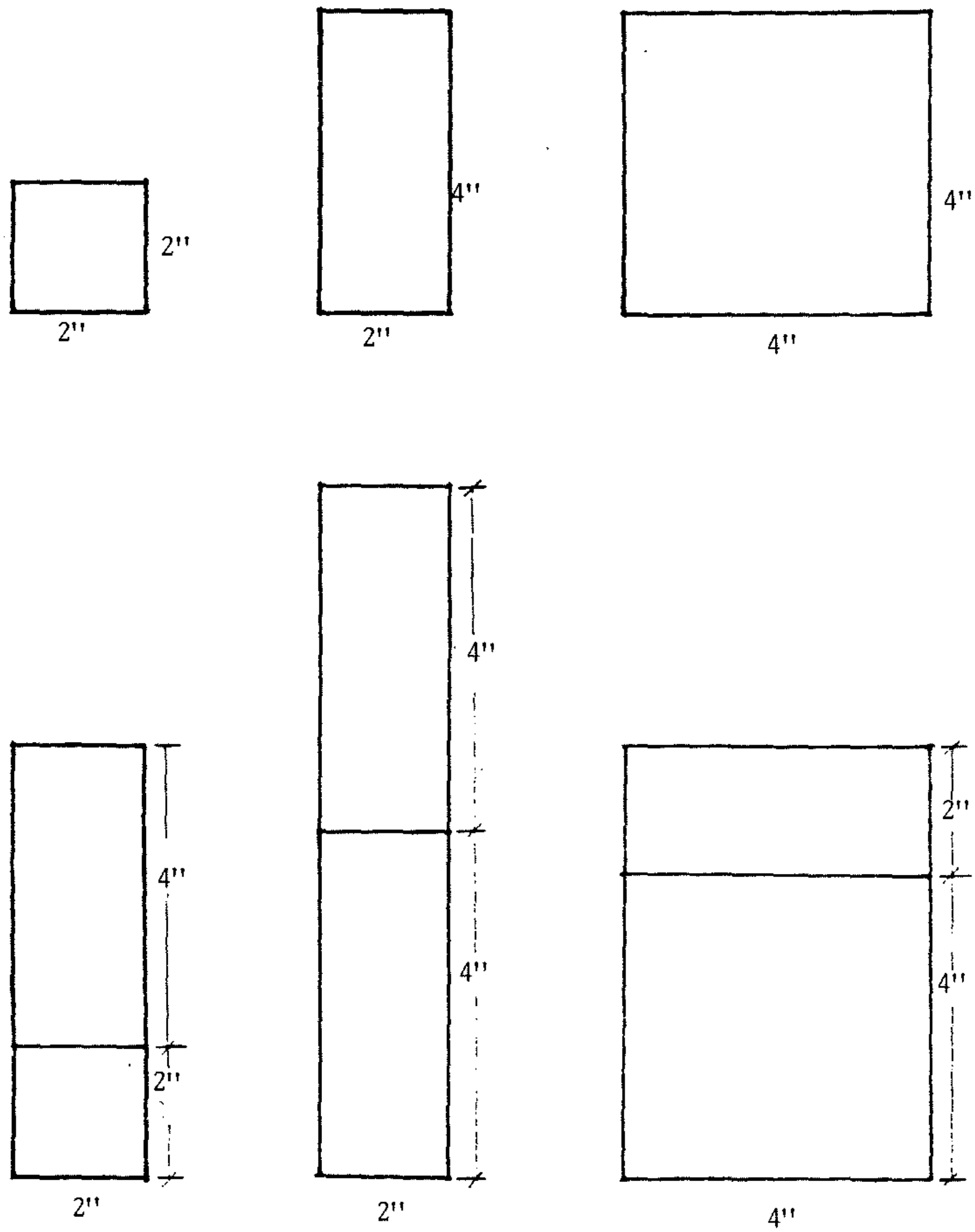
FIRECHAMBER WIDTH (in)		NUMBER OF PIECES OF WIDTH SHOWN (Odd Widths Nearest Center) Nominal Dimensions			
Greater Than	Less Than	2"	4"	6"	8"
	5.0	1			
5.0	7.5	2			
7.5	9.0	3			
9.0	11.5		2		
11.5	13.5	1	2		
13.5	15.5		3		
15.5	17.5	1	3		
17.5	19.5		1	2	
19.5	22.0			3	
22.0	23.5		2	2	
23.5	26.0			1	2
26.0	30.0				3
30.0	32.0			2	2
32.0	34.0			1	3
34.0	40.0				4
40.0					to fit

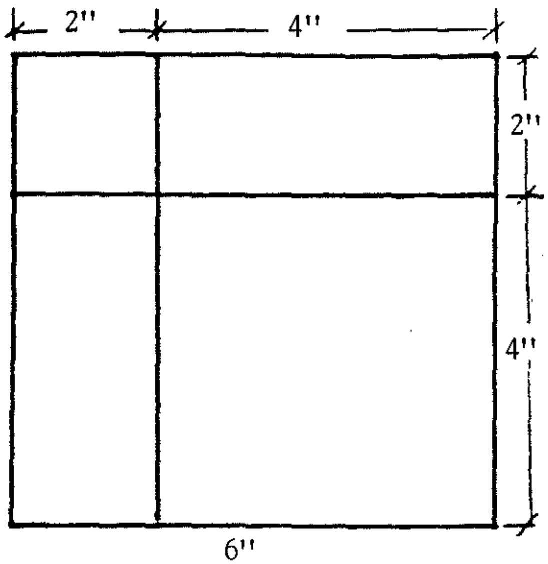
Table 1: Charge piece width selection for various firebox widths

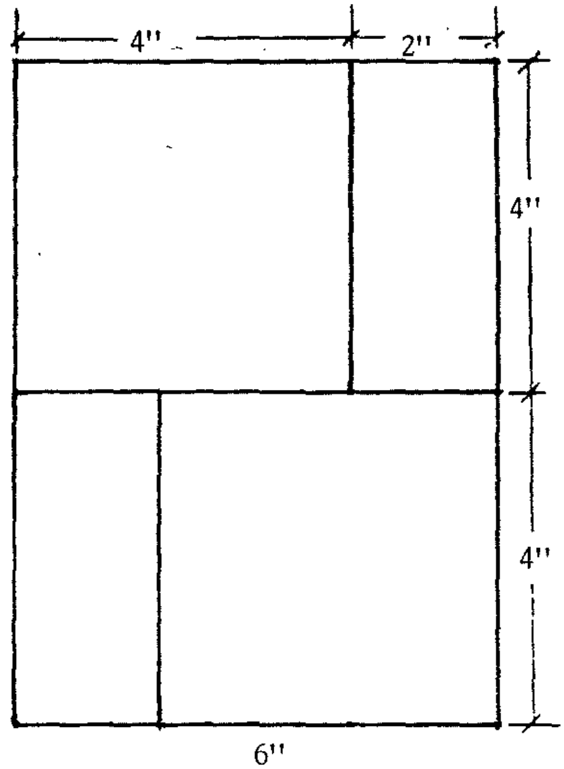
FIRECHAMBER HEIGHT (in)		NUMBER OF PIECES OF HEIGHT SHOWN (Smaller Pieces On Bottom) Nominal Dimensions			
Greater Than	Less Than	2"	4"	6"	8"
	8.0	2			
8.0	10.0	1	1		
10.0	14.0		2		
14.0	16.0	1	2		
16.0	19.0		3		
19.0	22.0		2	1	
22.0	24.5		1	2	
24.5	26.5			3	
26.5	29.5			2	1
29.5	32.0			1	2
32.0	37.5				3
37.5	40.0			2	2
40.0	42.5			1	3
42.5					to fit

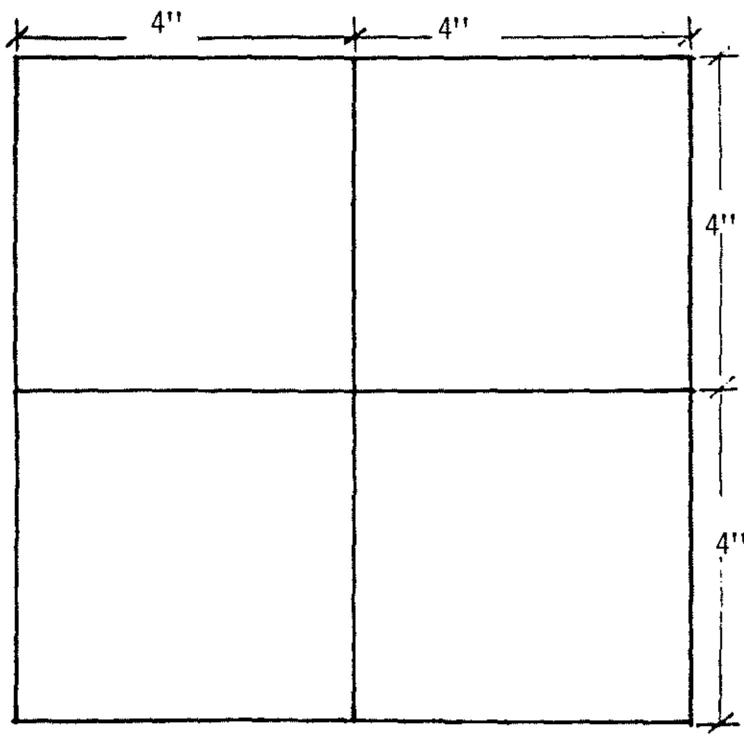
Table 2: Charge piece height selection for various firebox heights

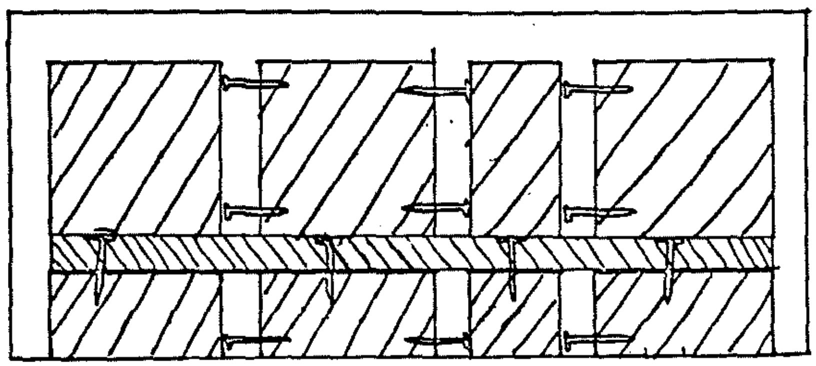
WOOD CHARGE PIECE CONFIGURATIONS TO BE USED IN TESTING
(Dimensions shown are nominal)

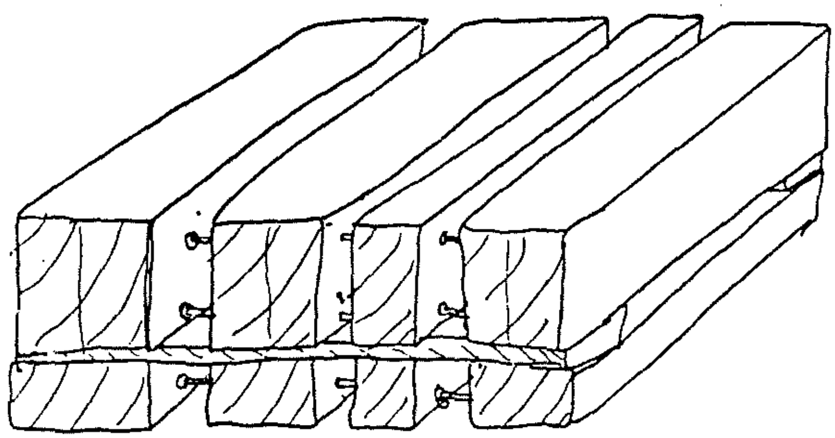



2"
4"
2"
4"
6"


4"
2"
4"
4"
6"


4"
4"
4"
4"





Example of Test Charge Load

11

PERKINS, COIE, STONE, OLSEN & WILLIAMS

A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS
ONE MAIN PLACE
SUITE 1660
101 S.W. MAIN STREET
PORTLAND, OREGON 97204
TELEPHONE: (503) 295-4400
FACSIMILE: (503) 295-6793

PLEASE REPLY TO PORTLAND OFFICE

SEATTLE OFFICE
1900 WASHINGTON BUILDING
SEATTLE, WASHINGTON 98101
TELEPHONE: (206) 682-8770
CABLE "PERKINS SEATTLE"
TELEX: 32-0319

WASHINGTON, D.C. OFFICE
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BELLEVUE OFFICE
ONE BELLEVUE CENTER
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BELLEVUE, WASHINGTON 98004
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May 4, 1984

Department of Environmental Quality
Public Affairs Section
P. O. Box 1760
Portland, Oregon 97207

Re: Proposed Woodstove Certification Rules

Dear Sir or Madam:

Enclosed are an original and a copy of comments regarding proposed regulations OAR 340-21-100 through OAR 340-21-166, for woodstove certification. These comments are presented on behalf of Klickitat Enterprises, Inc.

If we may be of further assistance, please do not hesitate to contact the undersigned.

Very truly yours,

Calvin L. Keith

Calvin L. Keith

CLK:ss
4693A
Enclosures

RECEIVED

MAY 07 1984

PUBLIC AFFAIRS

ENVIRONMENTAL QUALITY COMMISSION

COMMENTS ON PROPOSED RULES FOR OREGON WOODSTOVE CERTIFICATION PROGRAM

Presented by

Bette Hume, President
Klickitat Enterprises, Inc.

Of Counsel
Allan R. Abravanel
Calvin L. Keith
Perkins, Coie, Stone, Olsen & Williams

Comments

Klickitat Enterprises, Inc. ("Klickitat"), an Oregon corporation that distributes Kent Heating products, including woodstoves, in the United States, presents the following comments on the woodstove certification rules, OAR 340-21-100 through 340-21-166, proposed by the Oregon Department of Environmental Quality ("Department"). These comments supplement the oral testimony submitted by Bette Hume, President of Klickitat, during hearings held in Portland, Oregon on May 1, 1984. A copy of that testimony is attached as Appendix A.

I. The July 1, 1988 "7/3" Emissions Standard

The regulations provide for an emissions test standard, to be implemented July 1, 1988, of 7 grams per hour of weighted average particulate emission for noncatalytic woodstoves and 3 grams per hour for catalyst-equipped woodstoves (the "7/3 standard"). OAR 340-21-120(2). As is more fully discussed in Hume's oral presentation, Klickitat opposes this standard for two basic reasons. First, the 7/3 standard is unattainable through currently available technology, and no technology is on the horizon which will make the standard attainable. The result is that most, if not all, woodstove manufacturers and retailers will be excluded from the marketplace by a 7/3 standard. Second, the presently available scientific and technological evidence is insufficient to substantiate a 7/3 standard as the only standard which will achieve the Department's particulate emission goals.

In addition to the previously discussed problems with the models and data from which the Department derived a 7/3 standard, it has recently come to the attention of Klickitat that the population growth assumption upon which projected increases in woodstove particulate emissions are based is incorrect. For example, projected increases in woodstove emissions for the Medford area, an area of prime concern to the Department, are based in part upon projections of growth in woodstove use which assume that the population of Jackson County will grow by approximately 40% by the year 2000, based upon a linear projection of historical trends. (This information was provided by the Department during a public meeting held in Portland, Oregon on April 25, 1984.) This assumption is incorrect. The most recent available data, attached as Appendix B, from the Center for Population Research & Census of the Oregon Department of Higher Education at Portland State University, the agency authorized to collect such data pursuant to ORS 190.520, indicates that the population in the Jackson County area will increase by only approximately 30% by the year 2000.

The Department has keyed its statewide emissions regulations to the Medford area and alleges that a 7/3 standard will achieve an 80% reduction in total suspended particulate attributable to woodstoves in that area. It is alleged that this 80% reduction is necessary in order to meet total suspended particulate standards promulgated by the Environmental Protection Agency by the year 2000. See "Medford-Ashland Air Quality Maintenance Area State Implementation Plan for Particulate Matter," Oregon Department of Environmental Quality, pp. 12-15 ("State Implementation Plan"). The 7/3 standard is based upon reductions required due to projected increases in total suspended particulate attributable to woodstoves. However, because the Department used an inaccurate population growth projection of 40% instead of the currently accurate 30%, the increase in projected total suspended particulate should be reduced by 25%. "[S]ource emissions...are directly related to population growth." State Implementation Plan at p. 13. For this reason, assuming a 7/3 standard was necessary to meet the Department's goals based upon projected increases in suspended particulate attributable to woodstoves, a 7/3 standard clearly is no longer required.

Because the assumptions upon which the 7/3 standard is based are so fraught with error, Klickitat opposes promulgation of any regulation which would require a 7/3 standard by 1988. Instead, Klickitat proposes promulgation of the "15/6" standard for July 1, 1986, as set forth in OAR 340-21-120(1), with further study to be undertaken to determine what increase in the stringency of woodstove emission standards, if any, would be required to meet Environment Protection Agency goals by the year 2000.

II. Proposed Changes in OAR 340-21-166(2)

The regulations proposed by the Department provide that certification of a woodstove may be revoked if that woodstove is tested at a laboratory which is found to be in violation of accreditation criteria and rules at the time the woodstove was tested. OAR 340-21-166(2). Klickitat opposes this regulation as proposed and submits for consideration an amendment, attached as Appendix C.

The amendment proposed by Klickitat would provide that where a woodstove is tested at a laboratory which is later found to have been in violation of laboratory accreditation criteria at the time the woodstove was tested, the woodstove manufacturer, or dealer, shall have one year from the date of written notification by the Department to obtain recertification. Klickitat recognizes that where a woodstove is tested at a laboratory which is not in compliance with regulations regarding accreditation, recertification may be necessary. Arbitrary revocation of certification, however, unnecessarily and unfairly penalizes the innocent dealer or manufactuer. A revocation of certification would not only make the affected woodstove unmarketable in the state of Oregon for a period prior to recertification, with a probable loss of market share position, but could also affect subsequent marketability as consumers question the reason for revocation of certification. Where the dealer or the manufacturer is not at fault, such a penalty seems unnecessarily harsh.

The amendment proposed by Klickitat would give dealers or manufacturers notice of the necessity for recertification and a one-year "safe harbor" within which to seek recertification. This time period provides a dealer or manufacturer with sufficient time within which to seek recertification and should have little, if any, effect upon environmental quality. In addition, the proposed amendment includes language which would waive the certification fee required by OAR 340-21-140(2)(d). This would avoid any unfair penalty to a manufacturer or dealer where the need for recertification is not the fault of that manufacturer or dealer but rather the fault of a laboratory which did not meet accreditation standards.

III. Prohibition of In-State Warehousing, Sale or Advertising for Out-of-State Purchase

The proposed regulations state that "a person shall not advertise to sell, offer to sell, or sell a new woodstove in the state of Oregon" unless that woodstove is properly tested and certified. OAR 340-21-110(1). Klickitat would propose the addition of language to OAR 340-21-110, attached as Appendix D, which would make it clear that the regulation does not prohibit the sale, manufacture, advertising for sale, or warehousing of woodstoves to be used outside the state of Oregon.

It does not seem to be the purpose of the proposed regulations, nor is it within the jurisdiction of the Department of Environmental Quality, to regulate airshed emissions for areas outside the state of Oregon. In fact, an attempt to regulate commerce in this manner would violate basic constitutional prohibitions against undue burdening of interstate commerce. A&P Tea. Co. v. Cottrell, 424 U.S. 366 (1976).

While it does not appear that the proposed regulations are an attempt to regulate the air quality of other states, the amendment proposed by Klickitat would remove any doubt as to the scope of the regulations. The proposed regulations will have a harsh enough effect on the Oregon woodstove industry without limiting its ability to sell, warehouse, or advertise woodstoves for out-of-state purchase. Accordingly, Klickitat proposes an amendment to the regulations which specifically provides that Oregon woodstove manufacturers and dealers can continue to produce and market woodstoves for out-of-state purchase without the necessity of meeting Oregon woodstove certification requirements.

IV. Conclusion.

In summary, Klickitat opposes the proposed 7/3 standard for July 1, 1988. It is unconscionable to promulgate a standard, such as the 7/3 standard, which will have the effect of forcing the vast majority of, if not all, woodstove retailers out of the marketplace where the data upon which the standard is based is clearly erroneous. In addition, Klickitat proposes certain minor modifications to the regulations to make them more workable and fair.

Lastly, as was previously indicated, there is a dearth of scientific information available at the present time regarding the proposed emissions standards and testing methods. It is possible, however, that new and important information may soon be available. For this reason, Klickitat requests the right to make submissions of relevant information after the May 4, 1984 closing date for comment on the proposed regulations.

1801 N.W. Upshur • Portland, Oregon 97209
(503) 295-0121
Importers of Kent Woodstoves

Klickitat Enterprises, Inc.

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
Hearings on Proposed Rules for
Oregon Woodstove Certification Program
Portland, Oregon

May 1, 1984
7:00 P.M.

Testimony Submitted by Bette Hume
President, Klickitat Enterprises, Inc.

Good evening. My name is Bette Hume, and I am the President of Klickitat Enterprises, Inc., an Oregon corporation that distributes Kent Heating products in the United States. I was also a member of the Oregon Woodstove Advisory Committee, appointed by the Environmental Quality Commission to review proposals for woodstove certification rules, and charged by statute to "aid and advise the Commission in the adoption of emission performance standards and testing criteria." In both these capacities, I am pleased to have the opportunity to make this presentation today.

As a distributor of woodstoves in Oregon, I was an early supporter of legislation designed to regulate woodstove emissions in the Oregon airshed. I testified in favor of such legislation before committees reviewing the legislation, and added my support to that of other members of the woodstove industry.

Our support was engendered by the assurances of the Department, as frequently reiterated in House and Senate hearings and at meetings of the Woodstove Advisory Committee, that the regulations to be proposed by the Department of Environmental Quality and promulgated by the Environmental Quality Commission would be balanced, providing for the improvement of the Oregon airshed, while maintaining a reasonable standard that woodstove manufacturers could meet. I believe that the regulations proposed by the Department fail to conform to these assurances.

During the legislative hearings, the Department indicated that the goal of the legislation was to reduce particulate emissions in the Oregon airshed by approximately 65-75 percent. Given the assumptions of air quality the Department was expounding, this goal seemed reasonable, admirable and, most importantly, attainable. As the Department asserted in its legislative fact sheet submitted to these hearings:

> "For rules that are very complex or controversial, the Commission has used detailed work sessions where point by point differences are debated between staff and opponents before the Commission. The Commission is very careful not to adopt overly restrictive rules or to impose requirements or timetables which industry cannot reasonably meet."

After the legislation was enacted, however, it soon became clear that the Department was seeking a much greater reduction of what it perceived to be the current level of particulate emissions: the number the Department suddenly began to use was 80 percent, far in excess of the number the Legislature relied upon in enacting the legislation.

The Department has proposed a mandatory, phased-in emission standard of 15 gms. of particulate emitted per hour for non-catalytic woodstoves and 6 gms. for catalytic woodstoves by July 1, 1986, and, by July 1, 1988, 7 gms. of particulate emission per hour for non-catalytic woodstoves and 3 gms. for catalytic woodstoves. The proposal for a "7/3 standard," however, was made without any prior serious discussion by the Woodstove Advisory Committee.

The Woodstove Advisory Committee, which consisted of environmentalists, health officials, scientists, and manufacturing and retailer representatives, grappled long and hard with the question of particulate emissions, utilizing data provided by the Department. At no time did the Woodstove Advisory Committee agree that a "7/3 standard" would be acceptable. In fact, the Committee initially considered a standard of 20 gms. of particulate emitted per hour for non-catalytic woodstoves and 10 gms. of particulate emitted per hour for catalytic woodstoves. After reviewing the data base provided by the Department staff, the Committee finally settled on a standard, which was based on the information then available, requiring a "15/6 standard" for July 1, 1986, and a "9/4 standard" for July 1, 1988. Since the completion of the Committee's work, however, it has come to my attention that the information supplied by the Department, and upon which the "9/4 standard" was based, was inadequate in many respects and capable of vastly different interpretations. For these reasons, the doubts I had about the "9/4 standard" when it was adopted by the Advisory Committee are now more pronounced. I am, therefore, proposing that the Commission promulgate only the "15/6 standard" for July 1, 1986, and defer any action at this time on the "9/4 standard" until further examination of the Department's data and other data can be completed.

The Department has calculated its "7/3 standard" by arbitrarily mandating a reduction in the current levels of woodstove particulate emissions it assumes to exist by 80 percent. How are these current levels calculated? The Department relies on models containing imperfect assumptions and surveys containing inadequate data to achieve a presumed current level of emissions for the average woodstove in the field. The truth is, no one really knows if these assumptions are accurate, or if the surveys relied upon represent a true cross-sampling of Oregon users. Rather than delaying the promulgation of regulations until less nebulous data is available, however, the Department has decided to propose very concrete regulations that will have the effect of eliminating the woodstove industry in Oregon.

The Department could commence hearings on the 1988 standard early in 1987, after three more years of additional research has been done on the effect of woodstoves on the Oregon airshed and on the emissions of typical woodstoves. The response of the Department to this proposed deferral is to insist on the current promulgation of the July 1, 1988 standard, but to assure the public that if the July 1, 1988 standard proves to be incorrect, the Department will consider changing it. This attitude ignores, of course, the chilling effect that the Department's July 1, 1988 standard will have on the industry as a whole, whose members can only assume that the burden of proof to change a promulgated regulation will rest on the users of woodstoves, rather than the Department.

The July 1, 1988 "7/3 standard" proposed by the Department will eliminate virtually all non-catalytic woodstoves utilizing existing technology from the Oregon market, with the only prospect of continued operation dependent on some unknown and unforeseen technological change in the future. No new technology is either in existence or planned, however, which would enable non-catalytic woodstoves to meet the "7/3 standard" required by July 1, 1988. The attitude of the Department is that if the "7/3 standard" eliminates non-catalytic woodstoves, so be it: the Department will mandate an Oregon catalytic future. There is nothing in the legislative history, however, that indicates that the Legislature either contemplated, or condoned, an exclusively catalytic woodstove industry.

Overly restrictive standards will only worsen the potential defects of the regulatory program. Many arguments were raised in the legislative hearings regarding these defects, including, for example, the increase in cost to consumers of these regulated woodstoves, the ability of Oregon consumers to purchase nonconforming woodstoves in other states for unrestricted use in Oregon, the failure to regulate used woodstoves, and the continuance of airshed pollution caused by open fireplaces.

The Department's proposed "7/3 standard" will have its most severe economic impact on small business. Small manufacturers, distributors and retailers in Oregon will be put out of business or will flee across state lines to Washington, Idaho, or California for their only hope of continuing in business.

I urge the Environmental Quality Commission to consider the promulgation of a "15/6 standard" by July 1, 1986, and to defer the promulgation of any standard for 1988 until additional data has been accumulated and carefully examined.

Thank you very much.

To produce these population projections, a cohort-component model was used. This particular type of model separately projects births, deaths and migrants; and then uses these components of population change along with the beginning population to arrive at the size of the population at some future date.

Births were projected by applying age-specific fertility rates to the female population of each county. These rates began with the observed 1980 levels of fertility. Slight modifications to these rates were made during the period of projection (1980 - 2000) if the rates were below replacement level in 1980. That is, the county-specific fertility rates were allowed to gradually move toward replacement level.

Deaths were projected by applying state-wide survival rates to each county's age and sex distribution. These survival rates were developed by CPRC by modifying similar U.S. survival rates so they better reflected the mortality experience of the Oregon population.

Net migration was projected at the state level, using the State of Oregon economic forecast as a guide during the period 1980 through 1985. For those years beyond 1985, state-level migration was forecasted to increase to a level approximately 70% of that experienced during the 1970's. In this forecast, state-level net migration reached this level in 1990 and was held constant at this level through the year 2000.

PRELIMINARY POPULATION PROJECTIONS, 1985 - 2000

	1980 CENSUS	1985	1990	1995	2000	% CHANGE 1980-1990	% CHANGE 1990-2000	% CHANGE 1980-2000
BAKER	16134	16362	16992	17708	18400	5.3	8.3	14.0
BENTON	68211	71540	77769	83081	87091	14.0	12.0	27.7
CLACKAMAS	241911	249480	276053	304600	332628	14.1	20.5	37.5
CLATSOP	32489	33156	34985	36733	38418	7.7	9.8	18.2
COLUMBIA	35646	37068	39975	42832	45704	12.1	14.3	28.2
COOS	64047	59367	61807	64067	66218	-3.5	7.1	3.4
CROOK	13091	12999	14040	15101	16144	7.2	15.0	23.3
CURRY	16992	16900	18195	19359	20486	7.1	12.6	20.6
DESCHUTES	62142	64604	74958	87673	100670	20.6	34.3	62.0
DOUGLAS	93748	89934	97472	104962	112263	4.0	15.2	19.7
GILLIAM	2057	2071	2075	2070	2050	0.9	-1.2	-0.3
GRANT	8210	7749	8049	8339	8632	-2.0	7.2	5.1
HARNEY	8314	6617	6830	7142	7511	-17.8	10.0	-9.7
HOOD RIVER	15835	15657	16640	17568	18487	5.1	11.1	16.7
JACKSON	132456	134676	147280	160231	173031	11.2	17.5	30.6
JEFFERSON	11599	12605	14082	15534	16961	21.4	20.4	46.2
JOSEPHINE	58855	59686	66644	73966	81363	13.2	22.1	38.2
KLAMATH	59117	59301	63043	66670	70086	6.6	11.2	18.6
LAKE	7532	7891	8321	8720	9113	10.5	9.5	21.0
LANE	275226	270867	293081	314082	333925	6.5	13.9	21.3
LINCOLN	35264	38187	41163	43814	46292	16.7	12.5	31.3
LINN	89495	88770	95067	101759	108482	6.2	14.1	21.2
MALHEUR	26896	27353	29739	31888	34061	10.6	14.5	26.6
MARION	204692	211511	231577	252297	273454	13.1	18.1	33.6
MORROW	7519	6837	8262	9834	11502	9.9	39.2	53.0
MULTNOMAH	562640	569189	576359	580347	581519	2.4	0.9	3.4
POLK	45203	45271	48825	52476	56076	8.0	14.9	24.1
SHERMAN	2172	2195	2188	2157	2115	0.7	-3.3	-2.6
TILLAMOOK	21164	21127	22193	23158	24115	4.9	8.7	13.9
UMATILLA	58861	60502	65457	70500	75539	11.2	15.4	28.3
UNION	23921	25095	26851	28649	30386	12.2	13.2	27.0
WALLOWA	7273	7523	8026	8603	9240	10.4	15.1	27.0
WASCO	21732	22999	24070	24983	25884	10.8	7.5	19.1
WASHINGTON	245860	276472	310834	344413	377188	26.4	21.3	53.4
WHEELER	1513	1531	1523	1517	1526	0.7	0.2	0.9
YAMHILL	55332	58412	64579	70801	77096	16.7	19.4	39.3
STATE OF OREGON	2633149	2691504	2895004	3097634	3293656	9.9	13.8	25.1

PRELI [illegible]ARY, subject to change. December 1983.
Prepared by the Center for Population Research and Census.

PROPOSED AMENDMENT TO OAR 340-21-166(2)

Modify OAR 340-21-166(2) as follows:

Delete currently proposed language.

Insert the following:

(2) Certification of a woodstove tested at a laboratory found to be in violation of accreditation criteria and rules at the time the woodstove was tested for certification may be revoked if the woodstove is not retested and recertified within one year from the date of written notice from the Department to the manufacturer or dealer of the woodstove. The certification fee required by OAR 340-21-140(2)(d) will be waived for recertification required pursuant to this section.

PROPOSED AMENDMENT TO OAR 340-21-110

Add the following new subsection to OAR 340-21-110:

(4) Nothing in these regulations shall be construed to prohibit the manufacture, sale, advertising for sale or warehousing of woodstoves which do not meet Department certification standards where the woodstove is to be sold for use outside of the State of Oregon.

Appendix "D"

RECEIVED 12

MAY 07 1984

PUBLIC AFFAIRS

SIERRA CLUB ...Oregon Chapter

2637 S.W. Water Ave., Portland, OR 97201

May 3, 1984

To: DEQ Public Affairs Section
P.O. Box 1760
Portland, OR 97207

From: Ann Kloka, Air Quality Coordinator
Oregon Chapter, Sierra Club

Re: The DEQ's Proposed New Rules for Woodstove Certification

I would like to submit the following comments for the hearings record on behalf of over 6600 members of the Sierra Club in Oregon.

1. The woodstove testing procedures recommended by the Advisory Committee appear to be adequate in assessing emissions in a uniform manner for each stove. However, we would hope that the cost of the testing ($6000) could be reduced for the small manufacturer.

The increase from the original estimate ($3000) appears to be caused in part by the national woodstove industry's desire to have four different testing procedures (at low, medium, high, and maximum burn rates) so that they can use this testing to sell in other areas of the country where woodstove certification is being considered. However, we feel that small manufacturers who wish their stoves to be only certified for sale in Oregon should need to submit to fewer tests, and only at the lower burn rates, which are more appropriate for Oregon's mild climate. This would hopefully lead to a reduction in the testing fee for the small manufacturer.

2. We feel that the proposed labelling of certified woodstoves fulfills the legislative requirements of HB 2235.

3. We agree with the criteria proposed for accrediting woodstove testing laboratories.

4. We disagree with the Committee's recommended two-stage emission standard. First, we feel, as the DEQ noted in its full report, that it is preferable to have a single stage standard to reach air quality goals as soon as possible. Also, a second stage of a standard is often more difficult to establish than the weaker first standard. It may get postponed past 1988 or the DEQ may be prevented from implementing it entirely.

According to the DEQ and the medical advisors to the Committee, the only standard that would bring us into compliance with the secondary particulate air quality standard by the year 2000 is the 7/3 standard (7 grams particulate emitted per hour for non-catalytic stoves and 3 grams per hour for catalytic equipped stoves). This emission level would insure the needed 80% reduction in emissions deemed necessary to meet the standard.

<u>We therefore recommend that the 7/3 standard be established on July 1, 1986.</u>

Catalytic technology is now available to reduce emissions to 1.5 grams/hour, and we feel that the woodstove industry, which is now heavily committed toward catalytic technology, according to the DEQ, will come up with a good selection of models that can meet the strict standard.by 1986.

Originally, concern for the longevity of the catalyst was discouraging manufacturers from that technology, but now that seems to be less of a problem as better catalysts are being developed. In fact, one catalyst now on the market is warranted for 6 years, with a three year free replacement and a three year pro-rated warranty. We agree with the DEQ that any catalyst sold in Oregon should be proven in longevity testing in order to protect the consumer against poor quality.

The stricter 80% reduction level is necessary to insure a significant improvement in air quality because there are many other considerations that must be taken into account when setting the emission performance standard.

Some of these concerns are:

a) the stove may not perform as well in the field as in a highly controlled laboratory test;

b) the stove will not perform at the 80% reduction level indefinitely;

c) unless <u>all</u> installed woodstoves are performing at the 80% level, we will not reach our needed 80% emission reduction (<u>i.e.</u> if 100% of the installed woodstoves are burning clean, then we will reach the 80% level; however, if only 80% of the stoves are burning clean, we will obtain only about a 64% emission reduction);

d) testing procedures assume reasonably good operation of the stove, which is critical to insure a clean burn. Unfortunately, many woodstove owners don't follow good burning practices. They do not burn a hot fire, they will burn wet wood, they will overload their stoves and damper them way down at night, and may not replace a catalyst when necessary.

Because of these concerns, we feel that the best and cleanest stoves must be in use in order to attain the 80% reduction necessary to achieve air quality standards.

We urge the EQC to act quickly to have a strict standard in place for July 1, 1986. Even the clean burning stoves will still emit over 90 times the particulates that a gas furnace emits and over 45 times that of an oil furnace (for equivalent heat output).

Thank you for including our comments in the hearings record.

Mary Marke
Rt. 1 Box 77C
Cove, Or. 97824

D.E.Q.
attention: Public Affairs
P.O. Box 1760
Portland, Or.

RECEIVED
MAY 07 1984
PUBLIC AFFAIRS

To Whom it May Concern:

I would like to express my opinion regarding wood smoke in the Grand Ronde Valley. I have seen La Grande literally clogged with smoke during the winter. In the evening especially you can't escape the smell of wood smoke anywhere in town. The same is true of Cove, although it is smaller and the problem is not as severe. I would like to see legislation requiring more efficient burning stoves. The extra expense would be worth it to have cleaner air.

Sincerely,
Mary Marke

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ORLEY'S CUSTOM STOVES

May 4, 1984

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MAY 07 1984

PUBLIC AFFAIRS

D E Q Public Affairs Section
P.O. Box 1760
Portland, Oregon 97207

Regarding : Emission Standards

Dear Sirs/ Madam:

I, Orley B. Milligan, owner of Orley's Manufacturing Co. Inc., and, Orley's Custom Stoves, of Medford, Oregon, do certainly agree, to more healthful standards, for the State of Oregon. Also, better cleaner burning wood stoves, plus, no more zero clearance fireplaces sold in the State.

Wood stoves with 15/6 grams (of smoke) per hour to begin in 1986 is acceptable, providing, it can be accomplished by securely welded baffles.

Catalitic stoves, at this time, needs more improving. All itemsr to combat pollution, must be securely welded, and, practically impossible to remove, as some customers would remove the parts.

In trying to get our stove tested the first day, we called the D E Q. They had very limited money, therefore, I am certainly negative to paying $6,000.00 for the test of one stove, as most manufacturers have as many as 5 or more stoves, to be tested. In guessing, 100 manufacturers in the State X $30,000.00 each, makes D E Q testing a larger business, than any wood stove manufacturer, in Oregon, and would be too ex= pensive for the average manufacturer. It could easily put the manufacturer out of business.

The U.L. testing Lab should be able to test for temperature safety and pollution under one roof. As this one time venture to make our State a cleaner one, has now cost plenty of money, and business in the U S A and Canada.

Sincerely,

Orley B. Milligan

Orley B. Milligan
OBM/mm

2690 Crater Lake Hwy. • Medford, Oregon 97501 • (503) 779-5340

15

May 3, 1984

I am Roberta Bates, 403 "M" Avenue, La Grande, Oregon

Henry and I have lived in La Grande for 29 years. We have always regarded it as the perfect place to live because of its beauty, proximinity to the mountains, forests, and pure clean air.

However, in the last three or four years there are times when the air is not clean anymore, especially in the winter when it is usually cold and pure.

That is mostly due to the increase of the price of petroleum products and our proximinity to the forests. People are saving on their fuel bills by buying wood stoves and using them. Consequently, on cold days (and we have a lot of them), there is cords of wood being burned in our small town and palls of smoke contaminating the cold pure air. When there is an air inversion, the smoke is so thick that it burns my eyes when we go for our evening walk.

Henry has asthma and he cannot walk on such evenings without being affected by the smoke.

I understand people's desire to save on fuel and to be self-sufficient but this should not be done at the expense of the others any more than smokers should be allowed to smoke in a closed room and impose their wastes on others.

We favor good emissions controls on stoves. More and more people are going to be using wood if the high cost of oil and gas continues. The problem will grow. If it is controlled now, the expense will be less and easier for everyone to absorb than it will be if postponed until the future when it becomes a real threat.

We do not think that Eastern Oregon is any more or less privileged than any other sector of the state. At least most of us are closer to the source of fuel and can save money getting the wood.

Thank you for listening.

Roberta Bates

Henry G. Bates
403 'M' ave
La Grande, Or

16

THE LEAGUE OF WOMEN VOTERS OF CENTRAL LANE COUNTY

Affiliated with the League of Women Voters
of Oregon and the United States

May 4,1984

TO: Department of Environmental Quality

From: League of Women Voters of Central Lane County

RE: Proposed Wood Stove Rules

The League of Women Voters of Central Lane County thanks the Department of Environmental Quality for this opportunity to comment on an issue we see as critical for the health and economy of our area. We congratulate the DEQ for accomplishing in a timely manner, with broad representation of affected groups, what is truly a pioneering effort. We applaud the effort to produce standards which may one day be applied in other states.

After careful consideration we urge the DEQ to recommend the highest emission standard possible in certifying wood stoves sold in Oregon after July, 1986. It is our opinion we must strive to meet air quality standards by the year 2000, adopting the more strict emission level recommended by staff to be met by 1988.

We recognize the new certification may cause hardship to manufacturers and will likely result in increased costs to consumers. We feel, however, that this cost is preferable to the long term consequences of inadequate standards. In addition the League maintains that pollution control should be considered a cost of doing business, and citizens as consumers and taxpayers must expect some costs to be passed on to them.

RECEIVED

MAY 07 1984

PUBLIC AFFAIRS

In the past, the League of Women Voters of Central Lane County lobbied for adequate regulation of industrial pollution. We were active in the effort to regulate field burning. Today we see certification of wood stoves, with meaningful standards, as the urgent step we must take for the health of our air shed.

Suzanne Boyd, President
3429 Stark St.
Eugene, OR 97404

Kay Robinhold, Natural Resources Chair
4450 Hilyard
Eugene, OR 97405

17

LEAGUE OF WOMEN VOTERS OF OREGON
317 Court Street N.E., Suite 202 Salem, Oregon 97301 (503) 581-5722

May 1, 1984

TO: DEQ Air Quality Division

FROM: League of Women Voters of Oregon

RE: Woodstove Certification

The League of Women Voters of Oregon supports and applauds the efforts of the DEQ in the implementation of the woodstove regulations. We urge you to adopt a standard as strict as present technology will allow. As stated in the fact sheet, some catalyst-equipped stoves can already meet the stricter 1988 standard, therefore support the stricter 1988 proposed standard of 80% as the desired standard.

During the legislative session it was recognized that industry needed time to improve technology and retool factories, which led to the establishment of the July 1, 1986 date for certification. It would seem an economical advantage to manufacturers <u>not</u> to have to retool for <u>two</u> standards, but rather target for consistent standards that <u>will</u> meet the desired end result.

Kris Hudson
President

Mary Ann Rombach
Mary Ann Rombach
Natural Resources - Air

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MAY 07 1984
PUBLIC AFFAIRS

May 4, 1984

18

Dear Sir or madam,

I have been informed ~~that~~ you are trying to do something about the Smoke problem in La Grande and would like to give my Support to your efforts. It is now 9:30 Am on may 4 and the Smoke is very heavy. I Feel the Proposed wood Stove Certification Program is badly needed and a Step in the right direction to clearing up our air. I am very much in support of this program.

Sincerly,

Anna Spry

3302 Columbia

La Grand, Or. 97850

19

FIRE MASTER

DEQ ATTN: PUBLIC AFFAIRS
POB 1760
Portland, OR 97207

RECEI

MAY 07 1984

PUBLIC AFFAIRS

RE: TESTIMONY, OREGON WOODSTOVE EMISSIONS

Mark E. Warner
810 Davis St.
Milton-Freewater, OR 97862
503-938-7208

As an Oregon resident and consumer, I support the INTENT of the Oregon Woodstove Emissions law and have supported it since my own queries revealed that a woodstove related pollution problem did indeed exist in certain locales.

In addition to being an Oregon resident of ten years, I also own a small woodstove manufacturing company in Walla Walla, Washington, eleven miles from Milton-Freewater, Oregon. As a manufacturer who produces fewer than 500 units per year in six models, I am concerned with the cost of the proposed test protocol, in light of the fact that less expensive alternatives are available.

EMISSIONS SAMPLING METHOD
The Condar method (Barnett Sampler) has been determined as of this date to be not acceptable to test for Oregon's law. While no argument exists that Oregon Method seven is more precise, and has obviously been chosen for this reason, given the vast difference in cost for equipment between the two methods, and the relatively high comparative reliability of the Condar method, the Condar method is the clear preference if the decision is based upon cost/benefit analysis.

The following information has been gleaned from DEQ officials, some as recently as May 3, 1984 at the 2:00pm public hearing in Pendleton, and from the Woodstove Advisory Committee Meeting in Portland at the Marriott Hotel in late October, 1983:

1. The proposed protocol consists of four emissions/efficiency tests at an estimated test cost of 6000-7000 dollars;
2. the Barnett Sampler is recommended by DEQ as a manufacturer's inhouse screening method;

FIRE MASTER IRON WORKS
ROUTE 4, BOX 177A
WALLA WALLA, WA 99362
(509) 529-6220

FIRE MASTER

WOODSTOVE EMISSIONS TESTIMONY, PAGE TWO, MARK E. WARNER

3. The Barnett Sampler is 80% statistically reliable compared to Method Seven;
4. Capital cost for emissions/efficiency test equipment using Barnett Sampler is under $5000, while capital cost using Method Seven is over $40,000.
5. Per Barbara Tombleson (Pendleton May 3, 1984) Barnett Sampler is least accurate at lower output levels but that DEQ can provide a method to equate these to Method Seven;
6. Barnett costs 25% less to perform than Method Seven.

COST ANALYSIS ON SMALL MANUFACTURER (HYPOTHETICAL)

Following is a cost analysis on a small manufacturer producing 500 units per year in six models, with 300,000 dollars annual gross sales, and $30,000 net annual income.

	Percent of Ann. Sales	Percent of income
Cost to test all six models at $6500 per test, assuming each model passes the first test 6 times 6500=39000 dollars	13.0%	130.0%
Freight and travel at $500 per unit 6 times $500=$3000	1.0%	10.0%
DEQ Certification at $1600 first model, $800 subsequent models $1600+800+800+800+800+800=$5600	1.8%	18.7%
	15.8%	158.7%

This example shows that a small manufacturer can be exposed to unrecoverable costs that exceed one and onehalf years net income. The above costs are most conservative considering that they do not include research and development costs, retest costs for failed tests, and exposure to re-safety testing due to design changes at approximately $4000 per test. The costs outlined above total 47,600 dollars, or $95 per unit sold, which is higher than some manufacturer's total production cost.

FIRE MASTER IRON WORKS
ROUTE 4, BOX 177A
WALLA WALLA, WA 99362
(509) 529-6220

WOODSTOVE EMISSIONS TESTIMONY, PAGE THREE, MARK E. WARNER

I urge the commissioners to amend the proposed test protocol to include the following:

1. Accept the Condar method (Barnett sampler) of emissions measurement as an alternative to Oregon Method Seven;
2. Accept three emissions tests (25, 50, 75% of maximum) rather than four;
3. Accept one efficiency test rather than four, at 50% of maximum heat output.
4. Accept the 9/4 gm. per hour standard for 1988, at least until the 7/3gm/hr. standard is proven to be attainable by non-catalytic heaters.

ANALYSIS

Adoption of the above amendments would provide the following benefits:

1. Honor the intent of the law while allowing more small manufacturers to stay in business, rather than be driven out by the cost of compliance.
2. Provide higher levels of research and development by allowing more manufacturers to stay in business;
3. Maintain a high level of consumer choice;
4. Keep prices down by maintaining today's highly competetive market of many choices provided by many companies;
5. Eliminate unproductive testing expense;
6. Provide for continuing research into cleanburning noncatalytic stoves by establishing a 1988 standard that is within the vision of today's best woodstove design brains, because research into stoves which burn cleaner than 15 gm/hr will all but stop if the 7 gm noncatalytic standard is held.

Mark E. Warner

FIRE MASTER IRON WORKS
ROUTE 4, BOX 177A
WALLA WALLA, WA 99362
(509) 529-6220

20

KI T COE
1012 13th
LAGRANDE, OR 97850

MAY 4, 1984

RECEIVED

MAY 07 1984

PUBLIC AFFAIRS

DEPARTMENT OF ENVIRONMENTAL QUALITY
PO BOX 1760
PORTLAND, OR 97207

RE: PROPOSED NEW RULES FOR WOODSTOVE CERTIFICATION

I AM OPPOSED TO THE PROPOSED NEW RULES IN RESTRICTING THE EMISSIONS OF WOOD STOVES. IT IS A VIOLATION OF FEDERAL AND STATE LAWS.

FOR EXAMPLE, ASSUME TWO MILLION PEOPLE DECIDED TO MOVE TO THE GRANDE RONDE VALLEY (WHICH IS UNLIKELY BUT POSSIBLE) AND EACH ONE OF THEM INSTALLED A WOOD STOVE APPROVED BY THE D.E.Q. OREGON IS CURRENTLY VIOLATING THE FEDERAL CLEAN AIR ACT IN REGARDS TO THE AIRSHED OVER THE EAGLE CAP WILDERNESS AREA. ACCORDING TO MY FIGURES, IF THERE WERE ONLY ONE MILLION WOODSTOVES THERE WOULD BE TEN MILLION GRAMS OF WOODSTOVE SMOKE PER HOUR DRIFTING ACROSS THE FORMERLY PRISTINE WALLOWA MOUNTAINS.

A FEW YEARS BACK CHARLIE MANSON AND SOME BUDDIES KILLED SEVEN PEOPLE IN CALIFORNIA. CHARLIE IS SERVING LIFE IN PRISON BECAUSE OF HIS ACTIVITIES. WOULD IT HAVE BEEN BETTER IF OL' CHARLIE HAD ONLY KILLED ONE PERSON? WOULD HE ONLY BE SERVING A ONE-SEVENTH OF A LIFE SENTENCE? NO, NO MATTER HOW YOU DO IT, MURDER IS MURDER.

THE POINT IS, IT DOESN'T MATTER IF A PERSON BREATHES X-AMOUNT OF CARCINOGENS AND PARTICULATE MATTER OR TWICE THAT AMOUNT. THE RESULT IS DEATH BY CANCER OR RESPIRATORY DISEASE IN 30-40 YEARS DOWN THE ROAD. SO, YOUR PROPOSED WOOD STOVE EMISSION RULES ARE WAY TO HIGH. ZERO EMISSIONS IS A MORE RESONABLE NUMBER. THE ONLY WOOD STOVE IS A WOOD STOVE THAT IS VENTED INTO THE WOOD STOVE USERS LIVING ROOM.

YOUR PROPOSED RULES WOULD ONLY LEGALIZE MURDER AND DIRTY AIR. I AM APPALLED BY YOUR LACK OF SENSITIVITY. TO PARAPHRASE PATRICK HENRY: GIVE ME CLEAN AIR; DON'T GIVE ME DEATH.

FOR CLEAN AIR,

Kent Coe

P.S. EARTH FIRST!

21

Alan H. Tracy
60205 Ridgeview Drive E.
Bend, OR 97702

May 3, 1984

DEQ
Public Affairs Section
P.O. Box 1760
Portland, OR 97207

Dear Sirs:

Re: Proposed Rules for Woodstove Cert.

I support the proposed EQC rules.

Pollution in Oregon due to woodstove sources has already become ugly and unhealthy. It is interesting that pollution source has shifted from industry to the home--individuals who care can do something about it now.

It is also a credit to our legislature in responding to the threat by legislative leadership. I only regret action is not targeted for earlier correction.

Yes, go ahead with the DEQ proposals.

Sincerely,

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MAY 07 1984
PUBLIC AFFAIRS

22

DESCHUTES INDEPENDENT STOVE COMPANY
165 N.W. Greenwood
Bend, Oregon 97701

May 4, 1984

RECEIVED

MAY 07 1984

PUBLIC AFFAIRS

ENVIRONMENTAL QUALITY COMMISSION
DEPARTMENT OF ENVIRONMENTAL QUALITY
Post Office Box 1760
Portland, Oregon 97207

Dear Sirs:

First let me endorse the efforts of both WEI West and the WHA as being professional, prudent and ethical. They have brought together competent scientists to help supply accurate information and relevant insights. I sincerely hope the zealous efforts of the DEQ might be moderated in respect for these nationally recognized professionals.

Oregon and many other states have air quality problems due to woodstove burning. The DEQ estimates that Medford is the worst Oregon case, requiring an 80 percent reduction in wood stove emissions to comply with air quality standards. A more moderate standard for the state with some sort of user management policy might be in order for extreme conditions.

Estimates of average stove life are 15 years. The proliferation of wood stove use began about 1977. The replacement market for these stoves should begin in 1992.

Smaller manufacturers will likely be forced out of business if not given enough time to conduct costly research. National manufacturers may decide to delay new product entry into the Oregon market pending adequate development. In the interim, the Oregon consumer will likely be faced with more expensive and reduced product selection. Upgrading will likely be postponed, an unfair advantage to those manufacturers who can afford to wait it out.

There are currently available products with improved efficiencies that have wide acceptance in the market place. The proposed standards would eliminate them from the market place.

If customer resistance to high tech, high price product prevails, there will be no immediate improvement in the air quality. That is the goal, is it not? The standards as proposed are too strict, too soon.

One final comment about the standard. It seems ludicrous to require a stove that holds 30 pounds of wood to meet the same emission standards while burning at the same pounds per hour rate as a stove that holds ten pounds of wood.

May pragmatic judgment prevail in order to preserve what semblance of energy independence Oregonians have achieved.

Cordially,

Scott Norris

Scott Norris
Owner
DESCHUTES INDEPENDENT STOVE COMPANY

SN:br

23

Phone (503) 476-HEAT

Cascade HEAT with WOOD Shop

1559 Dowell Road ★ Grants Pass, Oregon 97526

May 2, 1984

RECEIVED

MAY 08 1984

PUBLIC AFFAIRS

To: E.Q.C.

From: Cascade Heat with Wood Shop
Grants Pass and Medford

Regarding: Comments on Wood Stove Emissions Standard

We at Cascade Heat with Wood Shop in Grants Pass and Cascade Block in Medford oppose the implimentation of the Wood Stove Emission Standard as presently proposed by the D.E.Q. More specifically it is the second phase of the standard we object to. As far as we know, there is not a single stove marketed at this time that would meet the 1988 standard of 7 grams particulate emission for non-catalytic stoves and 3 grams emissions for catalytic.

Stoves that might meet the 1988 standard would be neither desireable nor affordable to the Oregon stove buyer. The lack of product available that would both meet the standard and satisfy the consumer would encourage the purchase of uncertified stoves from other states and sources. The wood stove industry in Oregon has grown out of a stage when most stoves were made by the backyard welder. These unapproved and unlisted stoves were many times unsafe and inefficient. The second phase of your emission standard would encourage the return to home made stoves. We feel that this second phase would have a devastating effect on the wood stove industry while having a reverse effect on the air quality.

We feel that the first phase of the standard would achieve the desired reduction in particulate emissions. Stoves could be produced under this standard that would be efficient and appealing to the consumer, encouraging the purchasing of approved stoves.

We would also like to go on record as supporting the comments and recommendations of both the W.H.A. and W.E.I. West.

Sincerely,

CASCADE HEAT WITH WOOD

David E. Dennis

David E. Dennis

DED/hv

The Wood Heating Center
910 S.W. 6th Street • Grants Pass, Oregon 97526 (503) 479-4999

RECEIVED
MAY 07 1984
PUBLIC AFFAIRS

I WOULD LIKE THIS STATEMENT TO GO ON PUBLIC RECORD IN OPPOSITION OF THE 1/3 STANDARD PROPOSED BY THE DEQ.

MY MAIN REASON IS THE FACT THAT THE 1/3 STANDARD IS BY NO MEANS A STANDARD IN WHICH THE INDUSTRY WILL BE TO COMPLY TO, PUTTING TENS OF THOUSANDS OF OREGONS OUT OF WORK.

THE STOVES, IF AVAILABLE, WILL BE TO EXPENCIVE OR TO COMPLICATED FOR THE AVERAGE CONSUMER, LEAVING NO CHOICE BUT THE "BACK YARD" BUILT STOVES. WHICH WILL FURTHER ADD TO OUR DELIMA.

THE "BACK YARD" STOVES WILL BE A GIANT STEP BACKWARD IN THE INDUSTRY, FLOODING THE MARKET WITH CHEAP, HIGH POLUTING, UNSAFE MONSTERS. THE START OF ALL OUR PROBLEMS.

The Wood Heating Center

910 S.W. 6th Street • Grants Pass, Oregon 97526 (503) 479-4999

MY FEELING IS A LESS STRICT STANDARD WOULD ACHIEVE BETTER RESULTS BY GIVING THE CONSUMER A WIDER CHOICE OF MORE EFFICIENT TESTED STOVES.

ALSO THE EASIEST SOLUTION WOULD BE EDUCATION. EDUCATING THE PUBLIC IN PROPER OPPERATING THE STOVES & BURNING DRY WOOD, WOULD DRASTICALY REDUCE POLUTANTS AS WELL AS INCREASE EFFICENCY OF A GOOD STOVE.

WE, FOR THE PAST THREE YEARS HAVE PUT ON CHIMNEY & STOVE SAFETY SEMINARS, RESULTING IN A DROP IN FLUE FIRES, AS WITNESSED BY OUR FIRE DEPT. IF AFFORDABLE WE WOULD DO THIS SEVERAL TIMES A YEAR. WITH A GREATER RESULT THAN TO STRICT A WOOD STOVE POLUTION STANDARD.

SINCEARLY,

Michael Clough

MICHAEL CLOUGH, OWNER

25

Dear Sirs:

I will be unable to attend the public meeting on woodstove pollution to be held May 3rd but wish to send this recent article on the problem.

The situation is a serious one for the Southern Oregon region -- for business as well as the public health. It is a matter that will not much be helped by future legislation as the problem, in great part, is upon us, now. (Faulty stoves, the burning of unseasoned wood has long been tolerated). Too, I fear that if left to the public they will want to do noth ing -- witness the recent turndown of the automotive inspections for carbon monoxide.

The action necessary to curb woodstove particulates must be instituted now not in the "near future".

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
APR 30 1984
SOUTHWEST REGION OFFICE

Sincerely,

Guy Marek

No address

Smoke from dirty woodstoves a burning issue in West

by Mike Leary
Knight News Service

MISSOULA, Mont. — As he gunned his car through the south-hills of this picturesque lum-ing and university town, Scott Church scanned the somber noon-day sky for wisps of wood smoke spurting from home stacks.

Cresting a hill, Church, a county Health Department air pollution specialist, slammed on the brakes and pointed. Ahead, thick, whitish smoke curled from the chimney of a ranchhouse, the plume clearly outlined against a dark clump of pine trees.

"Whew," Church exclaimed. "That's bad, it's really bad. If that smoke doesn't thin out quickly, in the next 15 minutes, I'm going to have to issue a citation."

Since December, Church and fellow health inspectors, operating under a unique new county regula- have handed out more than two such wood-pollution citations that can carry fines of up to $100.*

"Smoke cops," some call them, and they have been cursed and threatened. One man shouted "I'll punch your lights out" at the 5-foot-6 Church, who burns wood in his own home.

Missoula County officials passed the wood-smoke regulation, empowering them to shut down virtually all wood stoves during times of poor air quality, amid bitter controversy late last year.

Voluntary control measures had failed to dispel the choking, acrid pall of wood smoke that has blotted out the soaring mountain vistas, aggravating colds and causing sore eyes.

As residential wood-burning for heat increases, the same sort of brown cloud has been spreading inexorably throughout the West — clogging the thin mile-high air in Denver; shrouding Portland, Ore., and Anchorage, Alaska; polluting the chic Colorado ski resorts of Aspen and Vail, and now floating over Jackson Hole and pristine Yellowstone National Park in Wyoming.

In New England, where more wood is actually burned for fuel than in the West, blustery winds tend to disperse the smoke more broadly. And New Englanders also use cleaner-burning hardwoods instead of the pine frequently used in the West.

Nevertheless, "we've certainly seen a degradation of air quality in the last five years," said David Howley, a Massachusetts air-quality official.

Suddenly, there is a growing recognition that wood, once championed as a clean, renewable and — most important — cheap fuel in times of tight and expensive energy supplies, actually can be a major polluter.

It also may pose a potential health hazard because wood-burning produces deadly carbon monoxide, and pumps minute solids into the air — some of them known to cause cancer. A 1980 study found that Missoula schoolchildren had less lung capacity than their peers elsewhere in Montana.

Although auto emissions greatly exacerbate the problem, tests have found that on winter days most of the dangerous pollutants in the air originate from wood stoves.

One Missoula physician, Bill Reynolds, told county commissioners during hearings on the wood regulation that "day after day" he has treated patients for asthma and emphysema. "The air is heavy with wood smoke — there isn't any question that we need to do something for those folks," he said.

Missoula, where the average air quality has violated federal standards every year since 1975, is generally considered by pollution experts to have the worst wood-smog problem in the country.

Wood-burning grew in popularity here and elsewhere during the last decade because of the rapidly rising cost of oil and natural gas as heating fuels. Wood was relatively cheap — even free for the taking in state and national forests. In Missoula County, more than half of the 23,000 households now burn wood, a Health Department survey found.

A black, cast-iron wood stove in the living room remains for many here a symbol of thrift, American energy independence from both foreign oil cartels and native power companies, and a willing reversion to a simpler, more natural lifestyle.

Wood-stove emissions can be cut down by using catalytic converters, similar to those in automobiles. They increase a stove's temperature so that more of the wood is consumed, but emit some other pollutants of their own, including small amounts of sulfuric acid.

Another potential clean-burning method is to replace inefficiently burning logs with wood pellets that can be slowly funneled into the stove from a hopper.

But both methods mean costly investments. "They're just another string government is tying to us," said Mattis, who said he is considering moving to Alaska. Things are "freer up there," he said.

But because the health hazards of wood-burning have not been established conclusively, the regulations infuriate many local wood-burners who invested a substantial amount of money in the stoves and now rely on them as their primary source of heat.

They have formed their own pressure group, United Woodburners (Mattis, for a time, was the president), and have launched a petition drive to repeal the regulation.

*SAME IN VAIL, COLORADO

IN ACCOUNT WITH

SEASIDE STOVE'S
4' S. FRANKLIN
SEAS..E, OREGON 97138
503-738-7464

26

Dear Mr James Peterson

As a small business man in the wood stove business, I can't understand how I can stay in business.

The D.E.Q. rules on the 7/3 proposed standards, I don't think is fair atall it will force Non-Catalytic Stove out of Oregon & people can still get any thing They want in Wash & Calif.

Why can't we get Together with a set of rules that will help us all! (not just catalytic)

We Retailers are really in Trouble

Thank you
Tom Baker

27

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MAY 07 1984

PUBLIC AFFAIRS

HOMESTEAD RESEARCH, INC.

Woodstove Emissions Hearing Officer
Department of Environmental Quality
Box 1760
Portland, OR 97207

May 4, 1984

Dear Madam,

The following is my testimony with regard to the proposed Woodstove Emission Regulations being promulgated by the Oregon Department of Environmental Quality:

After spending nearly five hours a year ago in a room with DEQ staff discussing woodstove design, installation, efficiency and emissions it became crystal clear to me that the staff did not want to be bothered by facts. Their mission was clear; the ultimate goal of the agency staff was to close down the Woodstove industry in Oregon.

Today I can only say let's get on with it! Set the toughest standard and the highest costs for testing and do it as soon as possible. My business will be better than it has ever been. Finally, I will get even for all those stove sales lost to Oregon because of the Washington Sales Tax. Hooray for the DEQ! Us bootleggers are going to clean up!

We had always thought we might someday open a quality stove shop in Portland. The DEQ has made our decision for us. Nobody in their right mind would dream of going into the stove business today in Oregon. Oregon's reputation as a foe of industry, even homegrown industry, is safe indeed.

Long live the DEQ!

Sincerely,

Carl D. English

Carl D. English, President

AT THE ENGLISH FARM/EAST MILL PLAIN, 17908 SE FIRST ST., CAMAS, WASHINGTON 98607 206/256-2465

28

F. L. ZIMMERS REALTY

LAND OF ENCHANTMENT

304 N Main Street
Myrtle Creek, Oregon 97457
Bus. 863-5264 · Res. 863-3392

RECEIVED
MAY 07 1984
PUBLIC AFFAIRS

May 3,1984

Department of Environmental Quality
Public Affairs Section
P.O.Box 1760
Portland, Ore. 97207

Dear Sirs:

Having read the article about wood stoves in the Roseburg News Review, I have decided to let you know my feelings on the matter; and I'm sure the sentiments of others in our small community who heat with wood.

As everyone is aware, the cost of using electricity is becoming more and more expensive all the time. Those older citzens on a fixed income are having a hard enough time to make ends meet as it is. Myrtle Creek is a town of about 3000 people within the City limits. Outlying areas within a 10-20 mile radius would constitute about another 7000 households.

The fact that the population is this area is scattered over a larger percentage of land poses no problem in our area as far as wood smoke is concerned. As always, in the past when there has been an issue voted on the cities and towns with the most population carries the issue.

It is my contention that the citzens in less populated areas should not have to abide by decisions made in another part of the State that does not know or recognise the problems we, in the smaller communities have; or don't have, as the case may be.

The Department of Environmental Quality should not be a State mandated entity; but rather each County should be reprensented by an office that is familar with the conditions within that County.

Sincerely,
F.L.Zimmers Realty
Luella M. Zimmers

29

ARROW WOODSTOVES

10340 S.W. Tualatin Rd. • Tualatin, OR 97062 • (503) 692-1500

May 4, 1984

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
MAY 15 1984
AIR QUALITY CONTROL

Environmental Quality Commission
P.O. Box 1760
Portland, Oregon 97217

FOR THE PUBLIC HEARING RECORDS

Dear Sirs:

Arrow Tualatin, Inc. is a manufacturing firm in Tualatin, Oregon who's sole product is woodburning appliances. We have been in this business since 1979, with each year since showing growth and added employees.

Arrow has since introduction of its products strived to improve their performance. It was within that policy that during the Legislative hearings, Joe Chamberlain, the President of Arrow Tualatin, Inc., testified that we would support a program being proposed by the DEQ to control and reduce emissions from woodstoves. The levels that the DEQ proposed, although not being obtained at that time, were felt to be reasonable and achieveable. By the end of 1982, a great deal of research and development work had already been done, so in the Spring of 1983 we were able to market one product that fell into the clean-burning stove category. Much has changed this past year and now we find we may not be able to ever achieve the new DEQ proposal.

When the Woodstove Advisory Committee was being formed, Arrow volunteered to serve as a representative for large woodstove manufacturers but that position was awarded to Fisher Century of Eugene, Oregon. Upon the retirement of their representative, I was appointed as his replacement in December of 1983. During meetings of the Advisory Committee, our position was still of support for the need of an achieveable program. This was not the position of the entire industry. I felt that although the date being presented by the DEQ to the Committee was weighted to support their stand; we would reach an agreeable level at which emission would be set that could be achieved by manufacturers both large and small.

By the last meeting of the Advisory Committee, the entire original DEQ proposed standard and test protocol had been revised several times, this making it impossible for manufacturers to verify the more recent conclusions and assumptions from the test programs.

Environmental Quality Commission

I find now, after the Advisory Committee vote that all was not as presented and feel a bit foolish that I accepted the DEQ statements as being fact. The non-catalyst stove (Jotul 201) did not and will not meet the 9 grams per hour level and that additional tests on a production unit of the catalyst equipped stove (Blaze Princess) would not meet the new DEQ proposed 3 gram per hour level for this category of appliance.

Because of this late information, Arrow Tualatin now feels the E.Q.C. should strongly follow the recommendations of the Wood Heating Alliance in setting an initial standard for July 1986 of 15 grams per hour for non-catalyst stoves and 6 grams per hour for catalyst stoves.

Further evaluation must be performed before a more stringent standard is applied. Along with that evaluation, a program to test fireplace inserts which comprise approximately 60% of woodburning appliances sales in Oregon should be effected as none has been discussed or tested to the proposed standard or protocol.

Please give these thoughts your full consideration.

Richard Sparwasser

Richard Sparwasser
General Manager
ARROW TUALATIN, INC.

RS/jl

30

PORTLAND, OR 972 PM 4 MAY 1984

William R. Day
3713 NE 6th Ave.
Portland, Oregon 97212
May 3, 1984

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MAY 07 1984

PUBLIC AFFAIRS

Environmental Quality Commission
P.O. Box 1760
Portland, Or. 97207

Comments on:
Proposed Woodstove Certification Rules

Re: Proposed OAR 340-21-100 through 340-21-166

Dear Commission Members:

I am a resident of Portland, Oregon who has been involved in wood heating safety, esthetics, and as an energy information resource. During the past fourteen years, I have authored numerous articles, appearing in Rain, Journal of Appropriate Technology and in Home Energy Digest as well as Wood Stove Durability, A Literature Review with Illustrations (1980) Western Sun. During this period of time, I have been employed by various Oregon educational institutions as well as U.S. Department of Energy (Regions IX and X) as a consultant, lecturer, and information resource.

Examination of D.E.Q. wood stove certification, and labeling standards prompts these observations:

I. I feel that Oregon D.E.Q. has misinterpreted the data available in determining "average" emissions characteristics of existing "in use" appliances. I believe their figures to be approximately half (30gr. per hour) the actual emissions rate. The majority of products now in Oregon homes, consists of older, oversized, underdesigned welding shop responses to the 1973-74 energy shortage....not the traditionally efficient Jøtul model 602, the appliance used recently to complete D.E.Q. test data as support for their "base line" emission datum.

II. D.E.Q. recommendations concerning wood fuel species to be used in testing is highly suspect. For instance, Oregon's seemingly "worst case" air shed conditions occur in an area which D.E.Q.'s own survey indicates predominate use of a different fuel than is now touted by D.E.Q as most appropriate.

III. The size and shape of fuel to be used in testing is different from that which is likely to be used by homeowners. Combustion characteristics of dimensional lumber differs a great deal from that of "split" firewood

IV. In order that Oregon Consumers are not required to assume exorbitant costs of wasteful, expensive and often duplicated testing and certification procedures; I propose the following general improvements be made:

1. Use of the Condar Particlulate Sampler instead of Oregon method seven test methodology.

2. Eliminating test data reviews by D.E.Q. personnel could be achieved by relying upon test data reports provided by independent testing laboratories.

3. Periodic "recertification" of a manufacturers product by D.E.Q. may be a simple form of "legalized" graft.

It appears that increased levels of ambiant air particulates may be a direct result of the D.E.Q. proposed 7/3 gr. per hour emission limit. Homeowners are likely to be discouraged by the high cost, reduced selection (maybe zero selection) of available wood heating appliances when obsolete, inefficient, oversized existing product has lost its' appeal and replacement is considered.

Wood burning habits of Oregon homeowners are, in my opinion, much different from suppositions made by D.E.Q. Instead of continuous operation over a twelve to twenty four hour period, appliances are more likely "batch" loaded for operating intervals of 3 to 6 hours. Dramatic changes in stove operation have resulted from continuous industry education efforts.

The Woodstove Advisory Committee chosen by the Environmental Quality Commission to advise D.E.Q. and E.Q.C. concerning proposed regulations has done an admirable job. Deciphering incomplete and often biased data interpretation supplied by D.E.Q. staff was a staggering task. My personal conversations with a number of former Woodstove Advisory Committee members indicate that thoughts expressed in their emission standard recommendation now should be revised to a single standard; 15/6 gr. per hour maximum rate. Fresh, new scrutinization of available data now indicates a need for revision of their terminal recommendation.

Imposition a of 7/3 gr. per hour maximum emission standard on the wood heating industry could have a catastrophic effect upon the thousands of Oregonians who earn all or part of their income providing goods or services to Oregonians as well as citizens in other portions of the U.S.A. For instance; if a physician licensed to practice in the State of Oregon were to be required to guarantee an 80% "cure" for all forms of cardiovascular ailments found in his patients...it's most likely we would lose our most qualified practicioners of this needed healing art. Supporting medical industries could face extinction in Oregon. Not only would this type of legal restriction decimate an Oregon physician's local practice, but most likely would prevent his acceptance of any patients residing outside the State of Oregon.

Thank-you for the consideration and patience required to read my comments.

Sincerely,

William R. Day

William R. Day

31

MI inc.
MARTENSON
INDUSTRIES, INC.
24430 S. Hwy. 99E
Canby, Oregon 97013
(503) 266-2026

May 2, 1984

Margaret McCue
Dept of Environmental Quality
Box 1760
Portland, OR 97207

Dear Ms. McCue:

We at Martenson Industries approve of the 1988 figures for clean stoves that D.E.Q. is proposing. We are confident that we have three or four non-catalytic models of stoves and inserts already in production and tested for safety that will meet the standards.

We do feel that the testing labs and not the Department of Environmental Quality should be the authority to certify the manufacturers as they already have qualified personnel inspecting periodically at the manufacturing plants and could check and, in fact, do already make the necessary inspections that would also affect the efficiency and clean burn.

Please include my opinion for the hearings record for the Environmental Quality Commission.

Sincerely,

Donald S. Martenson

Donald S. Martenson
President
Martenson Industries, Inc.

DM:mm

38

84 Danita Lane
Roseburg, Ore 97470
30 April 1984

Dear Chairman:

It is our opinion, rules are a necessity regarding pollution wood burning stoves emit into the atmosphere.

We reside in a mobile home park where a number of wood burning stoves emit an acrid smoke 24 hours a day. Because the stoves are allowed to smolder, the pollution is much more toxic than smoke from a normal wood burning fire. The smoke causes health problems for many who must breathe the pollution. There is no way it is confined to the user's home, just as there is no way it can be prevented from penetrating another's home who cannot tolerate the pollution healthwise.

Sincerely,
Don and Naomi Parker

33

Genesis Systems
1030 neil creek road
ashland, oregon 97520
(503) 482-3429

To: Mr. Fred Hanson, Director, DEQ 4/24/84

From: Paul Runquist

Dear Mr. Hanson

I feel the need to reflect some thoughts with you concerning the impending woodstove emission standards and the recommendations of the DEQ.

As you know I have been involved with this industry for many years having originally become involved in recognition of the need for an important job to be done ...to find an environmentally acceptable means of utilizing a renewable resource.

I have in fact been so committed to this cause that I have spent thousands of research hours and personal dollars in the quest for a satisfactorily clean burning appliance. Perhaps a flaw in my character has however prevented me from ever feeling satisfied with the progress I have made. I have thereby never commited to significant production scale as a matter of conscience and pride.

I know for a fact that my efforts to achieve clean burning in a appliance without degradable parts have been successful. The limited data on my appliance (non-catalytic) implies a test performance of about 10 g/hr. I am not satisfied with this however and might have been able to do better.

I have, however, decided to close down my business as it appears to me that the policy of your staff is to seek unreachable limits ..without concern for the "optimum" and with no safety net. I could not have sat across from John Kowalczyk for dozens of meetings and not gathered that, as he stated on occasion, his attitude was that woodstoves are without merit and should be eliminated. I personally feel that Mr. Kowalczyk's brand of extrapolation of fact, or the lack of it, is particularly dangerous in a public agency. It seems that industry suppression will be a continuing policy as long as his opinions are accepted without scrutiny. I am sure that you are becoming aware of this problem.

I do not wish to imply that the DEQ staff has been unreasonable as a whole. I have a high respect for the diligence of your staff especially Barbara Tombleson and Merlyn Hough. They have worked long and hard and listened.

I must now look to the future and seek a new course. I am sorry that we have never had a significant opportunity to sit and discuss matters personally. I do wish to encourage your increased awareness of your staff and that above all, as you steer the course of DEQ in coming years fairness and truth shall be the objectives of your department. You are thrown into a difficult position at a difficult time. I see that you are trying.

Good luck

Paul W. Runquist

Paul W. Runquist

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
APR 26 1984
OFFICE OF THE DIRECTOR

34

Please enter this into public record

RE: Pending Woodstove Legislation

In 1973, my government asked me and millions of other Americans to conserve. Being Oregonians, and naturally independent and energy concious, we sold our gas guzzler autos and purchased our not so luxurious but gasoline efficient economy cars. We turned our thermostats down at night, installed storm windows, added to the insulation in our houses, installed woodstoves to supplement our gas, oil or electric heat, and even put bricks in our toilets.

We did all of this to conserve. And in fact we did such a good job that last year alone, we Oregonians conserved 110 million dollars worth of natural gas, electricity, and oil.

I think we did a good job. However it appears you are now going to tell me that you want me to stop. Well, I admit I will take the brick out of my toilet, however, I like my smaller heating bills. I have no intention of going back to my previously wasteful ways.

I do not support this legislation in it's current state. This legislation will effectively BAN woodstoves from Oregon, since by DEQ's own admission there is no current technology to meet the proposed standard. I feel that we Oregonians are being penalized for doing such a good job of conserving when we were asked.

If this is the course our elected and appointed officials are to take, all that I can say is, don's ask me to pitch in for the "common cause" again because I WON'T.

Jody L. Smith
11055 SW 119th
Tigard Oregon 97223

35

PLEASE ENTER THIS INTO PUBLIC RECORD

RE: WOODSTOVE REGULATION

As an Oregonian, I am very upset that is apears that yet another freedom is being taken from.

I am a woodstove owner and have used wood heat as a supplement for several years.

This legislation, in my opinion will definitely help the economy of our surrounding states, since we Oregonians will now have to purchase woodstoves outside of Oregon. I would prefer to spend my money in my own state, especially in this failing economy, however, I will not purchase a catalytic woodstove. These units require an enormous amount of maintainence, including cleaning the carbon ash build-up as often as every month. A catalytic woodstove also costs 3-400 dollars more than the type of stove I now have.

There are alternatives. A reasonable standard for woodstoves could be set, allowing a variety of stoves to be sold in Oregon, not just catalytics.

Obviously, I along with many others will continue to use wood as a source of heat and independence, however if this legislation is passed in it's current state, I will be doing my shopping in Vancouver.

Gary Reid

Gary Reid
11725 SW 67th
Tigard Oregon 97223

Please put this into Public Record.

PUBLIC HEARING

"Proposed rules for limiting air-pollution from woodstoves"

I am a native born citizen of Oregon. I do not believe the proposed DEQ standards for "clean-burn" stoves will be an effective tool in controlling air pollution for the following reasons;

1. The standards are not attainable by the Woodstove industry (dirty stoves will be purchased out of Oregon and brought into Oregon).
2. Catalytic stoves are too expensive and will not be purchased by the Oregon woodstove consumer.
3. Catalysts for woodstoves need special care to operate and maintain and the average consumer will not follow the proper steps to keep the catalysts maintained.

I do not believe in this legislation and will not support it.

Sincerely yours,

Robert E. Loper

Robert E. Loper
15630 S.W. 88th
Tigard, Or 97223
620-5070

No address

37

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MAY 03 1984
PUBLIC AFFAIRS

Roseburg Oregon
May 1 1984

Department of Enviromental Quality.

Dear Sirs,

Some of you accomplishments have been good and the results beneficial. There seems to be a tendency to overreact along some lines. This wood stove regulations seems to be one such case. There is no concrete evidence that such regulations are needed. There wont be one homeowner out of twenty five who will give up the convenience of gas or electric heating to bother with wood stoves.

Therefore why burden these few with needless regulations? Many of these "few" are in the lower income group and should not be forced into expensive equipment buying.

Thank you for listening to me. I am in this lower income group,

V. K. Holcomb

38

Wood 'n Energy
SOLID FUEL JOURNAL

(603) 528-4285
Outside NH:
(800) 258-3772
PO Box 2008 Laconia, NH 03247

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APR 27 1984
PUBLIC AFFAIRS

Environmental Quality Commission
DEQ Public Affairs Section
P.O. Box 1760
Portland, Oregon 97207

Wood Heater Emissions Regulations

Wood 'n Energy is the wood heating industry's leading trade journal, circulated to 32,000 retailers, distributors and manufacturers nationwide. For the past four years, we have covered the progress of emissions legislation thoroughly. We also sponsored a conference in Oregon during late October that brought DEQ staff, the Woodstove Advisory Committee, and Wood Heating Alliance and more than 200 concerned industry representatives together for the first time.

Each month, we talk with more than 800 members of the industry, gaining insight and opinions on topics on concern. Wood 'n Energy would like to comment on the proposed emissions regulations from that perspective.

First, it is critical to understand the scope and nature of the industry. According to our records, there currently are 375 manufacturers of wood heaters, down from 550 in 1979. These manufacturers are small: 68 percent manufacture under 4,000 units annually. Some 27 percent grossed under $500,000 last year; 50 percent under $1 million. Many are small metal fabricators. Even today's leaders started humbly: Vermont Castings, for example, started with a pair of frustrated stoveowners. Fisher-Century by a man welding stoves out of his garage in Oregon. All but a handful of companies in this industry started small.

Despite their relatively small earnings and production volumes, there is significant concern about emissions. In a survey conducted in March 1984, an amazingly high 92 percent of the manufacturers surveyed considered emissions as "important"; with 21 percent saying it is "most important" and another 43 percent saying its "very important."

We also asked manufacturers what they planned to do about emissions. Some 89 percent are taking action.

Q: Is your company...

Marketing a Catalytic Unit	16%
Developing a Catalytic	13%
Considering Developing a Catalytic Unit	19%
Considered But Decided Not To Go Catalytic	14%
Marketing a Non-Catalytic Cleanburner	11%
Developing a Non-Catalytic Cleanburner	12%
Considering a Non-Catalytic Cleanburner	4%
Not Doing Any Cleanburning Research	11%

Q: If you decided _not_ to develop a catalytic unit, why not?

Not Convinced with Performance	43%
Durability Problems	29%
No Consumer Demand	20%
Too Expensive to Sell	18%
No Dealer Demand	16%
Not Enough Technical Data Available	12%
Other Reasons	33%

It is clear that there is considerable concern about emissions. It is also clear that support for catalytic technology among manufacturers is not universal. Manufacturers think they can make more efficient heaters _without_ them. This is more apparent in the answer to the second question, with nearly half of the respondents concerned about performance and/or durability.

In a survey we conducted among retailers, compiled in early April, we found many of the same concerns. Approximately 56.1 percent of the polled retailers carry catalytics (up significantly a survey conducted in November 1982 when 23 percent were retailing catalytic equipment). Among the 43.9 percent not carrying catalytics, the following reasons were cited for not stocking them:

Lack of Consumer Demand	92.9%
Too Expensive	67.1%
Durability Problems	65.9%
Unsure About Performance	52.9%
Carried Once But Dropped	10.6%

Take note of the final response. It is significant that such a large percentage of retailers have rejected technology that has been commercially available in a sizeable number of models for such at limited amount of time.

Catalytic technology is excellent way to boost efficiency and many catalytic stoves have proven to be extremely efficient. Unfortunately, there are too many stove owners who do not adhere to operating instructions that are required to make combustor technology effective. Note the large number of stove-related fires, for example, despite fire safety campaigns, CPSC labels on stoves, and UL testing. It is important for this industry -- and consumers -- to have an option.

The fear that the DEQ's proposed 7/3 standard for 1988 implementation will eliminate progress in non-catalytic technology is is well-founded. Manufacturers, we find, are looking for high performance stoves without catalytics. Retailers seek to sell such units.

Oregon's 450 retailers will suffer the most from this standard. Again, all are small businesses (with 60 percent grossing under $100,000 in stove sales). For most, it means a total replacement of their stock in a short period. The publicity also is taking its toll. Some of the state's best retailers are hinting strongly that they will close their doors shortly. If the standard mandates small stoves or only catalytics, the attrition rate will grow.

We also would like to point out a major statistical discrepancy, one that affects DEQ's recommendations for airshed particulate reduction. It concerns the number of wood stoves in use in the state. According to the Oregon Department of Energy's 1983 annual report, one-third of the state's households own a wood heater. DEQ, on the other hand, estimated in testimony given an April of 1983 (using 1982 data as opposed to DOE's 1983 data), that 55 percent of the state's households (250,000 stoves) are in use. The discrepancy is 50,000 stoves -- a considerable difference. Our discussions with manufacturers put the figure much closer to Oregon DOE estimates. Based on such unsound data -- on which two state agencies cannot agree -- DEQ's 7/3 recommendation, which it contends will cause an 80 percent reduction in emissions, is unfounded.

Your decision has national ramifications. As of April 13, 1984, Colorado has become the second state to adopt a certification program. Health Department officials say they are likely to adopt the Oregon standard as their own. Many mountain towns in other states will ditto your standard as well. It is critical that it be a fair one.

The Oregon Woodstove Advisory Committee's work is a commendable effort. That a diverse group of health officials, fire commissioners, environmentalists, clean-burning stove makers, and retailers could unanimously agree on any common ground speaks for itself. Wood 'n Energy urges you to adopt their recommendation.

39

MI inc.
MARTENSON
INDUSTRIES, INC.
24430 S. Hwy. 99E
Canby, Oregon 97013
(503) 266-2026

April 25, 1984

Department of Environmental Quality
Public Affairs Section
P.O. Box 1760
Portland, OR 97207

Dear Sirs:

I have received your recent test information and as a manufacturer I am concerned that it is not clear about allowing a chimney damper for a non-catalytic stove.

It has been our experience in years of designing and testing wood stoves that for maximum efficiency, it is very desireable to have a chimney damper.

Pamphlets on wood stoves produced by Oregon and Washington and also some test laboratories indicatethat a damper approximately 36 inches above the stove helps to provide maximum efficiency.

We hope you will see fit to make this available as part of the testing criteria.

Please let me hear from you about this important factor.

Sincerely,

Donald S. Martenson

Donald S. Martenson

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APR 27 1984

PUBLIC AFFAIRS

40

PLEASANT PRAIRIE FARMS
CUSTOM MANUFACTURING INC.

RT. 2, BOX 29 SPOKANE, WASHINGTON 99207 509-489-5476

CONTRACTOR'S LICENSE NO. 223-01-PLEASI * 229JE

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APR 27 1984

April 18, 1984

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
APR 27 1984
OFFICE OF THE DIRECTOR

PUBLIC AFFAIRS

Department of Environmental Quality
522 Southwest 5th Ave
Portland, Oregon

Attn: Fred Hansen, Program Director

As a manufacturer of Catalytic woodstoves and inserts, we have for a long time felt the need for cleaner burning stoves and for cleaning up the pollution problem caused by wood burning. We feel that the proposed implementation of the Oregon law has some very definite problems. Two of which I feel require some immediate attention to prevent a legal challenge.

The first is the proposed discrimatory standard between catalytic and non-catalytic stoves. Besides the obvious discrimination aimed at the catalytic stoves, the permitting of non-catalytic stoves to emit as much as 15 grams is not going to assist in accomplishing the goal as stated in the 'Background and Problem Statement'. Under the proposed performance standards it is possible that a catalytic stove might fail by a few points to pass the proposed standard and yet a non-catalytic with twice the emmissions would pass.

The second problem we wish to address is what is termed the certification fee schedule. The certification fee schedule would be in addition to the testing fees. We declare that this schedule is discrimatory in that it places a heavier burden on the small manufacturer on a per stove basis, while permiting the larger, high volume, high promotion manufacturer to operate in the state for exactly the same fee. We would strongly recommend a per stove fee instead of the lump sum certification fee.

Additionally in order to achieve the stated goal we feel that it is going to be necessary to regulate not only the sale of new stoves, but to monitor the use of existing stoves. Regulation of the sale of new stoves can not correct a problem that already exists which is being created by the use of "dirty stoves" which have a life expectency of 20 or more years. Even as they are replaced,the older stoves will be sold as used stoves and used in the same area.

David E. Gramlow, President
copies to Mike Sciacca WHA, Barbara Tombleson DEQ

41

The Earth Stove®

April 24, 1984

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
APR 26 1984
OFFICE OF THE DIRECTOR

Mr. Fred Hansen, Director
Dept. Of Environmental Quality
522 S.W. 5th
Portland, Oregon 97207

Dear Mr. Hansen:

My name is John McIntire. I am founder and Chairman of The Board of The Earth Stove, Inc. based in Wilsonville, Oregon. Our company is one of the pioneers of this Oregon industry. I have been, for obvious reasons, very much involved in the discussions as well as the advisory committee meetings since the beginning of work on the proposed Oregon standard. This letter therefore is based on a fairly good working knowledge of the content and intent of the proposed Oregon standard.

With that introduction, I would like to say that the proposed Oregon standard has some very unfair and unworkable aspects to it. I will start with the 84-86-88 phase in. At this point in time, the consumer as well as the dealer of our products is thoroughly confused as to what, if any, the current standard is, and what will meet the standard in 1986 as a result of the indiscreet handling of published information by the D.E.Q. and the media. We all have paid a substantial price for this confusion through lost sales. The phase in only prolongs this confusion for 4 more years.

Secondly, the emissions levels proposed by this 3 step standard suggest that there is some emerging technology that is going to be able to meet that standard by 1988 (7-3). Frankly, there is no one in this industry that believes this is possible or that there is any emerging technology, either catalytic or high tech, that can meet 7-3 by 1988.

My comments do not suggest that we have not put sufficient effort behind R & D. We are offering this season, a catalytic stove recognized as employing the most advanced technology available. Further the proposed standard is highly discriminatory in that it does not address manufactured fireplaces, which are woodburning devices found in greater numbers in this state than wood stoves. The proposed standard, which has been hastily drafted, stands to damage an Oregon based industry with a considerable employment

The Earth Stove, Inc.
Bldg. C-7, 9775 S.W. Commerce Circle, Wilsonville, Oregon 97070 Ph. 503/682-3384

base which also represents in excess of $50 million in exports from the state. From the industry's point of view, the standard represents a silent ban of wood stoves in Oregon, a position not fairly representing the independent nature of the people of Oregon. I suggest that more time is needed to draft a reasonable standard that meets reasonable objectives and considers fairly the problems and technical constraints facing our industry.

Respectfully Yours,

John E. McIntire

John E. McIntire

Footnote: This letter is available for public access.

42

SWEET HOME T.M. STOVE WORKS

Sweet Home Stove Works, Inc.
1307 Clark Mill Road
P.O. Box 233
Sweet Home, Oregon 97386
(503) 367-5185

April 23, 1984

Fred Hansen, Director
Department of Environmental Quality
P.O. Box 1760
Portland, Oregon 97204

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
APR 25 1984
OFFICE OF THE DIRECTOR

Dear Fred:

About a year ago, we carefully reviewed the proposed legislation to regulate emissions from woodstoves sold in Oregon. Even though we felt a strong commitment to design and market clean-burning appliances, we could not support that legislation for a variety of reasons. Of those, our overriding concern was that there simply was not sufficient information available on which to base such legislation. The recent decision by your department to recommend an emission standard of 7/3 grams per hour in 1988 has confirmed our worst fears.

I attended every meeting of the Woodstove Advisory Committee since early last October and was generally pleased with the care with which that committee carried out its duties. On the evening when they voted to recommend an emission standard of 15/6 in 1986 and 9/4 in 1988, it was quite evident that the industry representatives supported that motion with great reluctance. The test data available at that time demonstrated that meeting the 1988 standard would be extremely difficult for all manufacturers. Furthermore, that standard seemed to be a clear mandate for adopting the catalytic technology - a technology which is, in my opinion, much too young to rely on. In view of these facts, the more restrictive emission standard you are recommending seems indefensible to me.

Since the final meeting of the Advisory Committee, several issues have surfaced which, in my opinion, raise serious doubts about whether even that committee's recommended rules will actually achieve their ultimate objective - to significantly improve air quality. Of these, several are particularly important:

1. There is no nationally recognized reference standard for measuring emissions from wood-burning appliances. Furthermore, the two most likely candidates rely on different physical principles and give very different emission levels when performed simultaneously on the same appliances. It will be at least a year before the American Society for Testing and Materials will even have a draft proposal available.

2. No statistically significant emission level has been established for the baseline appliances currently owned by Oregon residents.

3. The model developed by DEQ to predict ambient air quality is riddled with assumptions of arguable validity. Consequently, the requirement that woodstove emission levels be reduced by 80% is open to serious questions.

4. The data used by your staff to defend 3 grams/hour is based on one test of a prototype appliance which is not being marketed. In earlier tests of that same appliance, emission levels were much higher. A production model of that stove would not even meet the proposed 1986 emission level in tests conducted during October of last year.

Taken together, these uncertainties suggest that the Department of Environmental Quality should proceed with caution in arriving at recommended emission levels. Replacement of existing woodstoves with clean-burning models has always been a cornerstone of the department's strategy to improve air quality. Clearly, any regulatory action which reduces the industry's ability to replace those appliances is counterproductive.

It is my belief that the best strategy for significantly improving air quality in Oregon is comprised of the following steps:

1. Set an interim standard of 15/6 grams per hour beginning on July 1, 1986.

2. Beginning immediately, assist the ASTM in adopting reference test methods for both emissions and efficiency.

3. Using those reference methods, gather data both on existing baseline appliances currently owned by Oregon residents and on clean-burning appliances. (This need not be the sole responsibility of your department.)

4. Once a solid data base has been established, it will be apparent whether further tightening of the interim standard is warranted.

I am, of course, aware that my proposal differs fundamentally from the one adopted by your department. Nonetheless, I strongly believe that it is the only strategy which can guarantee significantly reduced emission levels from wood-burning appliances. The absence of sound scientific data in so many areas can only be dealt with by taking the time to resolve those uncertainties. The fundamental difference between the above approach and the one recommended by the DEQ is that my plan gives everyone time to learn what is technically possible before the standard is finalized. In particular, it will enable those of us in the industry to learn how to design and market appliances which are clean burning as well as being attractive to consumers and reasonably priced.

Sincerely,

Robert W. Chapman

Robert W. Chapman
Technical Director

43

InterMountain Ambient
P.O. Box 5106 □ Missoula, MT 59806 □ (406) 543-6174

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
APR 23 1984

AIR QUALITY CONTROL

April 16, 1984

Ms. Barbara J. Tombleson
Area Source Control Specialist
Air Quality Division
Department of Environmental Quality
P.O. Box 1760
Portland, OR 97204

Barbara:

RE: DEQ Wood Stove Testing Program

At the close of the meeting in Eugene on April 11th, I quickly mentioned several additional questions we have about the DEQ's proposed testing procedure. All of these questions center around the accuracy requirements of the testing procedure. I will deal with our questions on a Secion by Section basis.

1. Sec.3.11.3 (p.6) Audits

Audit frequency is specified before, after and within each two hour intervals during the test.

If the instruments are to be as accurate as stated in Sec. 3.6.3, shouldn't an audit prior to and/or after each test cycle be sufficient. Instruments rarely drift out of control and then back into control that quickly. Usually if an instrument goes out of control it will continue its drift out of control. Thus, an audit at the start and/or end of each test would seem to be sufficient to validate a test cycle, for if the instrument exceeds the audit control limits of ± 5.0% specified in Sec. 3.11.3.c, the data is to be discarded. What this really means is starting the test cycle all over again. So, other than to provide an additional measure of accuracy, it makes no real difference to wait and do an audit point at the end of the test cycle. For if an analyzer is within the ± 5.0% control limits at the end of a particular test cycle, there is a very good chance that the unit has been within control limits during the entire test cycle.

2. Sec. 3.11.3.c (p.6) Audit Control limits of ± 5.0%.

This is very tight! I don't know of one other set of regulations that requires audits to be within ± 5.0%. Most are ± 15.0%. This desired degree of accuracy (± 5.0%) is going to be very expensive, especially since the data for the test cycle in question must be discarded if an audit exceeds the ± 5.0%.

Certainly this degree of accuracy will provide the manufacturer and the DEQ with very reliable information about the emissions amd efficiency of a particular stove. But is that degree of accuracy really necessary for the wood stove program to be successful. What would happen if the control limits were relaxed to $\pm$ 7.0%, $\pm$ 10.0 or even $\pm$ 15.0%? I think a cost/benefit analysis is in order here.

3. Sec. 340-21-165(5) (p. 32 - Lab Certification Requirements) Audit Test of Certified Stove

We have several questions about this section. They are:

1. What will be the audit control limits for DEQ's audit of a stove tested by an accredited lab?

2. How have (or are) these limits going to be established?

3. What will happen if a stove fails an audit?

None of the answers to these questions are contained in The Laboratory Accreditation requirements. Yet the answer to each question we feel is critical in the formulation of a complete picture of what DEQ really has in mind as far as accuracy is concerned. We certainly do not intend to make ourselves vulnerable to a civil penalty or have to repeat a large number of tests just because one stove should fail an audit.

We firmly believe that the DEQ needs to give this particular area a great deal of thought and propose some guidelines so that the Labs know exactly what they are getting into. As it stands now, we have absolutely no idea of what to expect.

I would like to suggest that the DEQ have at least four (4) accredited Labs conduct at least five (5) tests on a "generic" stove of the DEQ's chosing and that the results of these tests be used to establish interlaboratory control limits for the stoves audited by the DEQ. (This same stove and control limits could then be used by the DEQ to accredit labs.) As it stands now only one lab has done testing using the proposed testing method. Certainly the results indicate that the data is precise, but is it trully accurate? By conducting the tests I have suggested, the DEQ would be able to ascertain if the data was accurate.

Before continuing, let me state that we have no reason to doubt the accuracy of DEQ's data. We just do not have any information that establishes the verifiable accuracy of the data or the testing method. The whole testing process is filled with places where errors can creep in, instrument response time, instrument performance less than that specified by manufacturer, etc., and these errors can result in test data being less than trully accurate. Thus, we feel uncomfortable about the DEQ using limited test data from just one lab to establish control limits for accreditation and/or audits.

We would also like to know the instrument specs for the dilution gas monitor, so that we can insure we have the correct instrumentation.

Janice and I enjoyed the meeting on April 11th, and felt that we learned quite a lot from it. Personally I feel that give and take meetings such as the one on the 11th are much more productive than formal hearings.

I have also talked with RG (Raphel Guillen) and we still do want the stack velocity pressure and sampling rate differential pressure data for the confirmation tests. We are definitely going to try to certify the EMRC Gas Flow Monitor as an equivalent method for at least the higher velocity tests so the above data will be of value to us.

I certainly enjoyed talking with you again and we look forward to working with you and the other members of DEQ in a successful stove testing program. If you have any questions about the issues I have raised in this letter, please do not hesitate to contact me.

Sincerely,

Ben Myren (im)

Alben T. Myren Jr.
V.P.-Operations

ATM/im

Blaze King

WOODCUTTERS MFG., INC.

April 18, 1984

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
APR 20 1984
OFFICE OF THE DIRECTOR

Fred Hanson, Director
Department of Environmental Quality
Box 1760
Portland, OR 97207

Dear Mr. Powell:

This letter expresses our concern over the proposed Oregon Woodstove Certification program.

While we could differ with the standard in many areas, in general we find that the DEQ has done a remarkably good job of balancing the often divergent views of government, industry and the consumer.

One provision, though, causes deep concern. That is the emission standard to take effect on July 1, 1988. The 7/3 half of the dual stage standard is totally unrealistic.

We see a number of questions still unanswered.

1. DEQ statements of catalytic stove capabilities are based on only one prototype stove.

Our company supplied the prototype catalytic stove used by DEQ since July, 1982. All published DEQ figures for potential catalytic performance are based on extensive testing of that prototype stove. A production Blaze King, adjusted to burn at a rate consistent with consumers expectations, has not been tested by DEQ.

2. The 7/3 non-catalyst spread is based on a first generation catalyst.

The suggested spread for non-catalyst/catalyst stoves reflects the degradation rate for Cornings 6000 hour catalyst. (Oregon has calculated a 5000 hour conversion of 80%. Corning measured 88% at 5000 hours, which would significantly change both sides of the figure.) Cornings present 12,000 hour catalyst, warranteed for three years in Oregon-certified stoves, has not been age tested. With its warranteed longer life, we feel a narrower spread would be more accurate.

3. Multiple control non-catalytic models require constant operator attention for a consistently clean secondary burn.

The catalysts age-related efficiency decline is factored into the proposed standard. Therefore, the non-catalyst standard should include a factor for the stove owners who will neglect to operate their units in the cleanest mode possible.

RT. 4, BOX 218 • WALLA WALLA, WASHINGTON 99362 • (509) 529-9820

4. Poor model selection among true "home heaters" will force bootlegging.

Woodburning appliances are purchased to heat homes. Small pieces of fuel, low capacity fireboxes and short burn times are inconsistent with the perceived needs of the consumer. The proposed 7/3 standard will allow so few stoves that consumers desiring "home heaters" will be forced to go out-of-state to purchase units produced to no standards at all.

A higher standard would allow a larger number of manufacturers to compete, thereby potentially achieving the same goal.

5. The DEQ assertion that conventional stoves will be "available in some inexpensive versions ($99)" is very questionable.

It is doubtful that importers or manufacturers will spend more than $7,000 to certify a stove retailing for $99. For that matter, will consumers purchase such a cheaply made, super-small stove, even at $99?

We believe the proposed 7/3 standard is not in the best interests of the people of Oregon and strongly urge that consideration be given to changing it.

We request that this letter be read into the record of the Public Hearings.

Sincerely,

Hal Larson

Hal Larson
President
WOODCUTTERS MFG., INC.

HL:ss

cc: John Powell
P.O. Box 12459
Salem, Oregon 97309

45

City Of Union

P.O. Box 529
Union, Oregon 97883

City Hall Offices
342 S. Main
Phone (503) 562-5197

April 10, 1984

RECEIVED
APR 12 1984
PUBLIC AFFAIRS

DEQ
Public Affairs Section
P.O. Box 1760
Portland, Oregon 97207

On April 9, 1984, the City Council met and discussed the proposed woodstove certification rules being considered by the Oregon Department of Environmental quality.

A sentence under the paragraph heading "Need for this rule" sums up the Council's feelings the best regarding the proposed rules. Quote - - "It is needed in urban areas of the state to reduce violations of particulate and carbon monoxide air quality standards designed to protect against adverse health and welfare impacts." The key word here is URBAN! Many of the regulations adopted because of environmental conditions in the Willamette Valley corridor do not have a similar environmental impact in rural areas of eastern Oregon such as Union or the Grande Ronde Valley.

Air dispersal patterns documented by the Eastern Oregon Experiment Station in Union indicate that the Grande Ronde Valley suffers very rarely from atmospheric inversions during winter seasons when woodstoves are being used. On the contrary, the wind in this area nearly blows us off the map!

It is with this information at hand, that the City Council opposes the implementation of woodstove certification rules on stoves sold in rural eastern Oregon. The Council would consider their input on this matter effective if a waiver of these rules could be applied to all stoves manufactured for the eastern Oregon area and the rules, as proposed, implemented for the urban areas described in the "Statement of Need." Thanks for the opportunity to comment!

Sincerely,

Floyd Parrott, City Administrator

Oregon Department of Environmental Quality

A CHANCE TO COMMENT ON . . .

Proposed Adoption of Woodstove Certification Rules
Notice of Public Hearing

Date Prepared: March 20, 1984
Hearing Dates: May 1, 2, & 3, 1984
Comments Due: May 4, 1984

IS ...FECTED:

1. Residents of the State of Oregon who may buy a new woodstove in the future;
2. woodstove retailers and dealers who intend to sell new woodstoves in the State of Oregon;
3. woodstove manufacturers who manufacture with the intent of having their woodstoves sold in the State of Oregon; and
4. independent testing laboratories.

WHAT IS PROPOSED

The Department of Environmental Quality is proposing rules to be added to OAR, Chapter 340, Division 21, Sections 100-166, Woodstove Certification, that would be used to administer the Oregon Woodstove Certification Program which was authorized by the 1983 Oregon Legislature.

WHAT ARE THE HIGHLIGHTS:

The Department of Environmental Quality (DEQ) is proposing to establish emission standards and test procedures for certification of new woodstoves sold in Oregon after July 1, 1986. Interested parties should request a copy of the complete proposed rule package. Some highlights are:

1. Emission performance standards would be established for new woodstoves offered for sale or sold during the period:

   A. July 1, 1986 - June 30, 1988 - 15 grams of smoke emitted per hour (grams/hour) for non-catalytic woodstoves; 6 grams/hour for catalytic equipped woodstoves. This represents about a 50% reduction in smoke compared to conventional stoves.

   B. July 1, 1988 - on - 7 grams/hour for non-catalytic woodstoves; 3 grams/hour for catalytic equipped woodstoves. This represents about an 80% reduction in smoke from conventional stoves.

2. Criteria and procedures would be established for testing new woodstoves for efficiency and for compliance with the emission performance standard.

3. Two labels would be required for each certified woodstove:

   A. A permanent label that would describe the tested emissions and efficiency of the stove over the range of tested heat outputs.

   B. A removable point-of-sale label that would describe the average emission and efficiency of the stove, the range of tested heat outputs, and would compare the stove's performance to the Oregon emission standard.

4. Criteria and procedures would be established to accredit independent testing laboratories to test new woodstoves for emissions and efficiency.

5. A certification fee schedule would be established:

   A. $1600.00 fee for the first model a manufacturer submits for certification.

   B. $ 800.00 fee for each additional stove a manufacturer submits for certification.

6. Criteria and procedures would be established for enforcement of the program.

HOW TO COMMENT:

Copies of the complete proposed rule package may be obtained from the DEQ Public Affairs Section in Portland (522 S.W. Fifth Avenue) or the regional office nearest you. For further information contact Margaret McCue at 229-6488.

A public hearing will be held before a hearings officer at:

City	Time	Date	Location
Portland	2:00 p.m.	Tuesday, May 1, 1984	DEQ Conference Room 522 S. W. Fifth Room 1400
	7:00 p.m.	Tuesday, May 1, 1984	Multnomah County Courthouse, Room 602 1021 S. W. Fourth
Bend	2:00 p.m. and 7:00 p.m.	Wednesday May 2, 1984	City Hall Conference Room 710 NW Wall
Eugene	2:00 p.m. and 7:00 p.m.	Thursday, May 3, 1984	City Hall 777 Pearl Street
Medford	2:00 p.m. and 7:00 p.m.	Thursday, May 3, 1984	Jackson County Courthouse 8th & Oakdale Streets
Pendleton	2:00 p.m. and 7:00 p.m.	Thursday, May 3, 1984	Blue Mountain Community College Morrow Lecture Hall

P.O. Box 1760
Portland, OR 97207

FOR FURTHER INFORMATION:

Contact the person or division identified in the public notice by calling 229-5696 in the Portland area. To avoid long distance charges from other parts of the state call 1-800-452-7813 and ask for the Department of Environmental Quality.

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OMNI ENVIRONMENTAL SERVICES, INC.
10950 S.W. 5th Street — Suite 245
Beaverton, Oregon 97005
(503) 643-3755

OMNI

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
APR 10 1984
OFFICE OF THE DIRECTOR

Mr. Fred Hansen, Director
Oregon Department of Environmental Quality
P.O. Box 1760
Portland, Oregon 97207

April 5, 1984

Dear Mr. Hansen:

I am writing to express my concern regarding the DEQ proposed woodstove emission limits. Because of my experience in woodstove research for industry and throughout the DEQ testing programs and my membership on the EQC advisory committee, I feel my comments should be of value and can be considered qualified. I also participate in the national woodstove trade association (Wood Heating Alliance) technical committees which provide insight into research programs across the country and a perspective of the manufacturer's viewpoint. In addition, I have 15 years experience in the air quality field consulting to industrial and government clients regarding development of regulatory strategies, prevention of significant deterioration program compliance, and the evaluation and control of source emissions.

I've decided to address your office and the EQC because of my sincere concern that the DEQ proposed 1988 "7/3" standard is unworkably stringent. I believe implementation of this "7/3" standard will jepordize the effectiveness of the program and virtually eliminate a viable industry in Oregon. Specific comments regarding my concerns are as follows:

* The intent of the legislature in requiring the formation of the woodstove advisory committee was to provide a forum for the in-depth study of the complex woodstove emission control issues by air quality experts and industry and public interests. With a balanced make-up, consensus decisions made by the committee were to be viewed as the most beneficial to the overall public interest. After over 20 committee meetings, which included detailed and exceptionally complete presentations by DEQ staff, endless hours of discussion and document review, and extensive independent investigations by committee members there is no doubt that this committee represented the most informed body in the world on how woodstoves should be tested, what the limits of woodstove technology are, and impacts of woodstove emissions on local airsheds. It must emphasized that the deliberations of the committee were especially difficult since it is the first effort ever to reduce emissions from woodstoves on a statewide scale. The

success of this program and its ultimate effectiveness will have implications of national and international scope. A serious mistake in judgement at this point in time will jeopardize developing programs everywhere even future programs developed around other types of sources in Oregon.

* A complete review of committee meeting minutes will clearly show that decisions made by the committee were truly consensus determinations with concessions and compromise by all parties involved. This is especially true for the committee recommended 1988 standard of "9/4". "9/4" is in itself a very stringent standard not obtainable by the overwhelming majority of stoves presently marketed in Oregon. However, it does provide protection for the environment and a real-world goal for research and development by the woodstove industry. A four-year period to research, develop, and field test appliances that will meet this standard is also stringent since less than 5% of manufacturers even have the facilities or expertise at this time to begin work. Until this program is implemented the industry will never even have had a standardized test procedure with which they conduct research and development and know reliably that their results were relevant to the goal at hand.

* It is my opinion that implementation of the DEQ proposed "7/3" standard will so drastically reduce the number of woodstove models available in the Oregon market that consumers will circumvent the law by making their purchases across the border or by fabricating their own appliances. In either case consumers will less likely have their installations safety inspected exacerbating an already serious safety problem and will have defeated the intent of HB2235 for reducing woodstove emissions.

* There is no evidence anywhere even in the most active woodstove research centers that indicates that 7 grams per hour (at 13000 Btu/hour) is attainable by non-catalyst natural draft, stick wood burning appliances. There is only very little evidence that 9 grams per hour is attainable but there is enough to encourage the industry to develop refined techniques and materials to meet and exceed this committee proposed standard. Without encouragement it is doubtful that any suitably funded non-catalyst research would be performed.

* The "9/4" standard should be viewed as the maximum limit of emission rates allowable not as the absolute and only values that all certified stoves will attain. It is reasonable to assume that most stoves that certify will pass by a margin of confidence effectively reducing the average emission rate below the "9/4" required. It is also reasonable to assume that with the new standardized test procedures for providing a means of stove performance comparison in the marketplace, competitive forces will reduce the effective emissions seen by the environment even more.

In closing, I would like to add that although the difference between "7/3" and "9/4" appears to be small or insignificant the consequences of implementing the more stringent standard may be the cause of failure for all objectives.

With sincere regards,

Paul E. Tiegs

Paul E. Tiegs
Senior Principal

PT/bc

47

PERKINS, COIE, STONE, OLSEN & WILLIAMS

A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS
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BELLEVUE, WASHINGTON 98004
TELEPHONE: (206) 453-6980

ALLAN R. ABRAVANEL, P.C.

March 23, 1984

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
MAR 22 1984
OFFICE OF THE DIRECTOR

Honorable Frederic J. Hansen
Director
Department of Environmental Quality
522 S.W. Fifth Avenue
Portland, Oregon 97207

Re: Proposed Oregon Woodstove Certification Rules

Dear Fred:

The Department of Environmental Quality recently released proposed regulations relating to the certification of emission standards for woodstoves sold in the State of Oregon. These regulations contain mandatory July 1, 1986 emission standards of 15 gms. of particulate emitted per hour for noncatalytic woodstoves and 6 gms. for catalytic woodstoves (the "15/6" standard), and 7 gms./3gms. emission standards for noncatalytic/catalytic woodstoves by July 1, 1988 (the "7/3" standard). These regulations would be adopted pursuant to Sections 468.630-468.655 of the Oregon Revised Statutes, as enacted during the 1983 Legislative Session.

You have indicated in a memorandum, dated March 16, 1984, to the Environmental Quality Commission, that the proposed testing standards and emission criteria "address most concerns of the [woodstove] industry," and achieve most of the goals recommended by the Woodstove Advisory Committee appointed by the Environmental Quality Commission pursuant to ORS 468.655. Among the goals recommended by the Committee was the adoption of the 15/6 standard by 1986, and a "9/4" standard by 1988.

I represent Klickitat Enterprises, Inc. ("Klickitat"), a distributor of Kent Heating products in the United States. The President of Klickitat, Ms. Bette Hume, was a member of the Woodstove Advisory Committee. As counsel to Klickitat, I am not able to address the concerns of other members of the woodstove industry, who may have differing views on the proposed Oregon regulations. I am aware, however, that members of the industry are unanimous in their distress over the Department's proposed rejection of the Woodstove Advisory Committee standards, and the recommendation of the proposed July, 1988 7/3 standard.

In the memorandum of March 16, 1984, you explained the July, 1988 7/3 standard to the Environmental Quality Commission as follows:

> "Since catalytic technology is now available on a limited basis to meet a 7/3 standard, it is reasonable to expect that the industry would be able to provide a good selection of models with this technology within a four year time by July 1, 1988. A 7/3 standard by July 1, 1988 would provide a goal for non-catalytic manufacturers to reach and a reasonable time to reach it while not totally closing them out of the market in July, 1986 when the certification program sales restrictions go into place. If non-catalytic technology is not developed to achieve the emission reduction needs for Oregon airsheds by July 1, 1988 then catalytic technology should be widely available, well developed and well proved by then to be fully relied upon as a technology to completely meet airshed and consumer needs in Oregon."

As you acknowledge, therefore, the proposed regulations will eliminate virtually all non-catalytic woodstoves utilizing existing technology from the Oregon market, with the only prospect of continued operation dependent on technological changes in the future. To the best of my knowledge, however, there is no new technology either in existence or planned, which would enable non-catalytic woodstoves to meet the 7/3 standard required by July 1, 1988. Even the interim 15/6 standard of July 1, 1986, while not of particular concern to my client, will force a vast number of woodstoves out of the Oregon market. The above-cited statement in your memorandum simply glosses over this effect on the Oregon market.

In addition, the assumption that catalytic technology will be improved by July 1, 1988 to satisfy the 7/3 standard does not appear to have any basis in fact. I am informed that only one form of catalytic woodstove is presently capable, under ideal laboratory conditions, of meeting the 3 gms. per hour emission standard. In order to meet that standard, however, the catalyst must be more densely packed than would normally be required. This dense packing, I understand, causes the catalyst to decay far more rapidly than the manufacturer's specifications indicate. As a result, the effectiveness of the catalyst will dissipate more rapidly, causing this catalytic woodstove to emit greater amounts of particulate after a relatively short period of operation.

The July 1, 1988 standard, therefore, relies on assumptions of performance that do not now, and may never, exist or that could cause catalytic woodstoves, after a short period of operation, to have increased particulate emissions.

The common goal of the Department and of the manufacturers and retailers is to reduce pollution in the Oregon airshed. The proposed regulations, however, do not address certain concerns that may inadvertently cause pollution to increase, or at least remain unchanged:

a. The increase in cost arising from excessively stringent standards may cause consumers to continue to use their old, relatively high polluting woodstoves. Woodstoves, unlike automobiles, do not require frequent replacement, and consumers may be content to rely on older, higher polluting models for years.

b. Oregon consumers may easily cross state lines to purchase nonconforming and less expensive woodstoves for use within Oregon. Neither the statute nor the regulations prohibits the <u>use</u> of nonconforming woodstoves in this State.

c. The statute expressly exempts the sale of used woodstoves within the State from the certification process. As the cost of woodstoves required to meet excessively stringent regulations rises, the market for used woodstoves may increase dramatically.

d. Neither the statute nor the regulations address one of the major causes of airshed pollution, the use of open fireplaces by Oregon residents. Statutes in other states have addressed this polluting use, and have sought to regulate it in an overall attempt to reduce particulate emissions.

We are also extremely distressed that the July 1, 1988 7/3 standard appears to have been proposed without any empirical data indicating that it would reduce the level of pollution to the goal desired by the Department. Because of this apparent lack of empirical data, an alternative approach by the Department might be to defer the imposition of any standard in 1988 until the effect of the imposition of the 1986 standard can be observed and tested. In the alternative, the Department may wish to do a proper survey of woodstove emissions, to create a formal link between those emissions and the airshed pollution problem in Oregon. The promulgation of a standard without data creating this linkage, when that standard has the effect of eliminating a vast segment of an existing manufacturing and retailing network, appears to us to be unreasonable and arbitrary.

We also believe that the proposal does not adequately take into consideration the effect of these regulations on small businesses. When the enabling legislation was under consideration in the 1983 Legislative Session, many of the legislators supporting the proposal stated that the Department should specifically take into account the effect of the regulations on small businesses. Most of the entities that sell woodstoves in the State of Oregon are small, privately owned retailers, who will find their product line drastically reduced or eliminated as a result of the mandatory regulations which would take effect in 1986, and almost totally eliminated as a result of the mandatory regulations which would take effect in 1988. The fiscal and economic impact statement tries to ameliorate the effect on small businesses, however, by assuming the ready availability of products that do not currently exist, and that may not ever be available.

The consideration of the economic impact on small businesses is also mandated by ORS 183.540 - ORS 183.550, which sections require an agency to consider any significant adverse economic effect upon small businesses when promulgating any rule, and to the extent consistent with the public health and safety purpose of the rule, to reduce this adverse economic impact by, among other things, establishing differing compliance or reporting requirements or time tables for small businesses, or exempting small businesses from any or all requirements of the rule. The term "small business" is defined in ORS 183.310(9) to include businesses with 50 or fewer employees. Most of the retailers and distributors (including my client, Klickitat) have far fewer than 50 employees, yet the overwhelmingly adverse impact of this rule on them appears not to have played a significant role in the formulation of these proposed regulations.

Members of the industry intend to participate vigorously in the public hearings that have been scheduled by the Department and, I assume, to testify both in favor of, and against, various aspects of the proposed rules. I believe, however, that all testimony will oppose the proposed July 1, 1988 standard. In addition, the potential effect of the proposed July 1, 1988 standard is considered to be so severe, that members of the industry are currently examining the legal options available to them to seek redress in Oregon courts if the regulations are promulgated with the proposed July 1, 1988 standard.

Klickitat would be pleased to provide any additional information that you or members of your staff may request to amplify the comments set forth in this letter. We would also welcome the opportunity to discuss the data the staff of the Department has relied upon in reaching the July 1, 1986 and 1988 standards for woodstove emissions. As Klickitat has consistently demonstrated, it is eager to work with the Department to achieve standards that reduce pollution, but that are also reasonable and capable of being accomplished, and not arbitrary, excessively stringent and lacking any statistical support.

Very truly yours,

Allan R. Abravanel

Allan R. Abravanel

ARA:ss
3469A
cc: Ms. Bette Hume

46

LAWRENCE CRANBERG, PH.D.
CONSULTING PHYSICIST

1205 CONSTANT SPRINGS DR.
AUSTIN, TEXAS 78746
(512) 327-1794

March 29, 1984

Margaret McCue
Office of Public Affairs
DEQ
P. O. Box 1760
Portland, OR 97207

Re: The Slot Fire and its Implications for the Pollution Problems from Wood-Stoves: A return to the hearth with new technology.

Dear Ms. McCue,

You now have my opening letter of March 28, 1984, in which I staked out my basic position - namely, that the standard controlling air quality to which wood-stoves should conform is the standard set by the slot fire. I suspect that a great deal will have to be said before this proposition will be acceptable to DEQ, but I have no doubt whatsoever that eventually I shall prevail. The scientific evidence is what must count in the end.

When I say "in the end", I am referring to the fact that I am bucking a wood-stove industry which has been doing a land-office business since the onset of the energy crisis, and which has been doing its level best since I came on the market in 1975 to bury my product and what I have to say about it.

I am in the classical position of the inventor with a striking new invention which threatens existing economic interests. Those interests are represented by five of the nine members of the advisory committee created by the Commission in accordance with HB2235. Clearly, I am going to have a very difficult up-hill battle, but that is the battle I have been fighting since 1975 against a shifting alliance of adversaries.

The essential facts are that the wood-stove industry has been enjoying a bonanza which it simply does not deserve, considering the merits and demerits of its products, and the competition provided by my slot-fire-Texas-Fireframe-grate combination. And the chickens are now coming home to roost in the form of alarming safety problems and pollution problems. It is the public which has payed the price.

By this time the wood-stove industry has acquired tremendous economic and political clout, and it has been able to undermine, libel, and smother its competition from me. The question is how long will it be able to continue to do so. The public members of the Commission and of its advisory committee will be the ones to determine the outcome, and I intend to do everything in my power to reach them with my data.

Those data cover heat output, fuel efficiency, a steady rate of fuel consumption of about 4.7 pounds of wood per hour and about 45 pounds of air per hour, use of unsplit fuel, remarkable ease of starting, and thus far only an upper limit on the amount of carcinogens in the fuel gases which has already been sent you. At the same time the full beauty of the wood-fire is preserved and indeed strikingly enhanced, since the flames are now fully visible down to their roots in the logs. And all this for an appliance costing a mere fifty dollars! Small wonder I am anathema to the wood-stove industry! But I am not trying to put them out of business. As you can see from my correspondence with Vermont Castings in my letter to you of March 28, 1984, I have been trying to work with them. But so far they have merely snubbed me. I hope you can change this.

My hopes for a fair hearing from the Advisory Committee rest with the public members: Dr. Spolek, Mr. Chinnock, Mr. Heidtman, and Mr. Willhite. If I am to get any sort of hearing, it is essential that my materials reach those four gentlemen, that they have an opportunity to digest them fully, and to ask me questions about them.

I am willing to make all reasonable efforts to reach them with the full story in as much detail as anyone is interested in having.

What I am putting before the Advisory Commitee and the Commission is a great challenge and a great opportunity. The challenge is to look at the facts clearly, ignoring the veil of propaganda and personal attacks which I have found are inevitably the fate of someone in my position.

The opportunity is to return Americans to the hearths they were duped to deface or to leave in droves under the influence of the Anti-Fireplace Hoax so skillfully promoted for almost a decade. The hearth they left is the one which has been dear to the American householder since the founding of the Republic. It is a little-known fact that Benjamin Franklin was intent on preserving the open fire against a flood of wood-stoves which were being imported from Europe, and all his efforts at improvement of fireplace efficiency were carried out with the intent of preserving the appearance of the open fire. I have been continuing his efforts.

I am certain that if Benjamin Franklin were alive today and could be called upon as a witness before your advisory committee, he would stand behind me four-square.

I enclose a brochure which gives my earliest scientific contribution on wood-energy in 1975 to the American Physical Society, together with some later items of technical and consumer interest.

Sincerely yours,

Lawrence Cranberg

Lawrence Cranberg

Encl.

cc: Dr. Frank Press, President, National Academy of Sciences
Dr. Irvin L. White, President, New York State Energy and Research Development Authority

RECEIVED

APR 02 1984

PUBLIC AFFAIRS

TIME

TIME, DECEMBER 22, 1975

SCIENCE

The Physicist's Fire

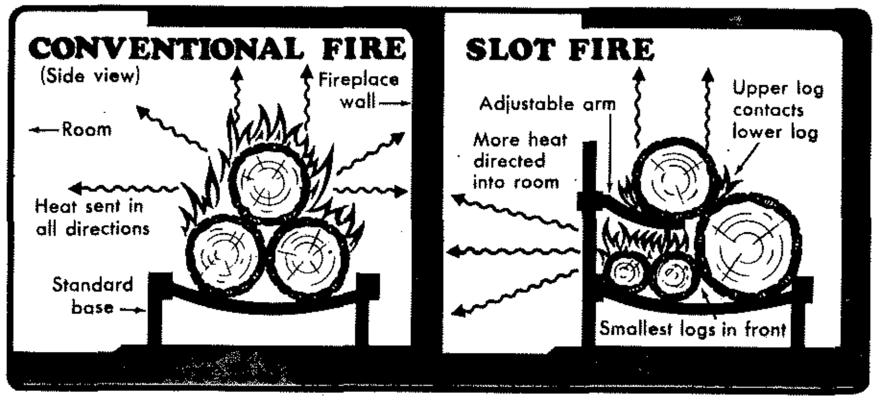
Few things in life are more attrac tive than an open hearth fire—or less efficient. It is messy, requires continual attention, and sends perhaps as much as 90% of its heat up the chimney with the smoke. Most homeowners learn to live with such flaws. Lawrence Cranberg, an Austin, Tex., physicist went back to basic physics to correct them.

He has designed a fireplace grate that forces a fire not only to burn better but to send more of its heat out into the room.

Cranberg turned his attention toward hearth fires last winter; in an attempt to conserve oil, he supplemented his home heating with his two fireplaces. Frustrated by the inefficiency of a standard three-log fire, he studied what really happened when he poked at the logs to make the fire burn better. His conclusion: "I was opening up a furnace, prying the logs apart a bit or rotating them to expose the hot, charred surface in order to get more heat into the room." He was creating, in effect, something similar to what physicists call a "black body," a furnace-like cavity with walls that absorb and then emit practically all the heat and other radiation that reaches them; only a fraction of the radiation escapes through a small hole in one of the walls.

Easy to Light. Applying this concept, Cranberg built the "Texas Fireframe," a spindly metal contraption that looks like a standard fireplace grate with two taller uprights at the front corners fitted with adjustable metal arms that extend into the fireplace. To use it, he places a large log toward the rear of the grate, two smaller ones toward the front, and a fourth log, slightly smaller than the first, on the adjustable arms *(see diagram).* He then lowers the arms until the top log just touches the surface of the large one at the rear. This creates a cavity that opens into the room—a sort of wooden furnace that contains the fire and prevents much of its heat from immediately escaping up the chimney.

One product of this arrangement is a hot, even, slow-burning fire; about 30% of the heat generated inside the slot eventually streams out into the room. There is another bonus: it is easy to light. A conventional fire requires a pile of kindling, a few balls of crumpled newspaper and, frequently, several matches before it will catch. Often it burns for half an hour or more before it starts dropping coals and throwing off substantial heat. Because his arrangement traps heat so well, Cranberg can light even damp wood with only a few sheets of newspaper, placed directly in the cavity, and have a hot fire in 15 minutes.



TEXAS FIREFRAME Co.

P.O. Box 3435 Austin, Texas 78764

Qs and As about the Slot Fire and the Texas Fireframe grate

Q. Can I make use of split logs as well as unsplit?

A. Yes. Our sketches show unsplit logs to emphasize that the chore of log-splitting can now be eliminated. Only logs too big to fit into the fireplace need be split now. All that matters is that you have a slot with logs in rough contact, as shown in the sketch on the reverse of this sheet and in the product Instructions.

Q. Does the Slot Fire require special wood?

A. No. The unique adjustment feature of the Texas Fireframe grate enables you to make a slot with the proportions recommended in the product Instructions, using a very wide range of log shapes and sizes. You **no longer** need special wood to make a fire, such as kindling or split logs.

Q. Why is log-to-log contact important?

A. The contact between the back log and the log next to it at the lower level is especially important. That line of contact is the "Hot Line"—the heart of the fire. Break that contact and you cool the fire, or prevent its starting. The other lines of contact are needed to prevent loss of radiant energy to the walls of the firebox and to the flue.

Q. What lifetime do you guarantee for the Texas Fireframe?

A. The best guarantee of long life is provided by following the Instructions—especially that you keep the base from sitting in a bed of ashes and hot coals. Spread ashes and coals on the floor of the hearth, out of contact with the ribs of the base.

Q. What do you mean by "radiant energy"?

A. The energy which reaches us from the fire in the fireplace is basically the same as the radiant energy which reaches us from the sun. Think of the fire as a tiny sun. The sun's rays travel millions of miles through space and when they strike and are absorbed by our skins, are transformed into heat energy, which we can then feel. The rays from your fireplace act in the same way when they strike and are absorbed by our skins or by the solid objects in our houses.

Q. What do you mean by a "beam" of radiant energy?

A. Radiant energy (for example, visible light, infrared, radio waves, etc.) can be reflected and concentrated into a beam by mirrors, lenses, antennas, etc. In the Slot Fire, we have made unique use of the logs themselves to beam the radiation into the room. Rays emitted by hot coals or flames which aim toward the walls of the log cavity are absorbed and immediately re-emitted by those logs. The rays bounce around in the cavity until they escape into the room. Thus, the arrangement of the logs forces radiation to be concentrated in the desired direction, like the beam of light from the headlight of an automobile.

Q. I see several devices on the market for which claims are made which are similar to yours. Some are cheaper than the Texas Fireframe. What makes yours better?

A. There has never been a good invention without cheap and inferior imitations following after it. Several of our would-be imitators support upper logs from the back, in apparent imitation of our arrangement. But with metal supports at the back, there can be no "Hot Line" of contact between the back log and its lower neighbor. Such arrangements cannot duplicate the performance of the true Slot Fire no matter what claims are made. The performance claims which we make can be duplicated only with the unique, patented Texas Fireframe grate (U.S. Patent No. 4,069,808, "Apparatus and Method for Combustion," Jan 24, 1978) used in accordance with the copyrighted Instructions which accompany the product.

Q. What is meant by a "beam of heat"?

A. A beam of radiant energy is sometimes carelessly referred to as a beam of heat. But heat is produced by radiant energy only when it strikes and is absorbed by matter. Careless or erroneous nomenclature is often associated with exaggerated and misleading claims.

BULLETIN OF THE

AMERICAN PHYSICAL SOCIETY

September 1975, Series II, Vol. 20, No. 9

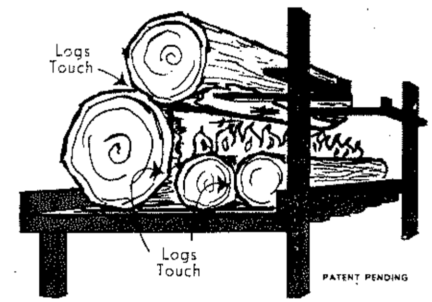
FRIDAY AFTERNOON, 31 OCTOBER 1975
ROOM 2-102 AT 2:00 P.M:
C. Zabel, presiding

DC12
Slot-Stable Flame with Hohlraum Radiation Pattern. L. Cranberg, Texas Fireframe Co. It has been found by experiment that a slot-shaped combustion chamber with horizontal opening, structured of fuel elements of cylindrical cross-section (e. g. logs), will support steady flames confined to the slot. The thermal radiation pattern therefor approximates that of a theoretical slit-Hohlraum. The flames are established easily using paper only as primer; a two-foot width of slot fills completely with flame in a few minutes; little attention is required to maintain a stable, flaming condition. Stability conditions will be discussed, and simple methods of assembling the chamber from natural materials will be described.

"The Physicist's Fire"

That is the name given by *TIME* magazine to a new type of fire, described to the American Physical Society in Oct., 1975, by physicist Lawrence Cranberg. It sends far more radiant energy into a room from a fireplace than any conventional fire.

The fire starts and burns steadily and evenly in a slot-shaped cavity formed by logs. The cavity channels radiant energy into the room in a wide beam.



To form a proper slot with logs of different sizes, Cranberg invented a new type of grate with unique, adjustable arms called the Texas Fireframe®.

Here is a comparison of the features of the Physicist's Fire made with a Texas Fireframe grate, and the features of a conventional fire made with other grates. (Figures are estimates based on use of seasoned wood.)

Feature	Texas Fireframe	All Other Grates
Sitting distance from fire	6 to 12 feet	2 to 5 feet
Time for hot fire	5 to 15 minutes	30 to 60 minutes
Starting	Simple, fast, reproducible	Hit-or-miss
Kindling	None needed	Needed for starting
Log Splitting	Not needed	Needed for starting
Poking, rotating logs	Rarely needed	Needed frequently
Flames	Steady, fully visible	Sporadic, partly visible
Control of heat	Adjustable with arms	No adjustment
Replacement logs	Throw heat quickly	Throw heat slowly
Fuel burn-up	Complete	Charred ends remain
Chimney fires	Upper logs reduce risks	Conventional risk
Lifetime of grate	Coals insulated from bars; life of grate prolonged	Coals in contact with bars; life shortened

Texas Fireframe Fan Mail

"The best new thing I have seen in my thirty years in the hardware business." C. P. Davis, Davis Hardware, Austin, TX.

". . . the temperature in the room increases 7 to 12 degrees with the Fireframe, over the temperature with a regular grate." L. Isaacson, Berrien Springs, MI.

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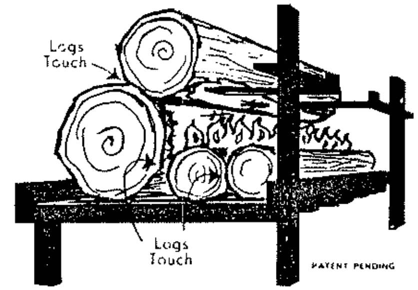

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RECEIVED

APR 04 1984

PUBLIC AFFAIRS

LAWRENCE CRANBERG, PH.D.
CONSULTING PHYSICIST

1205 CONSTANT SPRINGS DR.
AUSTIN, TEXAS 78746
(512) 327-1794

March 28, 1984

Margaret McCue,
Office of Public Affairs,
Department of Environmental Quality
P. O. Box 1760
Portland, OR 97207

Re: Comments on Proposed Adoption of Woodstove Certification Rules;
Request for Special Hearing

Dear Madam,

This is to acknowledge receipt of your Memorandum and related materials with respect to the opportunities for public comment on Woodstove Certification Rules due in your office before May 4, 1984.

The purpose of this letter is to lay out in preliminary fashion the following basic position: that the environmental standards to be met by woodstoves should not differ from those for the slot fire or the Physicist's Fire.

The enclosed copies of correspondence with the senior officers of Vermont Castings Inc. and of the ads used by Vermont Castings before and after that correspondence, tell the essentials of the story.

The slot fire or Physicist's fire makes it possible to closely match the performance of the wood-stove when the comparison gives full consideration to all the cost-effectiveness parameters involved in a responsible evaluation. There is therefore no justification for DEQ or any other public body with responsibility for pollution control to extend to the wood-stove any greater tolerance for pollutants than to the slot fire or fires made in a similar manner.

Thus far, there is only a single report on the pollutants produced by the slot fire made with the Texas Fireframe grate, and a copy of the report by Terralab Engineers is enclosed.

The DEQ is respectfully urged to conduct its own tests on the slot fire made with the Texas Fireframe grate in order to make its own evaluation of the pollutants produced thereby, and to take that evaluation into account as setting an <u>upper limit</u> for pollutants produced by wood-stoves.

It may not be possible for me to appear in person in Oregon for any of the public hearings now scheduled, due to conflict with a court appearance I am required to make in Washington, D. C. on the dates now scheduled for the hearings. But because of the great public importance which attaches to the comments submitted herewith, I respectfully request the permission of DEQ to make a personal presentation to an appropriate body at a mutually agreeable time and place.

Sincerely yours,

Lawrence Cranberg

Lawrence Cranberg

Encls.

P. S. Also enclosed is a copy of our Press Release of Jan. 31, 1984, "The Anti-Fireplace Hoax".

PRESS RELEASE JAN. 31, 1984

THE ANTI-FIREPLACE HOAX

Confusing the Consumers in the Billion-Dollar Wood-Burning Marketplace

Lawrence Cranberg
Texas Fireframe Co., Austin, TX 78764

Since the beginning of the energy crisis, many instant experts have surfaced in the media and elsewhere with the assurance that the fireplace is an energy-waster in a centrally heated home. Innumerable articles have been written which rehearse a now-familiar scare tale: the fireplace draws more energy out of the house in the form of warm air than it supplies in the form of radiant energy. This argument has been used with special effect as a sales gimmick to sell billions of dollars worth of wood-stoves and fireplace inserts, often as replacements for fireplaces. The argument is that an air-tight wood-stove draws much less air than an open fireplace, and therefore can be more efficient. What are the facts of the case?

Facts are astonishingly hard to come by, and in searching for them, we quickly discover that we have not been hearing facts, only vague generalizations, or numbers which conceal more than they reveal. What are the facts?

1. One pound of air heated from an outside temperature of 10 degrees F to an inside temperature of 70 degrees F requires only 14 BTU (British Thermal Units) of heat energy. Burning that one pound of air in a wood fire with 100 percent efficiency will yield 1,400 BTU. Thus, your wood-burning appliance has to have only a one per-cent efficiency to be a break-even proposition, and even the unimproved fireplace is credited with a ten percent efficiency.

2. Of course you can do a number of foolish things with fireplaces (and any other appliance you can think of) and blame the fireplace for your folly, rather than yourself. For example, you can leave the fireplace and flue damper open all the time whether you have a fire or not. You can set your thermostat out in the hallway, where it can't sense the fire, at a value which will keep your central heating system going all the time. And you can ignore the fact that the radiant energy from an open fire affords you the distinctive pleasure of enabling you to bask in its radiation while the heat from a central heating system or wood-stove is largely convective heat, which is much less cost-effective and pleasurable than radiant energy.

3. You can also ignore the fact that an air-starved fire in a wood-stove is a prolific producer of creosote, and is thereby responsible for a "staggering hike" in chimney fires according to the U. S. Consumer Products Safety Commission, and for a rise in atmospheric pollution so serious that Oregon has started the ball rolling on legislation restricting use of air-starved combustion devices.

What the consumer should not ignore is the major improvements in the fire in an open fireplace called the slot fire, first described in a paper presented to the American Physical Society in 1975. In a follow-up paper presented to the San Antonio Meeting of the American Physical Society on Jan. 30, 1984, it was reported that the slot fire, which requires only a fifty-dollar appliance called the Texas Fireframe grate, requires only 47 pounds of air per hour, compared to the 100 to 200 pounds of air per hour required for a wood-stove or fireplace insert. And the carcinogens and toxic substances in the flue-gas emissions, according to Terralab Engineers of Salt Lake City, Utah, were less than 5 parts per billion. Because the slot fire is capped from above so flames do not extend into the flue, it is very much less likely to start a chimney fire, and none has been reported since the slot fire was introduced into the marketplace in 1975. Its measured energy efficiency is 31 per cent.

For further technical information on the slot fire and the results of tests run on it by Terralab Engineers of Salt Lake City and reported to the American Physical Society in San Antonio, Texas, on Jan. 31, 1984, write to Texas Fireframe Co., P. O. Box 3435, Austin, TX 78764, or Douglas MacGregor, Terralab Engineers, 3585 Via Terra, Salt Lake City, Utah, (801)262-0094.

CERTIFIED MAIL

TEXAS FIREFRAME Co.

P.O. Box 3435 Austin, Texas 78764

Phone 512-327-1794

Feb. 28, 1983

Dwight S. Stimson
President
Vermont Castings
Box 40
Randolph, VT 05060

Dear Mr. Stimson,

The purpose of this letter is to introduce myself and my products to Vermont Castings. Doubtless you have already heard of my products, which have been on the marketplace since 1975, and which have been advertised nationally, and in addition have received a great deal of media attention. I enclose a brochure which reproduces some of that media material, and also enclosed are copies of some of my recent publications in the American Journal of Physics. A preprint of an article entitled "The Anti-Fireplace Hoax" is also enclosed.

In my view, statements such as are made in your advertising (see, for example, your ad in the February, 1983, number of Organic Gardening) that the fireplace, as a heat source, "is a dismal failure", are unwarranted. If you have credible scientific evidence to substantiate that sweeping statement, I would be most grateful to have it. In the absence of such evidence, I shall assume that the statement is not merely self-serving, but is deliberately defamatory of those who provide fireplace accessories, such as mine, which contradict the damning statements which Vermont Castings has made consistently about the fireplace.

It is not the purpose of this letter to stir up a controversy, but to continue an effort which began with my discovery of what TIME called "The Physicist's Fire", namely an effort to educate the public in the fundamentals of fire-making, and to encourage adoption of improved techniques of fire-making - specifically, the adoption of the Physicist's Fire or Slot Fire as I originally called it, with the help of the Texas Fireframe grate as the indispensable accessory.

This letter is being written to extend an offer of collaboration first in the area of technical understanding. If you have credible scientific evidence that the fireplace is a "dismal failure" as a heat source, then I would welcome that information in exchange for the materials I am enclosing. At the same time, I should say in all candor that if such information is not forthcoming, and Vermont Castings does not retract its defamatory remarks about the fireplace, then clearly collaboration between us will not be possible and other lines of action will be necessary.

I look forward to your early reply.

Sincerely yours,

Lawrence Cranberg

Lawrence Cranberg, Ph. D.

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Sincerely yours,

Lawrence Cranberg

Lawrence Cranberg, Ph. D.

VERMONT
CASTINGS
INC

PRINCE STREET, RANDOLPH, VERMONT 05060
Telephone 802/728-3181

March 16, 1983

Mr. Lawrence Cranberg, Ph. D.
Texas Fireframe Co.
P.O. Box 3435
Austin, TX 78764

Dear Mr. Cranberg:

In Mr. Stimson's absence, I have been asked to respond to your February 28, 1983 letter that takes exception to a Vermont Castings ad about fireplace performance.

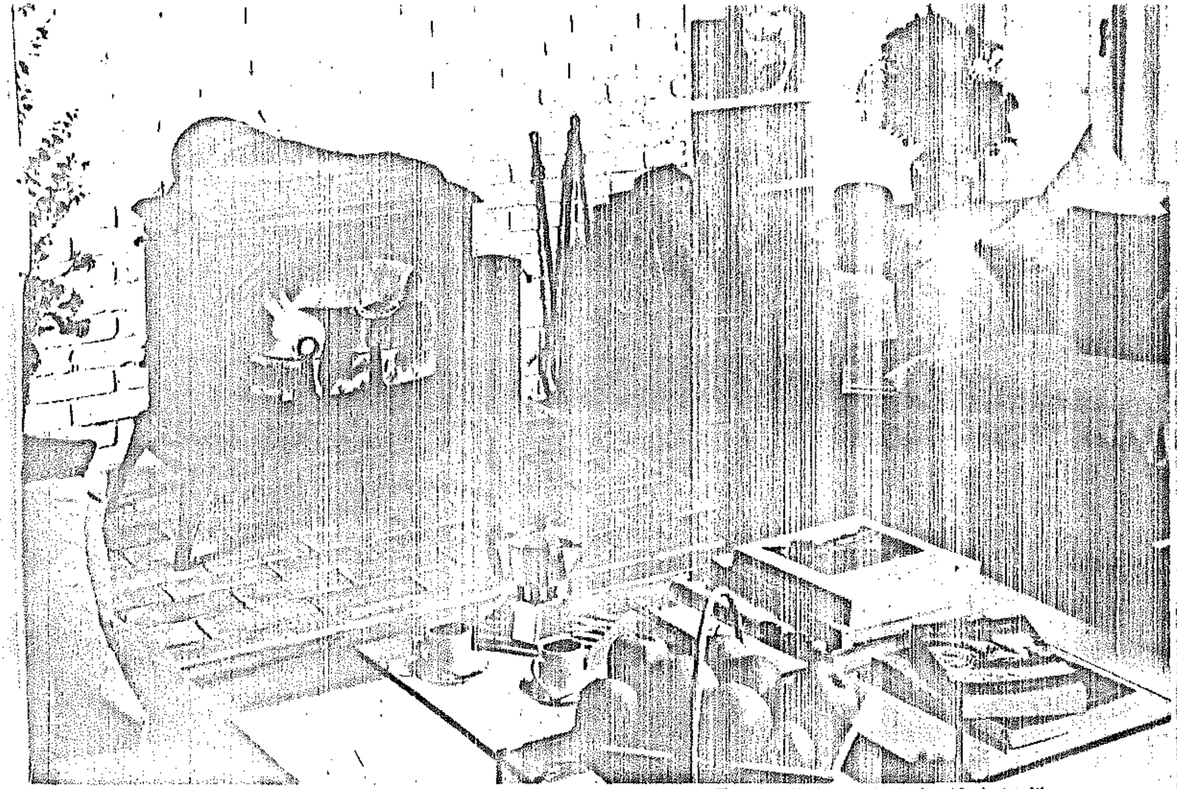
Even though your analysis of the combustion process that takes place in a fireplace is detailed, the method you employ to evaluate the effectiveness of the fireplace as a heating device is very narrow, which serves your commerical interest in selling your "Slot-Fire" grate. The broadly held measurement of heating appliance efficiencies, which you reference, place the conventional fireplace at efficiencies below 12%. When compared to the appliance efficiencies of airtight radiant stoves which, as a class, perform around 50%, an advertising reference to the fireplace as a "dismal failure" as a heating device is well within the range of commercial acceptability.

The ad specifically says, "There's nothing quite as cozy as sitting in front of a crackling fire on a cold winter night. Yet as a source of heat, the traditional fireplace is a dismal failure; the vast majority of heat goes straight up the chimney". With efficiencies at or below 12% for an unassisted fireplace and only 30% using your claim with the Texas Fireframe Company's grate, the notion that the majority of the heat goes up the chimney would appear self evident.

In conclusion, we are satisfied that there is adequate documentation to support our advertising. Though we appreciate your offer of "collaboration" as a competitor of Vermont Castings, Inc., you must certainly understand that such an effort would be quite impossible.

Sincerely,

E. L. Caldwell
Vice President/Engineering



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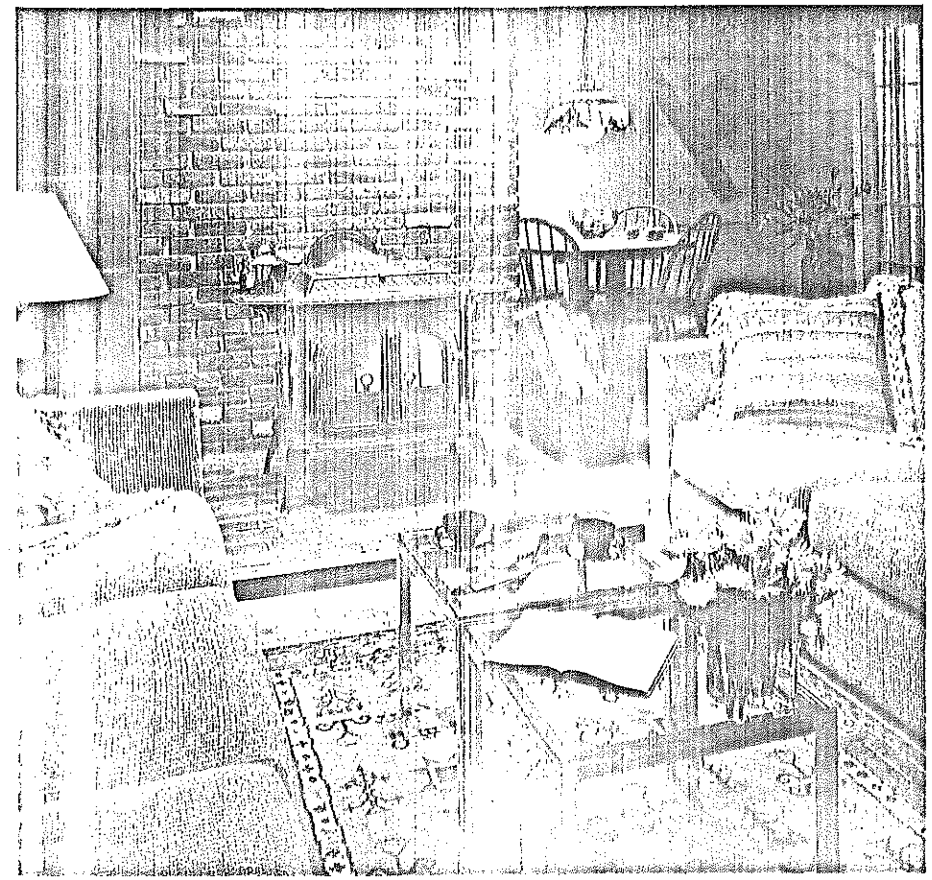

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TWX 910 925-4059

TEXAS FIREFRAME COMPANY
P.O. BOX 3435
AUSTIN, TEXAS 78764

Analysis No. 14727
Report Date 3 DECEMBER 1983
Date Sampled --
Where Sampled --
Sampled By CLIENT

This is to certify that we have examined:

CARCINOGEN AND TOXIC SUBSTANCE CONTENT OF EMISSION FROM TEXAS FIREFRAME SLOT FIRE.

and found:

Two woods were used, red oak and Douglas Fir.

The fires were burned in a standard fireplace and allowed to burn for 30 minutes. Samples were then taken by drawing four liters of flue gas through actuated carbon and silica gel sample tubes.

The sample tubes were then desorbed with dichloromethane and analyzed by gas chromatography/mass spectrometry.

There were no detectable levels of known carcinogens found in either flue gas.

Sample concentration:	200:1
Defectable limits in flue gas:	0.005 ppm

TERRALAB BY

DOUGLAS MAC GREGOR

DMG:kle

AMERICAN JOURNAL of PHYSICS

VOLUME 49, NO. 6
JUNE 1981

Domestic fire and its improvement: Some qualitative insights

Lawrence Cranberg
Texas Fireframe Co., Austin, Texas 78764
(Received 10 March 1980; accepted 29 August 1980)

Evidences of domestic wood fires have been found in caves occupied by Peking Man, and are estimated to be about half a million years old, so that fire-making with wood must be considered among man's oldest inventions. Perhaps the most remarkable fact about this particular invention, however, is that the technique of making and maintaining a wood fire may have changed very little in the vast stretch of time since Peking Man, in contrast with the striking evolution characterizing all of man's other early inventions, such as tools, clothes, and language.

To be sure, we now have very elegant methods of igniting a fire by the use of matches, fluid lighters, etc., and we have much-improved means of conducting smoke to the outside of our dwellings, but the process called "laying the fire," or arranging the fuel elements of the fire cannot be presumed to have changed materially since earliest times. The configuration of logs to be found in the fireplace of the modern American home is unlikely to differ materially from the arrangement on the hearth of the cave of Peking Man.

What the foregoing suggests is that the physical constraints which must be met to initiate and maintain combustion are severe and do not tolerate much variation. We shall see that this is partly but not entirely true, and that in fact the application of fundamental physical principles suggests improvements on the ages-old methods of laying a fire, with some useful and unexpected consequences.

The essential fact, driven home by universal experience, is that a single log or a pair of logs is insufficient to maintain combustion reliably even if much primer or kindling are laid under or over them. It must have become apparent very early in the history of man's firemaking efforts that there is a "Rule of Three"—that the simplest, most reliable arrangement of logs for maintaining a steady fire is an arrangement of three logs—typically, two resting in general contact, with the third resting on the two below, all with axes generally parallel, as shown in Fig. 1, with kindling in place for starting. The first question to be addressed is what is the controlling physical requirement which is met when one assembles logs as stipulated by the Rule of Three.

The answer is reasonably evident to anyone who has made a fire or who thinks about it. If one disassembles a three-log fire that has been burning for a while, it is clear that the burned surfaces on each log are those which faced each other. Thus the Rule of Three is just the condition that one should create a partially enclosed volume defined by the intersections of the surfaces of the fuel, or what we shall call a combustion volume or combustion space. Within this space are formed the coals which maintain a steady temperature, and when fresh wood is fed into that space, as by the operation of rotating one of the logs ("stirring" the fire), the fresh wood is pyrolized, producing a fresh show of flames, whose body extends outside the cavity through a space between the logs. This gives a visible show of flames

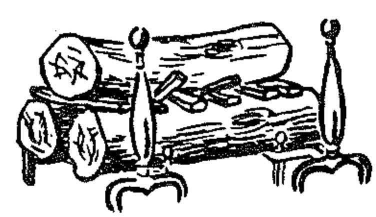

Fig. 1. Log arrangement of conventional fire, illustrating the Rule of Three, with kindling in place for starting.

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until the supply of pyrolized material is depleted and another rotation is needed. Typically the flames exhibit an exponential decay in height, diminishing by half in about five minutes. Thus the combustion space acts as a furnace, and the laying of a fire is in effect the construction of a furnace, into which one repeatedly feeds fresh fuel.

What we have just said is all readily observable and has perhaps been intuitively clear for a very long time. But only since the processes of heat transfer have been fully elucidated in the last 150 years or so can it be said that we have an understanding of what is going on in scientific terms, at least at the level of principle. It is significant to observe that thus far no one has calculated in detail how a fire develops, and we shall be concerned here only with a qualitative formulation in terms of the general principles of heat transfer, and the roles played by conduction, convection, and radiation separately and by interaction with each other in the context of the domestic wood fire.

CONDUCTION

The conduction of heat from flame to wood is the usual starting point of the process of igniting wood, and is called "pilot ignition," although convection and radiation ignition are also known, and play a role as we shall see. It is fortunate indeed that wood is a relatively poor thermal conductor, as is air, for if they were not, the heat applied by an open flame would be readily conducted away from the surface into the bulk of the material and into the air, and it would be far more difficult to raise the surface temperature to the ignition point. By the same token, it would be more difficult to maintain the ignition temperature at any particular site and thereby to maintain a self-sustaining combustion process. The presence of appreciable moisture in wood probably affects combustibility at least in part because of the increase it produces in the thermal conductivity of wood.

CONVECTION

Convection is presumably essential as the means of removing the products of combustion and maintaining a steady flow of air to the burning surfaces. The role of convection in transferring heat energy from one surface to another and thereby maintaining combustion conditions is less clear. Much of the convected energy is probably associated with flames, and while these may be rooted in surfaces within the combustion volume, the body of a wood flame typically extends outside that volume. Thus the plumes of the flames, which have been shown by simple calorimetric measurements[1] to transport about two-thirds of the energy of the flames, will typically carry convection energy outside the combustion volume and vent it up the flue. If that energy is not retrieved in some way, it represents a loss of energy whose only benefit is the creation of draft in the flue.

RADIATION

The crucial importance of radiation to the dynamics of the fire-making process, and the fact that our understanding of the properties of radiation is less than 150 years old are perhaps the chief reasons that our understanding of fire making has lagged as much as it has. Thus even the perceptive and highly motivated Count Rumford lacked the scientific tools with which to describe the role of radiation in the fire-making process.

Although our discussion will be limited to qualitative aspects only, it will be evident that such discussion is necessary as a preliminary to more quantitative studies, and in particular, proves useful as a guide to improvements at the practical level.

It is now clear that underlying the Rule of Three is the creation of a combustion volume in which energy exchange by radiation among the facing surfaces can take place freely and with little loss to the outside world. Indeed, this exchange of radiation will impel the surfaces to achieve a uniform temperature, so that the combustion space approximates the blackbody cavity of classical radiation theory.

It is, in fact, quite reasonable to describe the conventional fire as at heart the hohlraum or hole space of classical physics, but one with combustible walls on which there happens to be an ongoing combustion process. And the hohlraum it will be recalled, when provided with a small opening to the outside, becomes the ideal blackbody, which by Kirchhoff's law is the ideal radiator at a given temperature.

Thus the openings which occur fortuitously between the logs of the conventional fire due to their natural roughness become the working equivalents of the small hole which converts the classical hohlraum into the ideal blackbody. And now it becomes clear that the useful output of the conventional domestic fire in the fireplace, which is the radiation which emerges into the room, originates in the haphazard irregularities of the logs, rather than any conscious intent on the part of the fire maker.

What has been said thus far refers to that early stage of the fire before the logs disintegrate into coals. In the later stage, when coals form and accumulate on the hearth, the situation becomes considerably more complex as the radiation from the coals interacts with that from the logs. Without continuing into discussion of that later stage, however, it is already evident where improvements may be sought—namely, in the adjustment of the openings of the hohlraum and in the control of its proportions, rather than in leaving them to chance.

EXPERIMENTAL STUDIES

After a few preliminary studies indicated that the approach we have just described offered promise of interesting results, a simple steel support[2] was constructed which made it possible to arrange logs to enclose a cavity of adjustable proportions and adjustable opening. It is shown in Fig. 2. Logs are supported at a lower level, and one or more logs may be supported at an upper level whose height can be

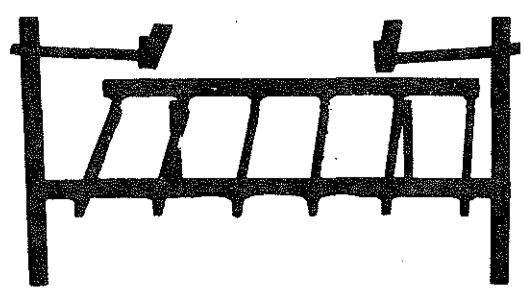

Fig. 2. Log support (Texas Fireframe grate) for experimental study of log arrangements for use in domestic fire making.

adjusted by means of friction-locking ns which slide up and down each of two vertical supports. By this means a cavity with given proportions can be created with logs of widely varying sizes, and conversely, the cavity can be given widely varying proportions with logs of given sizes. At the same time the opening of the cavity to the room can be adjusted. Use of the support is illustrated in Fig. 3.

Systematic investigation with the log support shown in Fig. 2, and with a variety of alternatives, including use of cavities fabricated of shaped wood blocks, quickly narrowed the investigation to study of the log arrangement shown in Fig. 3. In that figure, there is a large back log which provides the back surface of the cavity, several smaller logs which provide the floor, and an upper log or logs which form the roof.

For obvious reasons, the cavity created in accordance with Fig. 3 we call a slot–hohlraum. The properties of such a cavity are reasonably expected to be little different from those of the classical hohlraum, due account being taken of the considerably larger open area, including the entirely open ends. But it turns out that the characteristics of the combustion process which is initiated within such a cavity are so distinctive as to warrant a special name, and we call it the slot fire. The characteristics of the slot fire are as follows.

SLOT FIRE

Investigations with a variety of fuel materials give minor variations in results, but to be specific, we shall discuss observations with seasoned, unsplit oak logs of about 24 in. length, with a slot about 6 in. deep and about 3 in. high.

(1) *Starting.* Typically, three to five sheets of newspaper placed in the cavity and ignited will make the system "go critical" and initiate a steady fire which is confined almost entirely within the cavity, and which rapidly fills the cavity from end to end with flames which are rooted in the lower front logs.

(2) *End-to-end uniformity.* Within a few minutes of starting, it becomes evident that the axial symmetry of the arrangement creates a uniformity of the flames that is partly expected and partly surprising, particularly because it extends to the ends where one might expect less rapid burning than in the middle. Further, the end-to-end uniformity remains steady with time. As the fire progresses, the slot gradually widens as the lower logs are consumed, but the slot retains its essentially rectangular profile with constant proportions along the slot axis.

(3) *Burning of lower front log.* The site of most vigorous combustion appears to be the line of contact between the back log and the smaller log adjacent to it, and in due course these logs are consumed at their points of contact. When contact is broken, the fire cools appreciably, but is restored to full vigor when contact is restored. Thus the maintenance of vigorous combustion requires occasional pushing of the smaller front logs to maintain contact with the back log and with each other, but no rotating of logs is ever needed to maintain vigorous combustion. When the front logs are fully consumed, flaming ceases and the fire is in a banked or smoldering condition. Replacement of the front logs quickly restores flaming, which is evidently initiated by the buildup of radiation within the cavity (radiation ignition).

(4) *Burning of the back log.* The characteristic evolution of the back log is toward providing a wall of coals which faces the cavity and room, producing probably the largest fraction of the radiant energy which enters the room from the fire. This wall of coals gradually recedes toward the back surface. The crumbling of the back log is the signal for its replacement, which is accomplished by putting the replacement on the upper arms, and letting the new back log fall into its place.

(5) *Burning of the upper log.* The upper log is preferably in close contact with the back log, but there is relatively little combustion at the line of contact. The major combustion process takes place in a fairly uniform manner on the under side of the upper log, which gradually erodes to a flat surface if it was originally cylindrical.

(6) *Radiation pattern.* As must be expected, the radiation pattern from the slot is directed toward the principal opening of the slot, and is therefore in a predominantly horizontal direction. This pattern is clearly indicated by simply passing one's hand across the slot, and measurements by Walker[3] have confirmed it. Walker has also established the interesting fact that the radiant energy from the conventional fire is predominantly upward, a result which has unfavorable implications both for the efficiency and for the safety of the conventional fire. Since upward-directed energy increases the risk of so-called chimney fires, the horizontal beaming of energy from the slot fire has a potential safety benefit.

INTERPRETATION

The combustion process is in fact a complex of physical–chemical processes which extend far beyond the narrow reach of simple physical ideas. To calculate so basic a feature as combustion rate would go far beyond the physics of heat transfer. But it is interesting nonetheless to see how far one can go with those simple physical ideas, and we consider two aspects of the slot fire which are particularly striking: the ease of starting and the end-to-end uniformity.

A. Ease of starting

At first blush, the ease of starting is anomalous. The slot–hohlraum is far more open than the conventional hohlraum, with its almost totally enclosed combustion space, so that radiation can leak much more freely into the room when it is badly needed to sustain the process of ignition. The only resolution of this anomaly which is evi-

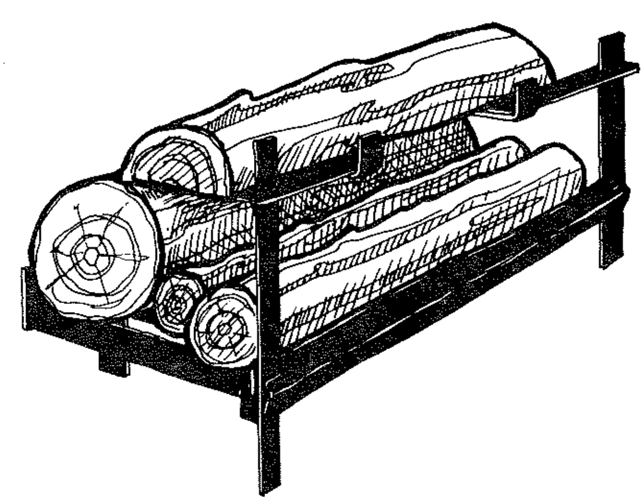

Fig. 3. Slot fire log arrangement.

dent to the author is that a crucial role is played by convection during the starting process. As indicated above[1] studies on simple flames showed that a very large fraction (two-thirds) of the energy produced by a flame is transported vertically in the plume. With the conventional fire, that energy is lost up the flue. But with the slot fire, that energy is intercepted by the upper log and much of it must be transferred to its under surface, where it is fed back into the cavity as radiant energy. Thus one may view the upper log as a convection-to-radiant energy converter, and the same may be said for the slot as a whole.

B. End-to-end stability

If we postulate that the economics—that is, the gain and loss—of radiation holds the key to the combustion rate once the fire is started, then a simple feedback argument can be adduced to interpret the end-to-end stability of the combustion rate. For if the combustion rate were to increase locally, the slot would enlarge at that place, increasing the solid angle through which radiation escapes into the room and decreasing the fraction retained within the cavity, with a corresponding reduction in combustion rate. This negative feedback coupling of geometry to combustion rate is just what is needed to produce the stable result which is observed.

ANALOGY BETWEEN COMBUSTOR AND NUCLEAR REACTOR

It is to be expected that the domestic fire and a nuclear reactor might exhibit significant similarities since both are exothermic chain-reacting systems based on solid fuel. In the fire, the photon plays a role which is analogous to the neutron in being the carrier or trigger of the chain reaction, as well as its byproduct. But the fire is in fact a much more complex system than the nuclear reactor. Despite its newness, a nuclear reactor can be designed from first principles, and such fundamental quantities as dimensions, criticality conditions, and power level can be calculated with a good deal of accuracy. None of these quantities is within the present compass of theory for the solid-fuel fire. It might be hoped, however, that the axial symmetry of the slot fire, which if infinitely extended reduces the complexity of the various processes by one dimension, increases the feasibility of a theoretical approach.

EFFICIENCY OF THE SLOT FIRE AND THE CONVENTIONAL FIRE; THERMAL COMFORT

Much has been said about the inefficiency of the conventional fire as a converter of chemical energy to useful heating energy, and much of what has been said is undoubtedly correct. But there is still a good deal of uncertainty about the magnitude of the observed efficiency, and the same applies, as of this date, to the slot fire. In a recent publication, Trefil[4] has given a figure of 11% for the conventional fire, with an efficiency for the slot fire which is 2.6 times greater. It would be useful to have further measurements by independent observers. In any event, it should be kept in mind that efficiency measurements give only one parameter of the utility of the domestic fire. Thermal comfort, which is the ultimate desideratum, is a direct function of one's proximity to the fire, and of the fraction of one's time spent in proximity to it. Those quantities are determined by a set of considerations even more complex than those which determine combustion rate. Among those considerations are the fascination of the fire itself as a visual spectacle and as a scientific challenge. Both promise to be of enduring value.

[1]L. Cranberg, Bull. Am. Phys. Soc. **25** (1), 23 (1980), paper DF-7.
[2]The device illustrated in Fig. 2 is marketed under the trademark Texas Fireframe Grate. It is covered by applicable U. S. Patent No. 4069808, "Apparatus and Method of Combustion," Jan. 24, 1978, which describes the slot fire and its method of use. See also, L. Cranberg, Bull. Am. Phys. Soc. **20** (19), 1183 (1975), Series II, paper DC-12.
[3]J. Walker, Sci. Am. **239** (2), 143 (1978).
[4]J. Trefil, Pop. Sci. **216** (1), 44 (1980). Trefil's results are for the standard, 25-in. model of the Texas Fireframe Grate. J. Shelton [Wood Burning Quart. 3 (3), 169 (1978)] reported results for the shortest (17-in.) model of the five available models, of 20% and 24% on two trials. Trefil's and Shelton's data are both consistent with an estimated efficiency for an infinitely long slot-hohlraum of about 42%, assuming there was no recovery of end losses in both sets of measurements. With perfect recovery of end losses—for example, with perfect reflectors directing end-loss energy into the room, the estimated realizable efficiency with a finite slot-hohlraum is therefore about 42%.

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State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
MAY 10 1984

AIR QUALITY CONTROL

May 4, 1984

Air Quality Division
Dept. of Environmental Quality
P.O. Box 1760
Portland, Oregon 97204

Attention: Ms. Barbara Tombleson

Dear Barbara:

Enclosed are the documents I would like to have forwarded to the E.Q.C.

Thank you very much for your help.

Very truly yours,

CONDAR CO.

Skip

Stockton G. Barnett
Director of Research and Development

Enclosures

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Condar Company Box 6, Hiram, Ohio 44234 (216) 569-3245 Telex 466625 CONDAR CI

May 4, 1984

Oregon Environmental Quality Comission
Portland, Oregon

Gentlemen:

I am writing this letter as someone who has, since 1978, been involved both in developing cleaner-burning, better-controlled woodstoves and in developing techniques to document their relative performance improvements. To date, I hold two issued patents with others pending.

My involvement with Oregon's clean burning woodstove program has been more extensive than you may be aware of. In March 1982, at the Wood Heating Alliance's National Trade Show, Condar presented a burning exhibit of our clean burning woodstove technology. Barbara Tombleson of the DEQ visited the exhibit and indicated that the DEQ was looking for examples of clean burning stoves. She informed us that if such technology could be demonstrated, a legislative woodstove bill might be proposed in Oregon. We then made arrangements with her to supply an example of our technology for testing.

In July 1982, the Blaze King Prototype of Condar's design was delivered to the DEQ for testing. The tests were successful, and the clean burning woodstove bill was introduced and passed in 1983. Since that time, extensive DEQ testing has documented this stove as the example of the "Best Practical Technology."

On another front, the woodstove emissions sampling system we developed at Condar attracted DEQ interest in early 1983, and a series of emissions tests were conducted by the DEQ using this system in the summer of 1983. The results were favorable, and the Wood Heating Alliance, in December 1983 funded a $20,000 project to demonstrate the equivalence of the Condar Emissions Sampling System and Method 7. A report on the results of these tests is included herein (Report #1.)

There is no question that positive benefits of the Oregon woodstove bill are already being realized. Extensive research has focused on woodstove emissions for the first time. Undoubtably, more has been learned about the subject in the last year than cumulative previously. At Condar we have conducted over 120 emissions and efficiency tests in the past year.

The DEQ has refined many aspects of stove testing, breaking ground successfully in many new areas. My objective in this letter and accompanying documents is to refine the foundation the DEQ has built. There are certain areas that I will address which I believe DEQ has not correctly interpreted. Unfortunately, these areas are extremely critical to the success of the wood stove program. The main points which the enclosed reports document are:

1. The Condar Emissions System should at least be permitted for use as an alternative to Method 7. The scientific evidence clearly supports this conclusion.

2. The Condar Emissions System should also be used for efficiency determinations. Again, abundant supporting scientific evidence is presented.

3. Use of the Condar system will provide stove test results at a savings of $4000 per stove. This will reduce the negative impact the DEQ's testing program would have on Oregon's cleanup program.

4. The DEQ's proposed catalytic stove emissions standard is too stringent. It is essentially "technology forcing" and causes a serious obstacle to an effective and well received emissions reduction programs. If the standard is relaxed only a moderate amount, the "best practical technology" can be used and many manufacturers will be able to produce stoves which will both pass the emissions standard and be far more acceptable and safe to consumers than conventional woodstoves. Standards more stringent than "best practical technology" will reduce the number of stove models to chose from and increase the cost, thus greatly slowing wood stove replacements and wood stove pollution clean up.

I have documented these points in four reports each based on an unusually large amount of supporting data. These reports along with brief annotations are:

(1) THE RELATIONSHIP BETWEEN METHOD 7 AND THE CONDAR EMISSIONS SAMPLING SYSTEM. This report documents that both Method 7 and the Condar system can be used as acceptable equivalents of one another. The Condar system is however, shown to be the more accurate system. Method 7 underestimates the relative emissions reductions provided by clean burning stoves. This discovery has significant implications pertaining to the establishment of emissions standards.

(2) IMPLICATIONS OF OREGON DEQ EMISSIONS TEST DATA ON CATALYTIC EMISSIONS STANDARDS. This report presents four lines of evidence using DEQ data, that an emissions standard of 3 grams/hour for catalytic stoves is not scientifically supported. Instead, all data supports a standard of about 5 grams/hour. The proposed standard of 3 grams/hour would be "technology forcing" and would have serious negative impacts on a woodstove cleanup program.

(3) DETERMINING EFFICIENCY OF WOODSTOVES USING THE CONDAR EMISSIONS SAMPLING SYSTEM. This report demonstrates that the Condar System produces highly accurate efficiency determinations at very low cost. Easy-to-use instructions for efficiency determinations are included. All necessary emissions and efficiency certification information can be provided at less than $2000 per stove (4 tests) compared with $6000 for the more complex and lengthly DEQ procedures. Supporting references are included.

(4) ROUGH DRAFT OF A STANDARD FOR MEASURING THE EMISSIONS AND EFFICIENCIES OF WOOD STOVES. This document follows paragraph by paragraph, the DEQ's proposed standard (dated Feb. 3, 1984) but revises and greatly simplifies it to conform to the use of the Condar System.

Finally it is important to keep in mind ingredients that are necessary if the Oregon woodstove program is to be successful. Ultimately, it is the manufacturers and their distribution systems who have the responsibility of making the woodstove program work. The program must provide them incentives to produce and promote cleaner burning stoves. This is the "make or break" aspect of the program and that is why I dwell on it. Issues such as cost of stove testing, and uncertainties concerning whether a manufacturer's stove will pass because the DEQ test when DEQ is using a test system the manufacturer cannot afford to have in-house, are leveraged more than you can imagine. The same is true if the emissions standards are set too low.

The wood heating Alliance has been incredibly progressive and helpful to the DEQ. They have not performed like a typical industry about to be regulated. Their suggestions are completely reasonable. Acceptance of them will enhance the strength of the regulatory system and ensure cooperation from the industry-cooperation which is necessary for success.

I believe that the enclosed documents will prove helpful to you. A resume of my professional activities is also included. It describes activities related to similar environmental issues and similar scientific principles over the past 10 years, the most recent being work with the International Joint Commission.

Sincerely,

CONDAR CO.

S.G. Barnett

Stockton G. Barnett, Ph.D
Director or Research and Development

Enclosure

SGB/kmg

NOTE:

New sections: Accuracy and roposed Equivalency Procedure.

040384
Updated 04/25/84

THE RELATIONSHIP BETWEEN OREGON'S METHOD 7 (MODIFIED METHOD 5) AND THE CONDAR EMISSIONS SAMPLING SYSTEM AS USED FOR WOODSTOVE PARTICULATE EMISSION

Author:
Stockton G. Barnett, Ph.D
Condar Company
Hiram, Ohio

ABSTRACT

SUMMARY OF THE WHA SPONSORED RESEARCH ON CONDAR-METHOD 7 COMPARISIONS:

(1) The Condar Emissions Sampling System and Method 7 emission factors have a highly correlated (R=.962) curvilinear relationship. Condar-derived emissions factors for clean burning stoves are significantly lower than Method 7 values.

(2) The analysis of precision of simultaneous duplicate samples (the case with the WHA data) requires special analysis to equate it to normal population precision analysis. The precision of both emissions measurement systems are essentially equivalent (Method 7 Standard Deviation ± 8%). This 8% value is not statistically significantly different from that of the more thoroughly documented Method 5 (standard deviation ± 10.4%).

(3) Method 7 and the Condar System have an acceptably consistent relationship, especially for the only emissions determination which is important: weighted average emissions of 4 stove tests per stove in grams/hour (the value that will be used to pass or fail a stove).

   a. All deviations between Method 7 and predicted Method 7 were less than ± 20%.

   b. Furthermore, the closer a stove is to the pass-fail level the better the Condar predicts Method 7 results.

(4) Tests were conducted on a clean burning stove to determine the relative accuracy of the two stack burning methods. Simultaneous indoor-outdoor sampling showed that the Condar system predicts outdoor particulate formation well. Method 7 predicts well for 15 + kg/hr stoves, but over predicts by a factor of about 2.5:1 for clean burning stoves (those stoves which have about 1 gm/kg Condar emissions factors). This has marked significance:

   a. Because Method 7 under-represents the relative particulate cleanup ability of clean burning stoves, emissions standards should be adjusted accordingly.

   b. For real world woodstove particulate measurement, the dilution air principle is a preferred reference principle to that of glass condensation utilized with Method 7.

(5) A procedure for determining equivalency of woodstove emissions sampling systems is proposed. This procedure is based on the experience gained in the WHA project and the proposed EPA equivalency regulations for airborne particulate sampling.

INTRODUCTION

This report will use the December 1983 WHA-Omni data to document the relationship between Oregon's Method 7 (often referred to as Method 5) and the Condar Emissions Sampling System. Some additional pertinent data obtained at Condar Co. will be presented as well.

The short term objective of this report is to document the equivalency of the two sampling systems to aid the State of Oregon in their decision concerning acceptance of the Condar System. A longer term objective is to use the available data to help establish national woodstove emissions measurement procedures which most accurately reflect airborne particulate loading from woodstoves and which are also most cost effective.

EQUIVALENCY OF THE CONDAR SYSTEM AND METHOD 7

For many air quality parameters, nationally recognized (EPA) reference principles* and reference procedures exist. Methods of establishing equivalent procedures also exist. However, for woodstoves there is no nationally recognized reference principle or reference procedure nor, of course, are there procedures for establishing equivalency.

The closest standard to woodstoves, one which measures condensable hydrocarbons, is the EPA diesel standard. The reference principle of this standard is to dilute the emission stream with ambient air, thereby cooling and condensing the hydrocarbons and then catching the particulates on double fibreglass filters. It is this principle that the Condar System uses, having catered the sampling system to the specific needs of woodstove sampling.

In Oregon, even though a national reference procedure for evaluating woodstove smoke is not now available, the State Department of Environmental Quality has decided to adopt a modification of EPA's Method 5 procedure (called Method 7). The Method 7 utilizes a somewhat different reference principle than the diesel and Condar dilution systems. Method 7 does not dilute stack gases within its sampling system. Instead, high temperature condensables and solids are collected on a hot front filter. Then most of the condensable hydrocarbons, along with large quantities of water are collected by impingement, on the cold glass surfaces of impinger tubes which are surrounded by an ice bath. The final collection medium is a single backup fiberglass filter.

* A reference principle is the physical and or chemical principle or principles which are used as a basis of measurement. For example, the expansion of mercury is used as a reference principle for measuring temperature.

The current issue in Oregon is whether Oregon will accept the Condar system as an equivalent of Oregon's Method 7 for woodstove certification. Tests funded by the Wood Heating Alliance at Omni Environmental Services were conducted in December 1983 to determine the equivalency of the two emissions sampling methods. These tests included 14 sample runs in which dual simultaneous Method 7 and Condar Sampling systems were operated.

Recognizing that procedures for determining the equivalency of the woodstove emissions sampling systems are not available, Oregon's DEQ chose to use a modification of EPA's airborne lead equivalency procedures as the closest available analogy. Two criteria must be met: (1) The precision of the Condar system must equal or exceed that of Method 7 and (2) a "consistent relationship" must be established between both systems. The issue of accuracy was not to be addressed.

Precision

Oregon's DEQ summaries of the WHA-Omni testing, dated 02/13/84 and 02/17/84, include the following statements: "The precision was high for both methods." "The precision of the Condar Method was virtually indentical to that of Method 7." "The Condar Sampler had precision equivalent to Method 7."

My research of the WHA-Omni data has indicated the DEQ statement of relative precision between the two methods needs no modification. However, examination of the precision technique that was used shows that the reported precision values are artificially low. These values were determined by comparing dual simultaneous sample pairs (generally referred to as duplicate sampling). This type of analysis restricts the distribution of values relative to the true distribution by virtue of having only two samples to compare. By comparing the deviations of the two samples to their own mean, the variation compared to population statistics is artifically restricted. On the other hand, when triplicate (as in the airborne lead method) or quadruplicate (as in standard EPA Method 5 precision analysis) samples are used, the true population distribution characteristics can be directly obtained.

It is possible though to convert duplicate derived statistics to population statistic distributions. The EPA uses the following formula:

$$\text{Standard Deviation} = \frac{\text{Average Range}}{1.128}$$

The average range was obtained from DEQ's 02/14/84 document.

For the Method 7 data: $\text{Standard Deviation} = \frac{4.5 \times 2}{1.128} = 8.0\%$

This standard deviation value (8.0%) is 1.48 times the $\pm$ 5.4% standard deviation value reported by DEQ.

I conducted a lengthy analysis to verify EPA's equation. I constructed a normal distribution of 99 values using the standard Critical Values of Z table for proportional area under the normal curve. The standard deviation was established at the outset at $\pm$ 10%.

Then, using a table of random numbers, I randomly selected 71 pairs (to produce duplicate sampling) and calculated the standard deviation following the customary procedure DEQ used. I also calculated the standard deviation of the population as a whole. The population standard deviation was 1.48 times the duplicate sampling-derived standard deviation. Thus, the DEQ's equation is verified and the standard deviation of 8% for Method 7 is the most correct available value based on the 14 sample pairs. This value is close to the 10.4% standard deviation the EPA reports for Method 5. The 95% precision limits for Method 7 (based on the limited available data) are:

$$\text{Standard Deviation} \times 1.96 = \pm 15.7\%$$

Consistent Relationship

The DEQ has inadvertently referred to the consistent relationship in their publications under the heading of accuracy.

The procedure the DEQ used to evaluate consistent relationship was a streamlined version of the airborne lead criteria. The DEQ stated, "Compare maximum difference (%) between candidate and MM5 Methods to 1.33 x maximum difference between simultaneous pairs of MM5 for 16 stove tests and at least 5 stove tests within 5 - 15 gm/kg range." The fact that 14 rather than 16 tests were conducted appears not to have caused a problem in analysis.

The DEQ's analysis of this relationship requires reexamination for two reasons:

(1) Their analysis was conducted before verified data was available.

(2) Their procedural approach needs alteration as explained below.

I will first summarize the DEQ's procedure and their results and then establish, based on a lengthly analysis of the data, what appear to be more appropriate analysis procedures.

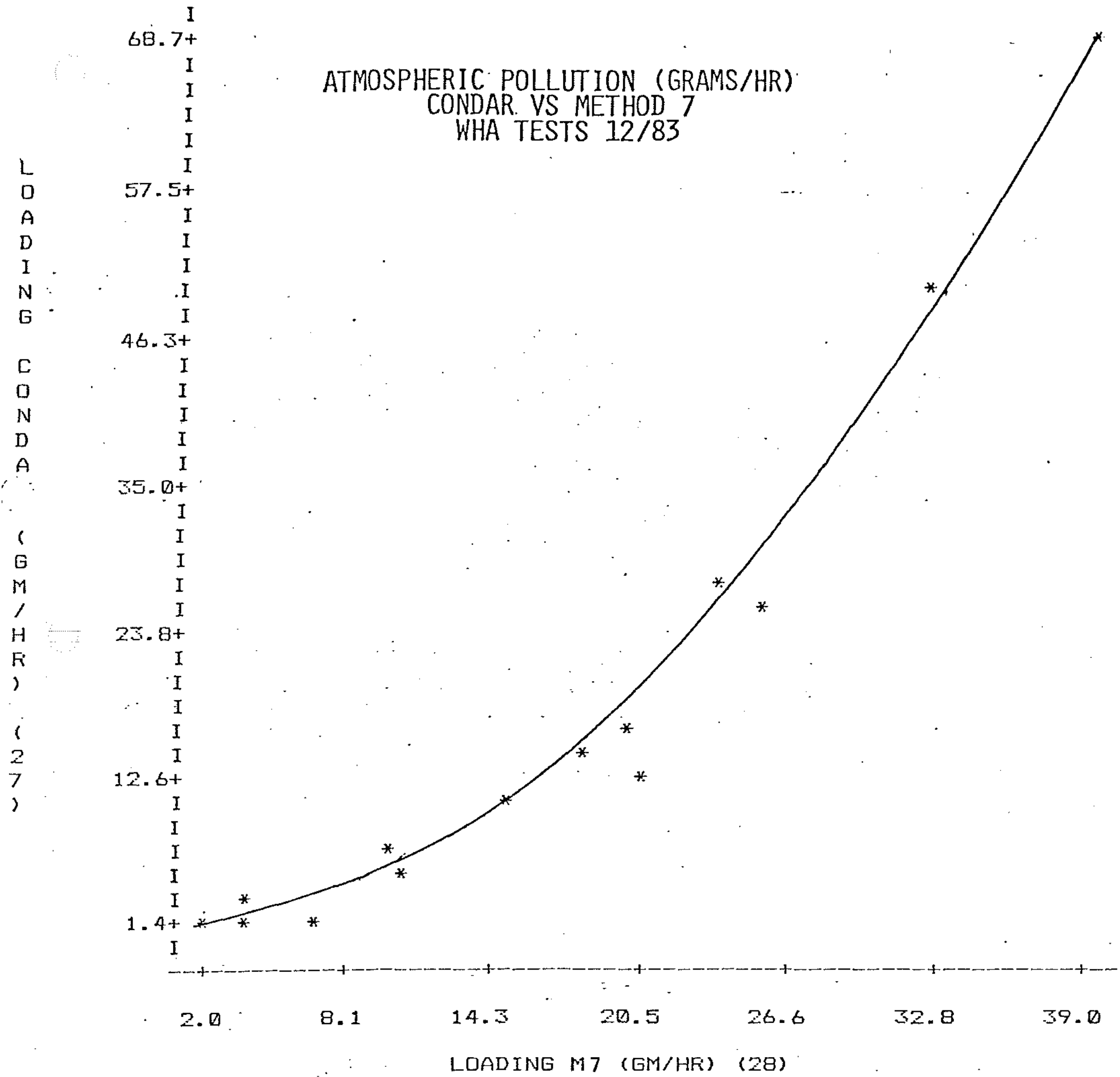
The DEQ established the maximum allowed difference at "1.33 times the maximum difference between simultaneous pairs of Method 5." This calculates as 1.33 x 18.8 = ± 23.7%.

The DEQ began its analysis by multipling the Condar emission factors times burn rate to calculate grams/hr. loading. They did likewise for the Method 7 results and then conducted best fit regression analysis of the curvilinear plot of results. This work needs review because finalized data and the best fit equation was not used. (It produces an R of .992, see figure 1) Their results showed deviations averaging ±28% and ranging up to ± 165% between the two methods. (See Appendix V)

However, more importantly, the basic approach needs to be changed. It should be built from the ground up. The Condar emission factors must first be converted into predicted Method 5 emissions factors via regression.
The curvilinear relationship of emission factors is shown in Figures 2 & 3. The correlation coefficient is .962. The best fit equation is:

$$\text{Log}_{10}\ \text{Method 5} = \frac{(\text{Log}_{10}\ \text{Condar Emission Factor} + .61)}{1.487}$$

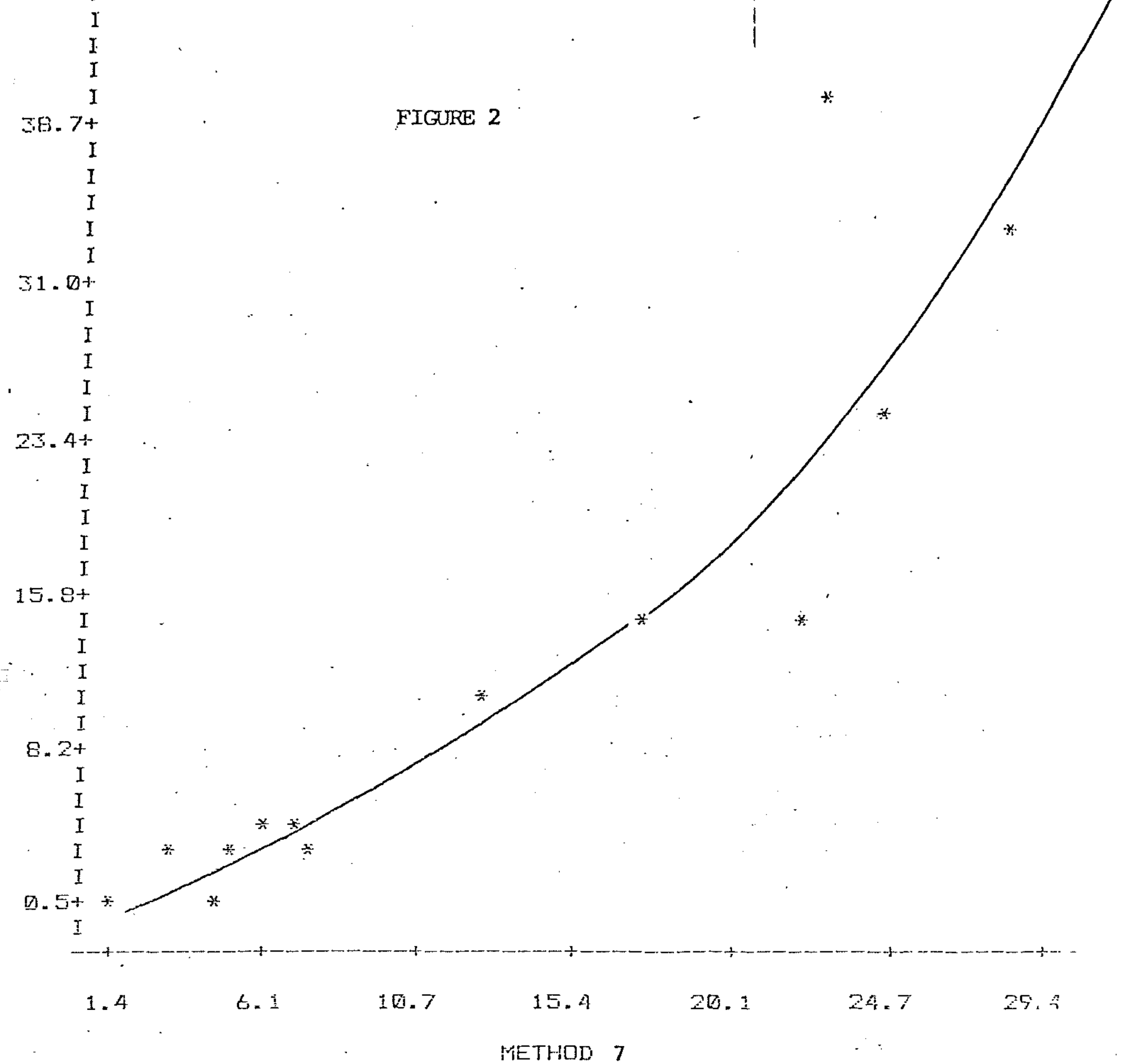
FIGURE 1



Mean of X = 385.68	Correlation coefficient = 0.992	Valid cases = 14
S.D. of X = 425.92	Degrees of freedom = 12	Missing cases = 0
Mean of Y = 17.61	Slope of regression line = 0.05	Response % = 10
S.D. of Y = 19.41	Y intercept = 0.18	

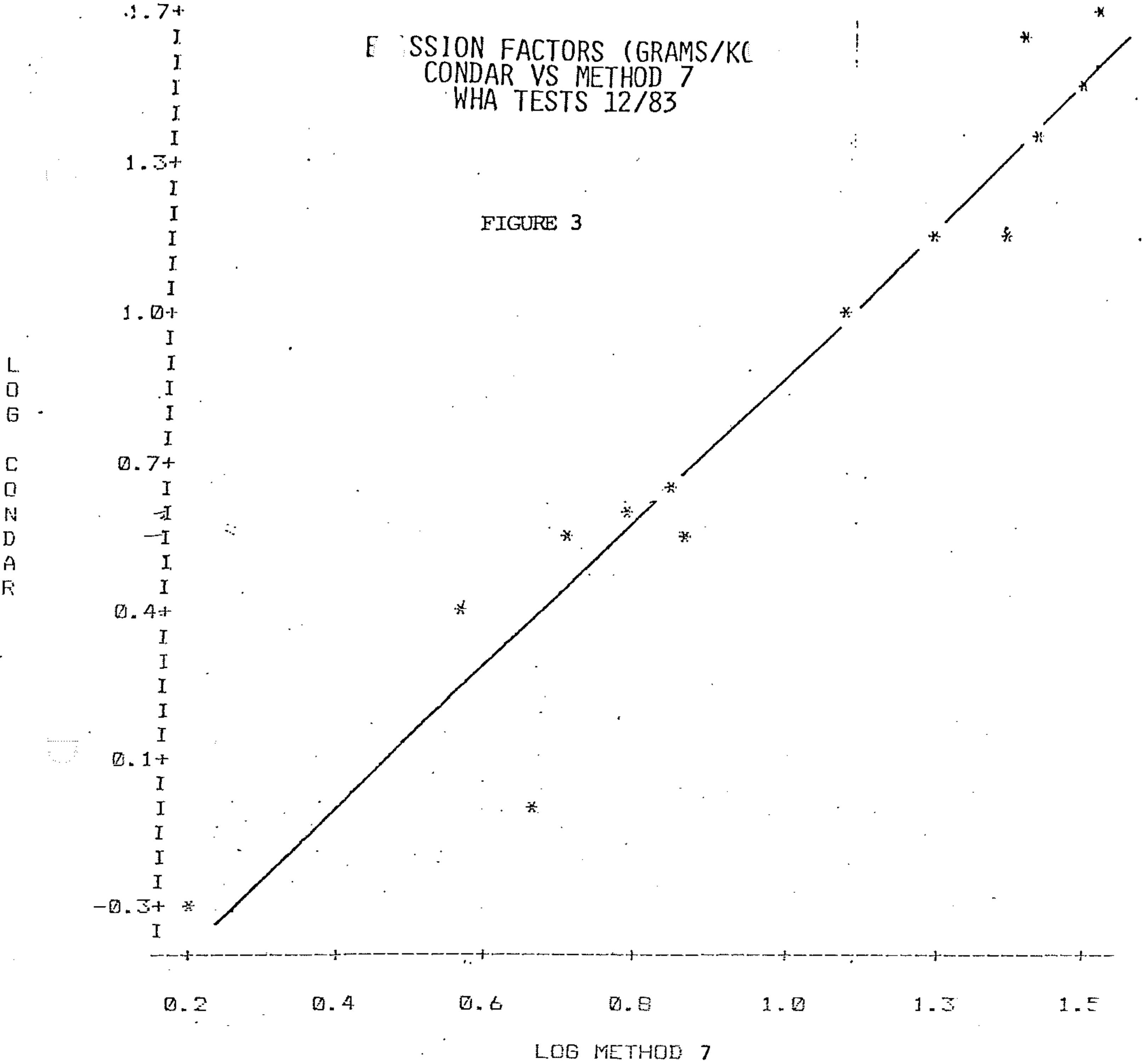
EMISSION FACTORS (GRAMS/KG)
CC..DAR VS METHOD 7
WHA TESTS 12/83

FIGURE 2




```
n of X = 13.66      Correlation coefficient    = 0.92      Valid cases    = 14
. of X = 9.57       Degrees of freedom         = 12        Missing cases  = 0
n of Y = 14.54      Slope of regression line   = 1.43      Response %     = 10?
. of Y = 14.89      Y intercept                =-5.05

ression equation :  Y' = 1.43 X - 5.05
nda  error of estimate for regression     = 5.781
ndard error of correlation coefficient    = 0.277
nificance of correlation coefficient      = 0.000
```




```
ean of X = 0.99      Correlation coefficient     = 0.96      Valid cases     = 14
 D. of X = 0.39      Degrees of freedom          = 12        Missing cases = 0
ean of Y = 0.86      Slope of regression line = 1.44         Response %      = 100
 D. of Y = 0.58      Y intercept                 =-0.58
```

Reduced Major Axis Equation

$Y = 1.487x - .61$

```
egression equation :  Y' = 1.44 X - 0.58
andard error of estimate for regression    = 0.159
 ndard error of correlation coefficient   = 0.277
gni  ance of correlation coefficient       = 0.000
```

****

****

This equation uses the Reduced Major Axis approach rather than conventional regression analysis. The Reduced Major Axis and conventional regression equations differ slightly. (See equations in Figure 3) Conventional regression assumes that the y variable is dependent on the x variable. Conventional regression thus, reduces the residuals only in the y direction. Method 7 and the Condar System are clearly independent of one another and a technique which analyze variables independent of one another is needed. Reduced Major Axis (long used in Biometrics) reduces residuals in both the x and y axis combined. Thus, no intervariable dependence is implied. (See Appendix I).

In the next step, the predicted Method 5 and Method 7 emission factors are multiplied by the burn rate to provide grams/hour particulate loading. These results are shown in table 1. These predicted vs observed differences are markedly lower and more consistent than DEQ presented because the analysis procedure relies on basic, rather than modified data. A plot of this relationship is shown in Figure 4.

There appear to be 4 cases that exceed the DEQ's recommended limit. However, in the airborne lead standard the maximum allowed difference is 1.33 times the maximum analytical precision. Precision is a statistical parameter obtained by analysis of one or more populations of data. The DEQ's use of the largest Method 7 simultaneous pair difference as a substitute for a measure of precision is statistically unsound. To most closely follow the lead method format, it must be emphasized that the consistent relationship maximum allowable difference is based on the inherent precision of the technique. (Appendix II) Therefore, the maximum allowable difference for Method 7 analysis must be the ratio of the precision of Method 7 to that of lead analysis.

In the De Wees article, (Appendix III) lead precision was reported as a standard deviation of $\pm$ 5% and Method 5, $\pm$ 10.4%. As noted in an earlier section, the Method 7 precision, based on a limited data base of 14 samples is calculated at 8%. Since Method 5 is inherently a simpler technique than Method 7 (utilizing fewer analytical steps) it must be documented with supportable scientific evidence that Method 7 is in fact more precise than Method 5. The 10.4% precision for Method 5 is based on a data base orders of magnitude larger than Method 7's using from 4 to 8 simultaneous samplers. A standard F test for significance of difference in population variances (Appendix IV) demonstrates that the Method 7 precision is not significantly different from Method 5 at the 95% confidence level. Therefore, one must use the Method 5 precision value as the most documented and probable precision value. The ratio of it to airborne leads precision is 10.4 : 5.0 = 2.08. Therefore, the allowable consistent relationship difference should be $\pm$ 20%(for lead) x 2.08 = $\pm$ 41.6%.

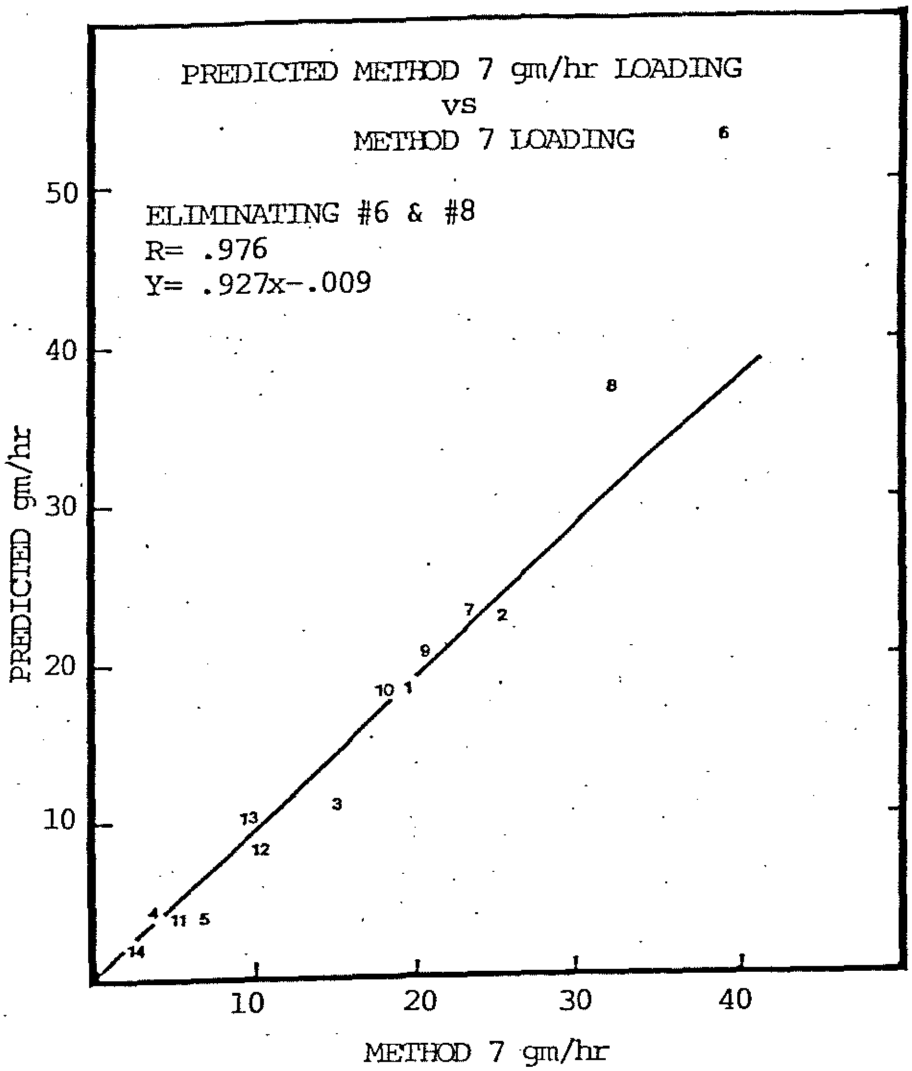
As can be seen from table 1 only one case in 14 exceeds this limit. Since only 5 cases are needed for lead analysis one deviation in 14 is not significant. In fact, EPA equivalency techniques which involve 14 comparisons (as opposed to 5) allow two deviations for a passing grade. (Appendix II)

Therefore, following the procedures originally established by the DEQ, the Condar system has an acceptable consistent relationship with Method 7. However, there is serious doubt that the entire consistent relationship analysis as described above has validity. Since the time when DEQ wrote their equivalency procedures, the definition of an emissions determination has changed.

CONSISTENT RELATIONSHIP BETWEEN GRAM/HOUR LOADING (FOR SINGLE TEST RUNS) OF PREDICTED METHOD 7 (USING CONDAR DATA) VS. METHOD 7 USING REDUCED MAJOR AXIS REGRESSION TO CALCULATE PREDICTED EMISSION FACTORS

TEST RUN#	EMISSION FACTORS					PREDICTED GM/HR			GM/HR	PERCENT DIFFERENCE		
	AVE. CON-DAR	CONDAR #1	CONDAR #2	PREDICTED METHOD 7 FROM AVE. CONDAR	METHOD 7	AVE. CON-DAR	CONDAR #1	CONDAR #2	METHOD 7	AVE. CON-DAR	CONDAR #1	CONDAR #2
1	14.7	14.4	15.1	15.7	17.1	18.06	17.70	18.55	19.7	- 8.1	-10.2	- 6.1
2	24.1	23.8	24.4	21.8	24.4	22.7	22.4	23.0	25.4	-10.6	-11.8	- 9.4
3	14.8	14.4	15.3	15.8	22.0	10.9	10.6	11.3	15.2	-28.3	-30.3	-25.7
4	.54	.61	.46	1.70	1.4	4.27	4.63	3.83	3.6	+18.6	+28.6	+ 6.4
5	.93	.95	.89	2.45	4.5	3.70	3.8	3.6	6.8	-45.5	-44.1	-47.1
6	39.5	39.5	39.6	30.5	22.4	53.1	53.1	53.2	38.9	+36.5	+36.5	+36.8
7	34.1	33.0	35.2	27.6	28.2	22.9	22.2	23.6	23.4	- 2.1	- 5.1	+ .9
8	46.3	44.1	48.3	33.9	29.2	37.3	35.5	38.9	32.3	+15.5	+ 9.9	+20.4
9	4.7	3.9	5.5	7.28	7.2	20.7	17.2	24.2	20.5	+ 1.0	-16.1	+18.0
10	10.6	10.4	10.8	12.6	12.6	18.0	17.7	18.3	18.0	0.	+ 1.6	- 1.6
11	3.6	3.15	3.95	6.09	5.0	5.0	4.57	5.32	4.1	+22.0	+14.6	+29.8
12	3.3	3.01	3.54	5.74	7.5	7.98	7.50	8.37	10.4	-23.3	-27.9	-19.3
13	3.8	3.98	3.66	6.26	6.1	10.0	10.4	9.83	9.76	+ 2.8	+ 6.5	+ .7
14	2.5	2.59	2.46	4.76	3.5	2.67	2.74	2.64	1.96	+36.2	+39.8	+34.7
										$\overline{X}$ =17.9	$\overline{X}$ =20.2	$\overline{X}$ =18.4

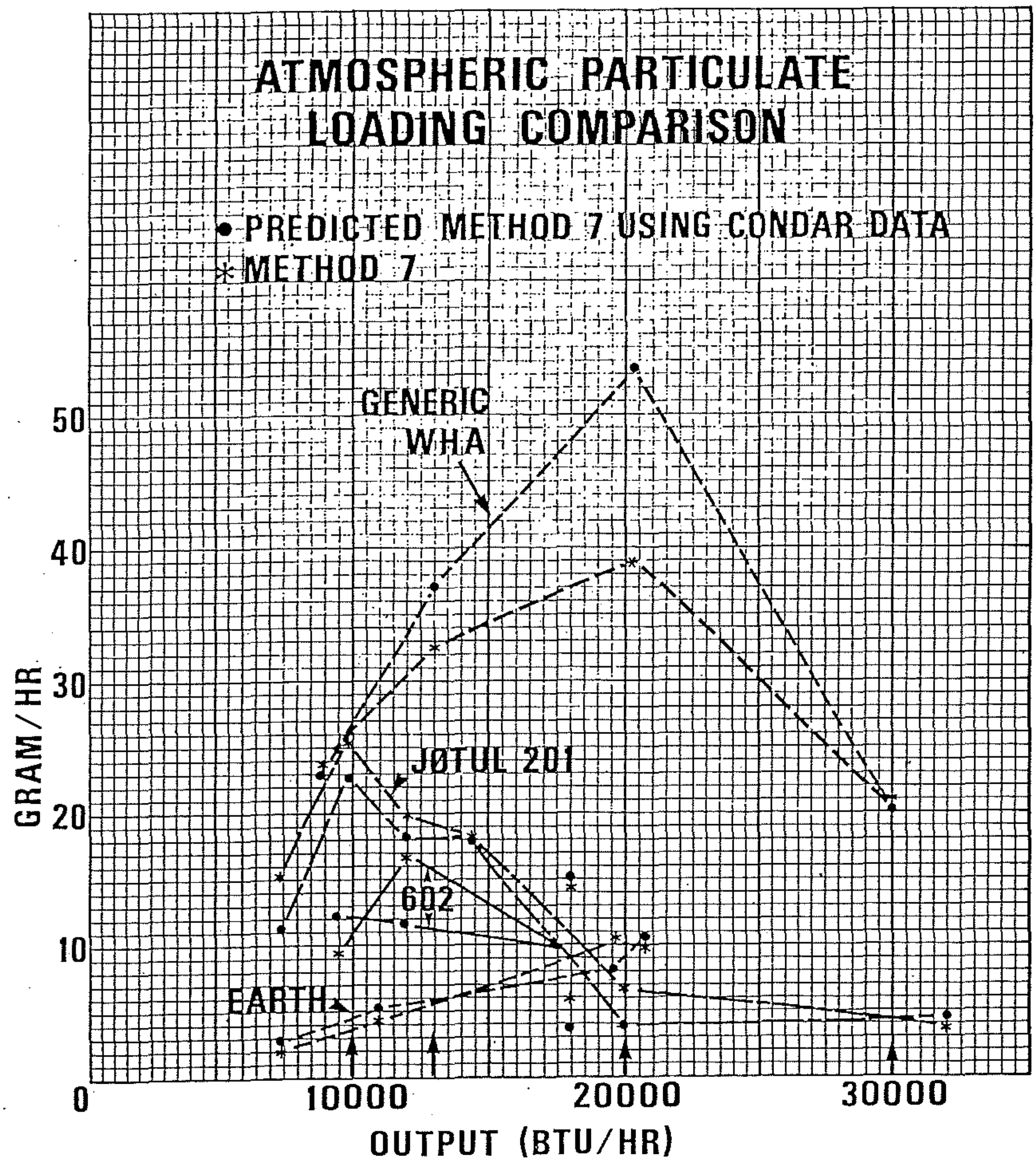
TABLE 1



PREDICTED METHOD 7 gm/hr LOADING
vs
METHOD 7 LOADING
ELIMINATING #6 & #8
R= .976
Y= .927x-.009
PREDICTED gm/hr
METHOD 7 gm/hr

FIGURE 4

FIGURE 5


ATMOSPHERIC PARTICULATE LOADING COMPARISON
● PREDICTED METHOD 7 USING CONDAR DATA
* METHOD 7
GENERIC WHA
JØTUL 201
602
EARTH
GRAM/HR
0
10
20
30
40
50
10000
20000
30000
OUTPUT (BTU/HR)

COMPARISON OF PREDICTED METHOD 7 (USING AVERAGE CONDAR SYSTEM DATA) AND METHOD 7 GRAMS PER HOUR POLLUTION; 4 STOVES

Weighing Scheme Per DEQ 12/19/83:

BTU/Hr	Weight
10000	.371
13000	.348
20000	.241
30000	.039
	1.000

STOVE: WHA GENERIC

(Predicted Method 7 From Condar)		Method 7
GM/HR. x WEIGHT =		GM/HR. X WEIGHT =
26 x .371 = 9.65		26 x .371 = 9.65
37 x .348 = 12.88		32.5 x .348 = 11.31
52.5 x .241 = 12.65		38.7 x .241 = 9.33
20.5 x .039 = .80		20.5 x .039 = .80
35.98	Difference = +15.7%	31.09

STOVE: JOTUL 201

(Predicted Method 7 From Condar)		Method 7
22.5 x .371 = 8.35		25.0 x .371 = 9.28
18.0 x .348 = 6.26		19.0 x .348 = 6.61
4.0 x .241 = .96		6.5 x .241 = 1.57
4.0 x .039 = .16		4.0 x .039 = .16
15.73	Difference = -10.7%	17.62

STOVE: EARTH

(Predicted Method 7 From Condar)		Method 7
4.2 x .371 = 1.56		3.5 x .371 = 1.30
5.7 x .348 = 1.98		5.8 x .348 = 2.02
9.0 x .241 = 2.17		10.1 x .241 = 2.43
10e x .039 = .40		10e x .039 = .40
6.11	Difference = -0.7%	6.15

STOVE: JOTUL 602 TYPE

(Predicted Method 7 From Condar)		Method 7
12.0 x .371 = 4.45		10.5 x .371 = 3.90
11.2 x .348 = 3.90		15.4 x .348 = 5.36
9.5 x .241 = 2.29		9.5 x .241 = 2.29
10e x .039 = .40		10e x .039 = .40
11.04	Difference = -7.6%	11.95

TABLE 2

COMPARISON OF AVERAGE PREDICTED METHOD 7 VS. METHOD 7 GRAMS/HOUR FOR 4 STOVES

Stove	Method 7	Predicted	%Difference	%Reduction From Generic
WHA Generic	31.09	35.95	+ 15.7	0
Jotul 201	17.6	15.7	-10.7	44
Jotul 602	11.95	11.04	- 7.6	62
Large Cat.	6.15	6.17	- 0.7%	81

Average Difference = 8.6%

MATRIX OF ALL POSSIBLE INTER-SAMPLER DIFFERENCES (%) BETWEEN PREDICTED METHOD 7 AND METHOD 7 GM/HR LOADING

WHA GENERIC STOVE

	METHOD 7
Condar Sampler #1	+14.6%
Condar Sampler #2	+19.0%

Largest Deviation From Mean = 2.2%

JOTUL 201 STOVE

	METHOD 7
Condar Sampler #1	-11.6%
Condar Sampler #2	- 8.4%

Largest Deviation From Mean = 1.6%

EARTH STOVE

	METHOD 7
Condar Sampler #1	- 1.6%
Condar Sampler #2	+ 2.9%

Largest Deviation From Mean = 2.3%

TABLE 3

As of mid-November this value constituted a single emissions factor determination from one stove run (as analyzed above).

At the end of 1983 the DEQ and the Oregon Woodstove Advisory Board adopted a new approach whereby now, an emissions determination for a stove is a weighted average (based on home heating loads) of four individual emissions values obtained over a range of outputs from about 10,000 - 30,000 BTU/hour. This single emissions determination value is what will be used to determine officially if a stove passes or fails the clean air standard.

It is now clear that the most meaningful test of a consistent relationship between the two techniques is to compare the weighted emissions determinations (in grams/hour) for the various tested stoves.

The grams per hour emissions values vs. net output have been plotted in figure 5 for predicted Method 7 and Method 7 for each stove. Then, following the DEQ's weighting scheme, (Table 3) the weighted results were calculated. Results are presented for both the two individual Condar testers and the average Condar results. (Table 3) An additional stove, the Jotul 602 type, for which only single tester data is available, is plotted (using the Condar - Method 7 emission factor equation as a predictor). In all, 4 stoves are presented. The data demonstrate three main points:

(1) The differences between Method 7 and Condar are reduced relative to when single emissions factors are compared. This is caused by the nonsystematic error in the techniques tending to cancel out when multiple data are used.

(2) None of the combinations of data produce differences that exceed even the strictest of criteria, the lead test of $\pm$ 20%, let alone the DEQ's $\pm$24%. (Table 3) It has been demonstrated that the Condar system has an acceptably consistent relationship with Method 7 for the most important bottom line determination; weighted emissions in grams/hour.

(3) The Condar System predicts Method 7 results more effectively the closer the stove is to the pass-fail grade. This is at least partly due to the nonconformity of the highest two gram/hour data points to the rest of the points (Figure 4). This causes the WHA generic stove (which far exceeds the passing grade) to have the largest differences between the two methods of analysis. If more data were available in that high emission range it might be justified to apply a sophisticated curve fitting routine to the data but it is premature now.

In summary, the Condar System and Method 7 have been shown to have a highly consistent relationship, particularly in the passing grade range for the bottom line emissions value; weighted grams/hour emissions. Even the lead standard values are exceeded.*

ACCURACY

Accuracy is defined as how close a measurement approaches the truth. The truth as it applies to suspended airborne particulate analysis is how close does a particular stack analysis method predict the amount of particulates that will form in the atmosphere under atmospheric conditions once the flue gases have entered the ambient environment.

* In the March 20, 1984 Federal Register the EPA has proposed that the lead procedure for consistent relationship be adopted for ambient suspended particulate analysis.

Accuracy is not addressed in the equivalency establishment procedures the DEQ set up. However, the strongly curvilinear relationship between Condar and Method 7 emission factors (Figure 2) strongly suggest that one of these techniques is more accurate (and probably much more accurate than the other).

In examining figure 2, note that for emission factors in the 15-25 gram/kg range, both Condar and Method 7 produce very similar results. But, for clean stoves, for example a stove with a Condar emission factor of 1.0 gm/kg, the corresponding Method 7 value is about 2.6 gm/kg. This boils down to two important points. If the Condar values are more accurate than Method 7:

(1) Dilution type systems should be the reference woodstove smoke evaluation systems.

(2) Clean burning stoves actually clean up the air of particulates much more effectively than Method 7 results would lead one to believe. This has serious implications for appropriate air quality emission standards.

This issue is so important that we at Condar have expended large efforts to evaluate accuracy. These are the only efforts we are aware of.

Our tests were all conducted using a prototype catalytic stove which produces average Condar emissions factors of about 1 gram/kg at low to medium burn rates (8,000 - 15,000 BTU/hour). This stove was used because the discrepancy between Condar and Method 7 results is at their greatest (2.6 to 1) under these clean burning conditions. The discrepancy is so large that it should not be difficult to determine which method is more accurate.

The stove was set up four feet from a thin outside wall, with a horizontal run of 6" fluepipe running through the wall to a draft inducer located outdoors. Two emissions samplers were run simultaneously for 3 to 5 hour sample runs. One sampler was located immediately inside the wall such that dilution air would be the normal warm (65 - 70°F) indoor air that the sampler always uses. The other sampler was located outside the wall (nozzle 12 inches from that of the indoor tester) so that the flue gases would enter the sampler barrel and be diluted with cold outside air. This sampler used 2 to 3 times the dilution air compared to the indoor sampler so as to thoroughly cool the flue gases before they hit the filter.

The second and third stove runs utilized barrel extensions of 12" and 18" to increase the dwell times for condensation of organics, as well as to separate the two filters as much as possible. These tests produced a real outdoor environment in the sampler barrel: a highly dilute and cold environment (filter temperatures averaged 40° during the second and third tests). If additional airborne condensation takes place in the outdoor environment these tests would detect it. Additionally, the filters which were used in the sampler are the same ones used in ambient air samplers so the test had true suspended particulate applicability.

Before each run both of the sampler flow gauges and nozzles were calibrated under the same pressure head to be within ±2% of each other. During the second and third runs the gauges were switched half way through the test. Since each filter had been separately weighed, a double check was conducted on gauge consistency during the tests.

RUN DATE	WEATHER CONDITIONS	OUTDOOR TEMPERATURE	INDOOR TEMPERATURE	OUTDOOR FILTER TEMPERATURE	INDOOR CONDAR EMISSION FACTOR GM/KG	OUTDOOR % EMISSION FACTOR DIFFERENCE	EXPECTED OUTDOOR % DIFFERENCE: FROM PREDICTED METHOD 7 EMISSION FACTOR
11/5/83	CLOUDY AND OCCASIONAL LIGHT RAIN	40°F	65-70°F	50°F	.97	-8%	+160%
03/13/84	CLOUDY, DENSE FOG	36°F	65-70°F	42°F	.84	+19%	+172%
03/17/84	SUNNY, NO CLOUDS	33°F	65-70°F	42°F	1.02	-13%	+161%

TABLE 4. SIMULTANEOUS INDOOR-OUTDOOR EMISSIONS SAMPLING USING THE CONDAR EMISSIONS SAMPLING SYSTEM TO EVALUATE THE EFFECT OF THE OUTDOOR ENVIRONMENT ON THE FORMATION OF AIRBORNE PARTICULATES. CATALYTIC PROTOTYPE STOVE AT BURN RATES OF 2.5-3 LB/HOUR WAS USED.

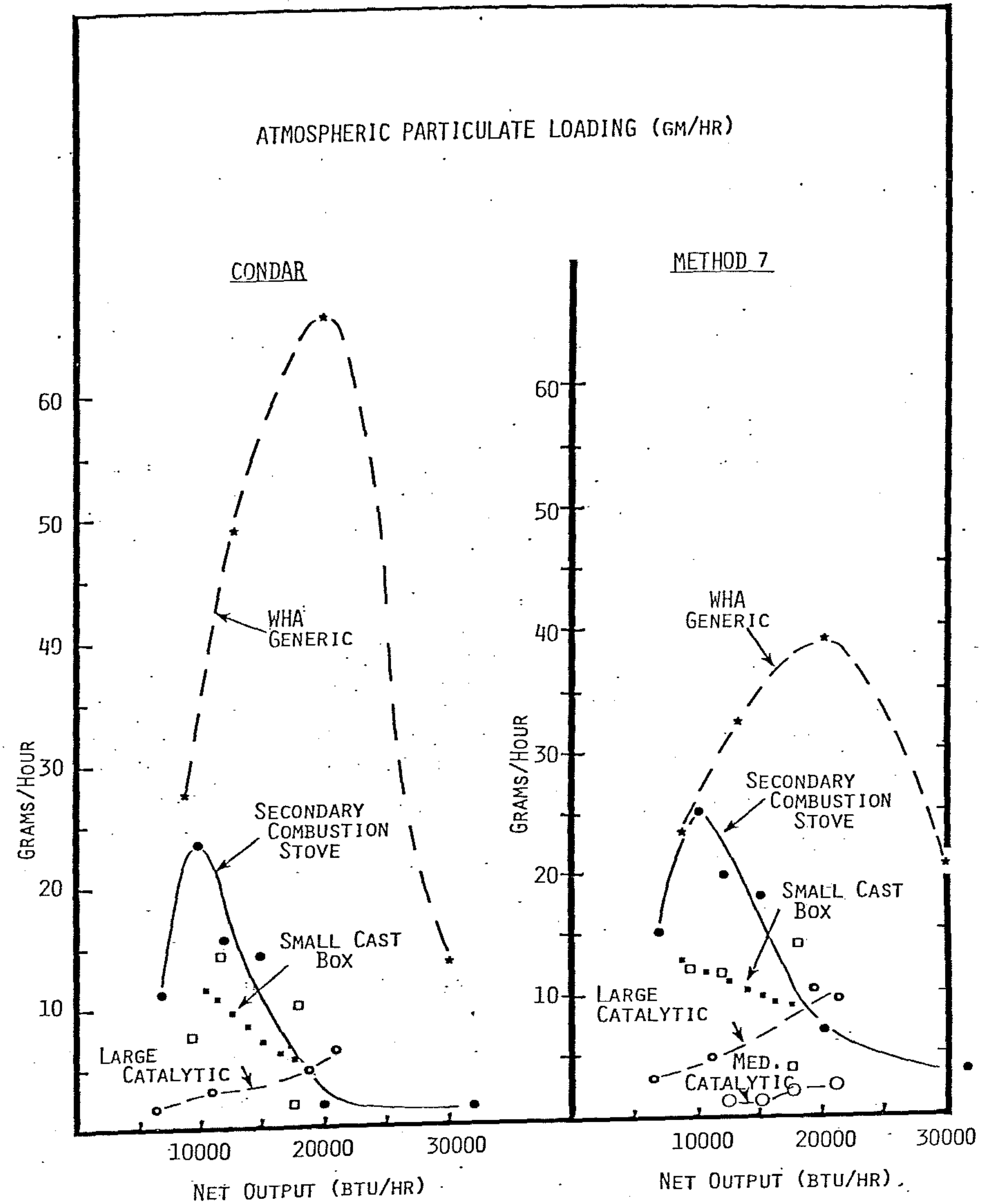

ATMOSPHERIC PARTICULATE LOADING (GM/HR)
CONDAR
METHOD 7
GRAMS/HOUR
WHA GENERIC
SECONDARY COMBUSTION STOVE
SMALL CAST BOX
LARGE CATALYTIC
MED. CATALYTIC
10
20
30
40
50
60
10000
20000
30000
NET OUTPUT (BTU/HR)

FIGURE 6

GRAMS PER HOUR USING CONDAR EMISSION FACTORS
(USING DEQ WEIGHING SCHEME)

WHA GENERIC STOVE

34 x .371 = 12.61
51 x .348 = 17.7
68 x .241 = 16.4
12 x .039 = .47
47.2

EARTH

2.6 x .371 = .96
3.6 x .348 = 1.25
5.5 x .241 = 1.32
10e x .039 = .40
3.93

JOTUL 201

25 x .371 = 9.28
14 x .348 = 4.88
1.5 x .241 = .36
1.5 x .039 = .06
14.58

JOTUL 602

9.3 x .371 = 3.45
14 x .348 = 4.88
5.5 @ 18,000 x .241 = 1.33
5e x .039 = .40
10.06

****

COMPARISON OF GRAMS/HOUR REDUCTION OF PARTICULATES FOR METHOD 7 VS CONDAR USING EACH AS A MEASURE OF PARTICULATE POLLUTION

Stove	%Reduction Method 7	% Reduction Condar
WHA Generic	0	0
Jotul 201	44	69
Jotul 602	62	79
Large Cat.	81	92

TABLE 5

The results of the three tests are shown in table 4. They show that on the average, the Condar sampler samples the same particulate quantity that forms in the winter outdoor atmosphere. Additionally, the weather conditions have some effect on particulate formation. In clear and cloudy conditions probably less particulate formation takes place outdoors due to the effect of high dilution (produced in the tests by the highly dilute outdoor sample). When fog is present somewhat more particulate formation takes place (about 20%), possibly caused by entrapment of some otherwise volatile organics by the fine fog mist.

The significance of these results is clear. The Condar air dilution system quite accurately reflects outdoor particulate formation. Method 7, which utilizes the principle of cold surface condensation, collects more condensate than is actually produced in outdoor air for clean burning stoves but not so for dirty stoves as noted above. (See also Figure 2). Therefore, the hypothesis suggested earlier, that air dilution systems are more appropriate for reference techniques, is strongly supported. Method 7 over-estimates particulate formation for clean burning stoves.

The significance of the relative over-estimation of emissions by Method 7 is shown graphically in figure 6 and table 4. Note in figure 6 the much greater relative particulate reduction indicated by the Condar results. It is quantified in table 4. Using air dilution data even stoves such as the Jotul 201 and 602 type provide 69% and 79% particulate reduction (compared to 44% and 62% respectively using Method 7 data).

ADDENDUM

There is an additional aspect of Method 7 testing that poses a potential systematic error problem: Method 7 utilizes a fiberglass backup filter which is intended to catch those condensable organics which have not been caught by the impinger train. This filter is small, (less than 3 inches diameter) and remains in line for up to 4 or more hours before it is changed.

At Condar we have conducted research into the phenomenon known as revolitization of organics on filters. It works like this: When a filter is first installed, its collection of particles is essentially complete. Consistent high collection efficiency continues until at some point in time some of the already collected material begins to be revolitized by the passing gas stream and pass out the back of the filter. From this point on (it is a rather sudden event) the collection efficiency of the filter drops markedly and the resulting calculated emission factor is artificially low. Research at Condar indicated, of the several factors involved, the most important factor which effects the time at which revolitization will start is the total cumulative number of cubic feet of gas per square inch of filter area which has passed through the filter. Considering the small diameter of the Method 7 filter, the flow rate, and the length of time the filter is left on, revolitization undoubtably occurs frequently and possibly begins as early as 30 - 45 minutes into a test.

The significance of this phenomenon is because woodstove tests vary greatly in length, the amount of lost particulate matter from revolitization is not consistent from test to test. Generally, longer tests probably exhibit the most pronounced reduction in emission factors caused by revolitization. According to Dr. Charles Knight of the Tennessee Valley Authority, (personal communication, 1983), who has extensive Method 5 experience, this phenomenon could effect results quite significantly.

The need here is to evaluate magnitude of the Method 7 revolitization effect: itself a simple research project, and take precautionary measures (add a second backup filter for example) if necessary.

PROPOSED PROCEDURE FOR DETERMINING EQUIVALENCY OF WOODSTOVE PARTICULATE SAMPLING SYSTEMS

I am describing a proposed woodstove equivalency procedure for two reasons:

(1) I have had as much experience dealing with this issue as anyone.

(2) The EPA has recently (March 20, 1984 Federal Register) issued proposed equivalency procedures for airborne particulate analysis.

TEST PROCEDURE

a. Sample collection: Conduct 16 stove emissions test runs following appropriate sampling protocol, 4 tests each on each of 4 stoves. Dual simultaneous samplers shall be used for both reference and candidate method.

Calculate reference method weighted grams per hour emissions for each stove (see c - 1 below) following the Oregon weighting technique. Disregard any stoves which exceed 20 gm./hr weighted average. Four stoves are needed for the tests to be valid.

b. Test for Precision: (1) Calculate the precision for each method: For a given test, calculate the mean emission factor and the range (difference between the two test values) as a percent of the mean. Determine the average range of the 16 tests.

$$\text{Standard deviation} = \frac{\text{Average Range}}{1.128}$$

(2) If the standard deviation of the reference method exceeds 11.0% or any single test range exceeds 22%, the precision of the reference method analytical procedure is out of control. Corrective action must be taken to determine the sources of imprecision and then those reference method tests in exceedence of 22% range must be repeated. If, after these tests are in accordance and the standard deviation still exceeds 10.5% the entire test procedure must be repeated.

(3) If any single candidate method test's range exceeds 22% or its standard deviation exceeds 11% the candidate method fails the precision test. Only those tests count in which the reference method displays adequate precision.

c. Test for consistent relationship.

1) Reference Method: For each stove, determine the weighted grams/hour emissions (4 tests per stove). For each test use the average emission factor value per test for the reference method.

2) Candidate Method: Using average emission factors for each test, calculate a best fit line (straight or curvilinear) for the Candidate vs. Reference method relationship. Using the best fit equation calculate predicted Reference method emission factors for each test, for each tester (#1, #2) and then predicted gm./hour emissions for each tester. Determine the weighted gm./hour emissions for each tester for each stove. Make a matrix of comparison of differences between candidate and reference method (as % of reference method).

Example: Stove 1

	Reference Method, weighted gm./hour
Candidate Tester 1, weighted gm./hr	12%
Candidate Tester 2, weighted gm./hr	5%

Repeat this for all four stoves.

No difference in all the paired comparisons shall exceed 20% if the candidate is to pass.

THE UNIQUE LINE OF ORGANIC CORRELATION (REDUCED MAJOR AXIS)

Since the assumption of dependent and independent variates in the case of morphological dimensions is often without real foundation according to Kermack (1950), the use of the conventional regression-line suffers from a serious drawback. There is usually no clear justification for saying, e.g., that increase in skull length is dependent upon increase of body length; it is more realistic to consider changes in skull length and body length as due to a set of common factors.

When conventional regression methods are used, the slope of the regression line is directly dependent upon which one of the two morphological dimensions is chosen as the independent variable. Considerations of rates of growth, e.g., would depend on the choice of dependent variable. This difficulty is magnified in cases where the correlation is low, thus resulting in a large angle of intersection between the two possible regression lines. Pearson (K. Pearson, 1901, On lines and planes of closest fit to systems of points in space, *Phil. Mag.* 6: 2; 559ff.) utilizes in the place of regression lines the single line which forms the major axis of the correlation surface. In accord with this proposal, a single line called the *reduced major axis* has been suggested [Jones (1937) and Tessier (1948)] whose properties are better suited for analysis of paired morphological dimensions than Pearson's major axis.

The properties of the reduced major axis (also referred to as the unique line of organic correlation) have been worked out and discussed by Kermack and Haldane (1950) and Kruskal (1953). A detailed discussion with examples of both regression methods and reduced major axis methods is

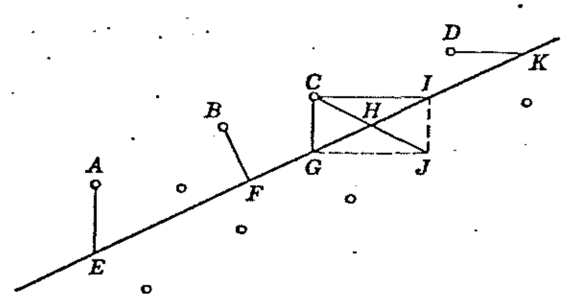


FIG. 9.1. Diagram to show various methods of fitting a line to a scatter of points. A regression y on x minimizes the sum of the squares of the deviations measured as *AE*. A regression line x on y minimizes the corresponding sum of deviations measured as *DK*. A major axis minimizes the sum of the squares of the deviations measured as *BF*. A reduced major axis minimizes the sum of the areas of triangles *GCI*. (Taken from Imbrie, 1956, The place of biometrics in taxonomy, *Bull. Amer. Mus. Nat. Hist.* 108: 2; 211–252.)

FROM: MILLER & KAHN; STATISTICAL ANALYSIS IN THE GEOLOGICAL SCIENCES given by Imbrie (1956*a*). Figure 9.1, reproduced from Imbrie (1956*a*), shows the relationships between the several methods of fitting a line to a scatter of points.

If inspection of the scatter diagram indicates that a straight line of the form $y = b + Kx$ will not satisfactorily fit the points, it is suggested that the new scatter diagram be plotted on double log paper. If a straight line appears to give a satisfactory fit to the points in this second case, then the straight line may be expressed in the form $\log y = \log b + k \log x$, which is equivalent to the allometric equation, $y = b + x^K$. The following statistics may be used equally well where now all x and all y in the equations are replaced by their log values. For the reduced major axis in the form of a straight line $y = b + Kx$ (the isogonic growth equation) the statistics which follow are available.

The Statistics

The slope

$$K = \frac{s_y}{s_x}$$

where s_y is the standard deviation of y and s_x the standard deviation of x.

This may be put in convenient computing form as

$$K = \sqrt{\frac{\sum y^2 - \bar{y}\sum y}{\sum x^2 - \bar{x}\sum x}}$$

The standard error of the slope s_K is expressed as

$$s_K = \frac{s_y}{s_x}\sqrt{\frac{1 - r^2}{n}}$$

where r^2 is the square of the correlation coefficient and n the size of the sample.

The intercept

$$b = \bar{y} - \bar{x}K$$

The standard error of the intercept s_b is expressed as

$$s_b = s_y\sqrt{\frac{1 - r^2}{n}\left(1 + \frac{\bar{x}^2}{s_x^{\,2}}\right)}$$

Dispersion around the reduced major axis, S_d

$$S_d = \sqrt{2(1 - r)(S_x^{\,2} + S_y^{\,2})}$$

Comparison of the slopes of two separate reduced major axes. The hypothesis is that the difference between K_1 and K_2 is no greater than that expected by chance.

(1) Zero (0) failures: The candidate method passes the test for consistent relationship.

(2) Three (3) or more failures: The candidate method fails the test for consistent relationship.

(3) One (1) or two (2) failures: Conduct a second set of simultaneous measurements as specified in Table C-1. The results of the combined total of first-set and second-set measurements shall be interpreted as follows:

(i) One (1) or two (2) failures: The candidate method passes the test for consistent relationship.

(ii) Three (3) or more failures: The candidate method fails the test for consistent relationship.

(4) For sulfur dioxide, the 1-hour and 24-hour measurements shall be interpreted separately, and the candidate method must pass the tests for both 1-and 24-hour measurements to pass the test for consistent relationship.

(d) A 1-hour measurement consists of the integral of the instantaneous concentration over a 60-minute continuous period divided by the time period. Integration of the instantaneous concentration may be performed by any appropriate means such as chemical, electronic, mechanical, visual judgment, or by calculating the mean of not less than 12 equally spaced instantaneous readings. Appropriate allowances or corrections shall be made in cases where significant errors could occur due to characteristic lag time or rise/fall-time differences between the candidate and reference methods. Details of the means of integration and any corrections shall be submitted.

(e) A 24-hour measurement consists of the integral of the instantaneous concentration over a 24-hour continuous period divided by the time period. This integration may be performed by any appropriate means such as chemical, electronic, mechanical, or by calculating the mean of twenty-four (24) sequential 1-hour measurements.

(f) For oxidant and carbon monoxide, no more than six (6) 1-hour measurements shall be made per day. For sulfur dioxide, no more than four (4) 1-hour measurements or one (1) 24-hour measurement shall be made per

§ 53.32 Test procedures for gaseous pollutants.

(a) Conduct the first set of simultaneous measurements with the candidate and reference methods:

(1) Table C-1 specifies the type (1- or 24-hour) and number of measurements to be made in each of the three test concentration ranges.

(2) The pollutant concentration must fall within the specified range as measured by the reference method.

(3) The measurements shall be made in the sequence specified in Table C-2, except for the 1-hour SO_2 measurements, which are all in the high range.

(b) For each pair of measurements, determine the difference (discrepancy) between the candidate method measurement and reference method measurement. A discrepancy which exceeds the discrepancy specified in Table C-1 constitutes a failure. (See Figure C-1 in Appendix A for a suggested format for reporting the test results).

(c) The results of the first set of measurements shall be interpreted as follows:

day. One-hour measurements may be made concurrently with 24-hour measurements if appropriate.

(g) For applicable methods, control or calibration checks may be performed once per day without adjusting the test analyzer or method. These checks may be used as a basis for a linear interpolation-type correction to be applied to the measurements to correct for drift. If such a correction is used, it shall be applied to all measurements made with the method, and the correction procedure shall become a part of the method.

TABLE C-1.—*Test concentration ranges, number of measurements required, and maximum discrepancy specification*

Pollutant	Concentration range, parts per million	Simultaneous measurements required: 1-hr, First set	1-hr, Second set	24-hr, First set	24-hr, Second set	Maximum discrepancy specification, parts per million
Oxidants	Low 0.06 to 0.10	5	6			0.02
	Med 0.15 to 0.25	5	6			.03
	High 0.35 to 0.45	4	6			.04
Total		14	18			
Carbon monoxide	Low 7 to 11	5	6			1.5
	Med 20 to 30	5	6			2.0
	High 35 to 45	4	6			3.0
Total		14	18			
Sulfur dioxide	Low 0.02 to 0.05			3	3	0.02
	Med 0.10 to 0.15			2	3	.03
	High 0.30 to 0.50	7	8	2	2	.04
Total		7	8	7	8	
Nitrogen dioxide	Low 0.02 to 0.08			3	3	0.02
	Med 0.10 to 0.20			2	3	.02
	High 0.25 to 0.35			2	2	.03
Total				7	8	

TABLE C-2—SEQUENCE OF TEST MEASUREMENTS

Measurement	Concentration range: First set	Second set
1	Low	Medium.
2	High	High.
3	Medium	Low.
4	High	High.
5	Low	Medium.
6	Medium	Low.
7	Low	Medium.
8	Medium	Low.
9	High	High.
10	Medium	Low.
11	High	Medium.
12	Low	High.
13	Medium	Medium.
14	Low	High.
15		Low.
16		Medium.
17		Low.
18		High.

(Secs. 110, 301(a), Clean Air Act as amended (42 U.S.C. 7410, 7601))

[40 FR 7049, Feb. 18, 1975, as amended at 41 FR 52693, Dec. 12, 1976; 44 FR 37917, June 29, 1979]

§ 53.33 Test procedure for lead methods.

(a) *Sample collection.* Collect simultaneous 24-hour samples (filters) of lead at the test site or sites with both the reference and candidate methods until at least 10 filter pairs have been obtained. If the conditions of § 53.30(d)(4) apply, collect at least 10 common samples (filters) in accordance with § 53.30(d)(4) and divide each to form the filter pairs.

(b) *Audit samples.* Three audit samples must be obtained from the Director, Environmental Monitoring and Support Laboratory, Department E, U.S. Environmental Protection Agency, Research Triangle Park, N.C. 27711. The audit samples are ¾ × 8-inch glass fiber strips containing known amounts of lead at the following nominal levels: 100 μg/strip; 300 μg/strip; 750 μg/strip. The true amount of lead in total μg/strip will be provided with each audit sample.

(c) *Filter analysis.* (1) For both the reference method and the audit samples, analyze each filter extract 3 times in accordance with the reference method analytical procedure. The analysis of replicates should not be performed sequentially (i.e., and single sample should not be analyzed three times in sequence). Calculate the indicated lead concentratons for the reference method samples in μg/m³ for each analysis of each filter. Calculate the indicated total lead amount for the audit samples in μg/strip for each analysis of each strip. Label these test results as R_{1A}, R_{1B}, R_{1C}, R_{2A}, R_{2B}, . . ., Q_{1A}, Q_{1B}, $_{1C}$, ..., where R denotes results from the reference method samples; Q denotes results from the audit samples; 1, 2, 3 indicates filter number and A, B, C indicates the first, second, and third analysis of each filter, respectively.

(2) For the candidate method samples, analyze each sample filter or filter extract three times and calculate, in accordance with the candidate method, the indicated lead concentration in μg/m³ for each analysis of each filter. Lable these test results as C_{1A}, C_{1B}, C_{2C}, . . ., where C denotes results from the candidate method. (For candidate methods which provide a direct measurement of lead concentrates without a separable procedure, $C_{1A}=C_{1B}=C_{1C}$, $C_{2A}=C_{2B}=C_{2C}$, etc.)

(d) For the reference method, calculate the average lead concentration for each filter by averaging the concentrations calculated from the three analyses:

$$R_{i\ ave} = \frac{R_{iA} + R_{iB} + R_{iC}}{3},$$

where i is the filter number.

(e) Disregard all filter pairs for which the lead concentration as determined in the previous paragraph (d) by the average of the three reference method determinations, falls outside the range of 0.5 to 4.0 μg/m³. All remaining filter pairs must be subjected to both of the following tests for precision and consistent relationship. At least ~~five~~ filter pairs must be within the 0.5 to 4.0 μg/m³ range for the tests to be valid.

(f) *Test for precision.* (1) Calculate the precision (P) of the analysis (in percent) for each filter and for each method, as the maximum minus the minimum divided by the average of the three concentration values, as follows:

$$P_{Ri} = \frac{R_i \max - R_i \min}{R_i \text{ ave}} \times 100\%, \text{ or}$$

$$P_{Ci} = \frac{C_i \max - C_i \min}{C_i \text{ ave}} \times 100\%,$$

where i indicates the filter number.

(2) If any reference method precision value (P_{Ri}) exceeds 15 percent, the precision of the reference method analytical procedure is out of control. Corrective action must be taken to determine the source(s) of imprecision and the reference method determinations must be repeated according to paragraph (c) of this section, or the entire test procedure (starting with paragraph (a)) must be repeated.

(3) If any candidate method precision value (P_{Ci}) exceeds 15 percent, the candidate method fails the precision test.

(4) The candidate method passes this test if all precision values (i.e., all P_{Ri}'s and all P_{Ci}'s) are less than 15 percent.

(g) *Test for accuracy.* (1) For the audit samples calculate the average lead concentration for each strip by averaging the concentrations calculated from the three analyses:

$$Q_{i}\ \text{ave} = \frac{Q_{iA} + Q_{iB} + Q_{iC}}{3},$$

where i is audit sample number.

PROPOSED RULES

Calculate the percent difference (D_q) between the indicated lead concentration for each audit sample and the true lead concentration (T_q) as follows:

$$D_{qi} = \frac{Q_i\ ave - T_{qi}}{T_{qi}} \times 100$$

(2) If any difference value (D_{qi}) exceeds ±5 percent the accuracy of the reference method analytical procedure is out of control. Corrective action must be taken to determine the source of the error(s) (e.g., calibration standard discrepancies, extraction problems, etc.) and the reference method and audit sample determinations must be repeated according to paragraph (c) of this section or the entire test procedure (starting with paragraph (a)) must be repeated.

(h) *Test for consistent relationship.* (1) For each filter pair, calculate all nine possible percent differences (D) between the reference and candidate methods, using all nine possible combinations of the three determinations (A, B, and C) for each method, as:

$$D_{in} = \frac{C_{ij} - R_{ik}}{R_{ik}} \times 100\%, \text{ where}$$

i is the filter number, and n numbers from 1 to 9 for the nine possible difference combinations for the three determinations for each method (j= A, B, C, candidate; k= A, B, C, reference).

(2) If none of the percent differences (D) exceeds ±20 percent, the candidate method passes the test.

(3) If one or more differences (D) exceeds ±20 percent, the candidate method fails the test for consistent relationship.

(i) The candidate method must pass both the precision test and the consistent relationship test to qualify for designation as an equivalent method.

TABLE C-3—TEST SPECIFICATIONS FOR LEAD METHODS

Concentration range, µg/m³	0.5 to 4.0
Minimum number of 24-hr measurements	5
Maximum analytical precision, percent	15
Maximum analytical accuracy, percent	±5
Maximum difference, percent of reference method	±20

(Secs. 110, 301(a), Clean Air Act is amended (42 U.S.C. 7410, 7601))

[44 FR 37917, June 29, 1979]

TABLE A-3. SOURCE EMISSION METHODS FOR WHICH PRECISION/ACCURACY DATA EXISTS BASED ON COLLABORATIVE TESTS OR SINGLE-LABORATORY EVALUATIONS

A hod	Description/Application	Condition of test	Standard Deviation Within Lab	Standard Deviation Between Lab	Accuracy
	Velocity Volumetric Flow	Real sample, Multi-laboratory	3.9% of flow 5.5% of flow	5.0% of flow 5.6% of flow	Accurate within limits of method precision
	CO_2 (manual)	" "	0.2%	0.4%	" " "
	O_2 (manual)	" "	0.3%	0.6%	" " "
	Molecular Weight	" "	0.35 g/g mole	0.048 g/g mole	" " "
	Particulate Emission	" "	10.4% of conc.	12.1% of conc.	Not determinable
	Stack Moisture Content	" "	0.1%	0.1%	Within limits of method precision
	SO_2-Power Plant	" "	4.0% of conc.	5.8% of conc.	Accurate within limits of method precision
	NO_x-Nitric Acid	" "	14.9% of conc.	18.5% of conc.	" " "
	NO_x-Power Plant	" "	6.6% of conc.	9.5% of conc.	" " "
	SO_2-Sulfuric Acid Plant	" "	8.0 mg/m^3	11.2 mg/m^3	" " "
	H_2SO_4-Sulfuric Acid Plant	" "	2.7 mg/m^3	3.0 mg/m^3	" " "
	Stack Gas Opacity	" "	2.0% of opacity	2.0% of opacity	5% opacity at level of standard
	CO-Refinery FCC	" "	13 ppm	25 ppm	$\leq$ 24 ppm
	H_2S-Refinery Fuel Gas	Simulated sample, Multi-laboratory	2.1% of conc.	4.5% of conc.	4% at level of standard
	Pb	Real sample, Single laboratory	5% of conc.	—	Accurate within limits of method precision

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Comparing Two Population Variances

The F distribution can be used to test the hypothesis that the variance of one normal population equals the variance of another normal population. This test is often useful because a decision maker wants to determine whether one population is more variable than another. For example, a production manager may want to determine whether the variability of the errors made by one measuring instrument is less than the variability of those made by another measuring instrument. In addition, this test is often used to determine whether the assumptions underlying other statistical tests are valid. For example, in carrying out the t test to determine whether the means of two populations are the same, we assume that the variances of the two populations are equal. (Recall Chapter 8.) This assumption can be checked by carrying out the test described below.

The null hypothesis is that the variance of one normal population σ_1^2 equals the variance of the other normal population σ_2^2. To test this hypothesis, a sample of n_1 observations is taken from the first population and a sample of n_2 observations is taken from the second population. The test statistic is $s_1^2 \div s_2^2$, where s_1^2 is the sample variance of the observations taken from the first population and s_2^2 is the sample variance of the observations taken from the second population. If the null hypothesis (that $\sigma_1^2 = \sigma_2^2$) is true, this test statistic has the F distribution with $(n_1 - 1)$ and $(n_2 - 1)$ degrees of freedom.

Decision Rule: When the alternative hypothesis[12] *is* $\sigma_1^2 > \sigma_2^2$, *reject the null hypothesis if the test statistic exceeds* F_α. *When the alternative hypothesis is* $\sigma_1^2 \neq \sigma_2^2$, *let the population with the larger sample variance be the first population (that is, the one whose sample variance is in the numerator of the test statistic); and reject the null hypothesis if the test statistic exceeds* $F_{\alpha/2}$.

To illustrate the use of this test, suppose that a firm wants to test whether the variance of the length of life of type A light bulbs equals the variance of the length of life of type B light bulbs. (The significance level is set at .02) A random sample of 25 type A bulbs is selected, as is a random sample of 25 type B bulbs, and it is found that the sample variance is 50 for type A bulbs and 80 for type B. Since the alternative hypothesis is that the two variances are unequal (regardless of which is bigger), we let the type B bulbs constitute the first population (since its sample variance is larger than the sample variance of type A bulbs). Thus, $s_1^2 \div s_2^2 = 80 \div 50$, or 1.6. The null hypothesis should be rejected if this test statistic exceeds $F_{.01}$ (the number of degrees of freedom

12. When the alternative hypothesis is one-sided (that is, when the variance of one population is larger than that of the other population, according to the alternative hypothesis), the population with the larger variance according to the alternative hypothesis should be designated as the first population.

statistic does not exceed $F_{.01}$, the null hypothesis should not be rejected.

APPENDIX 10.2

Formulas for Computations in the Analysis of Variance

In calculating the sums of squares that are required by the analysis of variance, it is usually best to use formulas that require finding only sums and sums of squares of the observations. Such formulas are given below for the sums of squares in Table 10.9:

$$BSS = \frac{1}{n}\sum_{j=1}^{k} T_j^2 - \frac{1}{nk}T^2$$

$$TSS = \sum_{i=1}^{n}\sum_{j=1}^{k} x_{ij}^2 - \frac{1}{kn}T^2,$$

where T_j is the total of the observations from the jth population (or the jth treatment), and T is the total of all observations. Once these two sums of squares are calculated, we can obtain WSS by subtraction. That is,

$$WSS = TSS - BSS.$$

An additional formula that applies to Table 10.12 is

$$RSS = \frac{1}{k}\sum_{i=1}^{n} T_i^2 - \frac{1}{kn}T^2,$$

where T_i is the total of the observations in the ith block.

To illustrate the use of these formulas, consider once more the data in Example 10.3. Clearly, $T = 552$, $T_1 = 204$, $T_2 = 160$, and $T_3 = 188$. Thus,

$$BSS = \frac{1}{4}(204^2 + 160^2 + 188^2) - \frac{1}{4(3)}552^2 = 25{,}640 - 25{,}392 = 248$$

$$TSS = 25{,}652 - \frac{1}{4(3)}552^2 = 25{,}652 - 25{,}392 = 260$$

$$WSS = 260 - 248 = 12.$$

Comparing these results with those in the solution to Example 10.3, we find that they are identical. The advantage of the formulas given here is that they are easier and more efficient to calculate. Although this is not obvious in this case (since the numbers were intentionally chosen so that the calculations would be simple), this is generally true.

BARNETT CONDAR DATA

RUN NO.	PREDICTED METHOD-7 VALUES CONDAR-1 (G/HR)	CONDAR-2 (G/HR)	AVERAGE (G/HR)	REFERENCE METHOD-7 (G/HR)	DIFFERNC CONDAR-1 (G/HR)	DIFFERNC CONDAR-2 (G/HR)	DIFFERNC AVERAGE (G/HR)	DIFFERNC CONDAR-1 (%)	DIFFERNC CONDAR-2 (%)	DIFFERNC AVERAGE (%)
1	18.1	18.7	18.4	19.7	-1.6	-1.0	-1.3	-8.3	-5.0	-6.6
2	23.8	24.2	24.0	25.3	-1.5	-1.1	-1.3	-5.8	-4.2	-5.0
3	13.5	14.0	13.7	15.2	-1.7	-1.2	-1.5	-11.5	-7.8	-9.6
4	5.3	4.9	5.1	3.6	1.7	1.3	1.5	48.4	37.5	42.9
5	5.2	5.2	5.2	6.8	-1.6	-1.6	-1.6	-23.1	-24.2	-23.7
6	37.0	37.0	37.0	38.9	-1.9	-1.9	-1.9	-4.9	-4.9	-4.9
7	26.1	27.1	26.6	23.4	2.7	3.7	3.2	11.3	16.0	13.7
8	34.9	36.0	35.5	32.2	2.7	3.8	3.3	8.5	11.7	10.[illegible]
9	15.6	16.9	16.2	20.4	-4.8	-3.5	-4.2	-23.5	-17.4	-20
10	17.1	17.7	17.4	18.1	-1.0	-0.4	-0.7	-5.3	-2.3	-3.[illegible]
11	6.5	7.1	6.8	4.1	2.4	3.0	2.7	58.0	74.2	66.1
12	8.1	8.8	8.5	10.4	-2.3	-1.6	-1.9	-22.2	-15.2	-18.7
13	10.2	9.7	10.0	9.7	0.5	0.0	0.3	5.3	0.2	2.8
14	5.3	5.2	5.3	2.0	3.3	3.2	3.3	165.5	161.7	163.6
MEAN	16.2	16.6	16.4		2.1	2.0	2.0	28.7	27.3	28.0

EOF..

APPENDIX V

DEQ'S ANALYSIS OF CONDAR - METHOD 7 CONSISTENT RELATIONSHIP

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IMPLICATIONS OF OREGON DEQ EMISSIONS TEST DATA ON CATALYTIC STOVE EMISSION STANDARDS

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INTRODUCTION

The EPA, following the provisions of the Clean Air Act, has historically developed regulations which, when based on technology performance, utilize either "reasonably available control technology"* hereinafter referred to as "best practical technology," "best available technology,"** or a phased-in combination of both. The DEQ, in its woodstove regulation program has followed the "best practical technology" approach by testing clean-burning stoves that are currently available and commercially viable.

In this report I will present evidence that the recent DEQ proposal to require a 3 gram/hour emission limit for catalytic stoves exceeds both the performance levels of "best practical technology" and "best available technology" as we now know it to be. A requirement of 3 grams/hour would invoke "technology forcing"; requiring development of technology beyond the best currently available so that the standard can be met.

I will document both the above position and will describe the development of an emissions limit I believe is applicable to "best practical technology" using data the DEQ has obtained.

The DEQ has conducted sixteen stove tests on catalytic stoves at Omni using their testing protocol. Three stoves, which use various versions of our catalytic technology were tested. In addition, at Condar we conducted 15 stove tests for DEQ in November 1983 using three other stoves employing the same technology.

I will attempt to analyze the available data in several different ways and then collate the results to see if they all point to a similar conclusion.

STOVES TESTED AT OMNI

(1) Blaze King Princess Prototype - This stove has served as the primary DEQ catalytic test stove. It was constructed in June 1982 by Keith Yarwood of Woodcutters and myself. The catalyst mixer and support system is a prototype of what is now our commercialized cast catalyst support system. The performance of the prototype version has proved essentially identical to the commercially available cast in our lab tests. The prototype stove used our thermostat control system but, its application is not standard. This causes lower maximum burn rates and a somewhat less steady burn than it should. The secondary air supply is greater than our program recommends.

* Best practical technology refers to technology which is generally now commercially viable.

** Best available technology is available but not considered commercially viable. This technology produces lower emissions than best practical technology, however.

The catalyst has been 5.7" x 3" x 25 cell Corning. (A replacement catalyst of the same type was installed for the December 1983 tests) Although it was used in early stoves, this catalyst has proved to overheat and burn out prematurely. We have since found 5.7" x 3" x 16 cell or 5.7" x 2" x 25 cell catalysts have adequate life.

The important points about this stove are:

a. Its physical design closely follows our plans.

b. Secondary air supply is somewhat too great - promoting hotter, cleaner burns at high burn rates, and shorter catalyst life.

c. The 3" x 25 cell catalyst is not used in production anymore. This catalyst produces somewhat lower emissions than commercially-used catalysts, causing this stove to be somewhat unrepresentative of more recent technology modifications which balance emission performance with catalyst life better. Basically, the Blaze prototype is an example of "best available" rather than "best practical technology."

(2) Blaze King Production Princess - This production stove was purchased by Kent Stove for testing purposes at Omni. It uses a 5.7" x 3" x 16 cell Corning catalyst. This stove is a modification of our system in three ways.

a. The mixer system has been changed.

b. A different control system has been used.

c. More secondary air is used.

The significances of this stove are that is uses a commonly used combustor, it is a production stove but, its combustion and control systems vary somewhat from the prototype.

(3) Earth Stove - This stove, built by John McIntire and myself, is close to a production stove but, in the haste to prepare the stove for testing, the secondary air system was inadvertently blocked off. The stove uses Condar internal parts and a 5.7" x 2" x 25 cell Corning catalyst. The thermostat is different and some unsteadiness in burn occurred during the tests. The secondary air and control problems have since been improved.

The significance of this stove is that because its secondary air was blocked and control was poor the stove's performance cannot be considered acceptable.

STOVES TESTED A CONDAR:

Stove x. A production stove of another brand in our program. This stove follows our plans closely and uses all components. Catalyst: 5.7" x 3" x 16 cell Corning.

Stove y. Condar's prototype stove containing all components and following our plans closely. Catalyst: 5.7" x 3" x 16 cell Corning.

Stove z. A production stove of an additional brand in our program. This stove follows plans quite closely and uses all components. Catalyst: 5.7" x 3" x 16 cell Corning.

To my knowledge these three stoves perform as well as any in our program.

ANALYSIS APPROACH 1:

Examine the Earth Stove performance. At a low burn rate the emissions are similar to, but somewhat above those of the Blaze Prototype (Figure 1). At this low burn rate secondary air is not required and the stove's performance is representative. At higher burn rates progressively more secondary air is needed. The lack of it in this stove caused the emissions curve to have an uncharacteristic steep rise. (Figure 1)

The significances of this unique stove are:

a. The weighted emissions value for this stove of 6 grams per hour (table 2) is unacceptably high for a standard.

b. The low burn rate emissions support other data that this type of technology produces no greater than 2 grams/hour emissions at 7500 BTU/hour net output.

ANALYSIS APPROACH 2:

Examine the Blaze King Princess Prototype data. The unfortunate aspect of this data is that it is known that a 5.7" x 3" x 25 cell catalyst produces lower emissions than a 3" x 16 cell catalyst. Unfortunately, the magnitude of this effect has not been quantified. This problem is further complicated by the fact that Corning has introduced a new longer lasting 16 cell catalyst which will probably soon dominate the market. The performance of this catalyst in the Blaze prototype stove is probably the most significant information which needs to be obtained relative to "best practical technology" performance.

Setting aside the uncertainties associated with the various catalysts' performance, the available data can be analyzed as an example of "best available" (although not "best practical") performance level. Figure 1 dramatically demonstrates the marked difference in performance caused by the use of two different catalysts (both 5.7" x 3" x 25 cell). The summer 1983 series, utilizing the original catalyst, produced emissions levels more than 2.5 times as great as the December 1983 series when a new replacement catalyst was used. (See Figure 1 and table 2). Performance sensitivity to a specific catalyst is evident. This begs the questions; what would performance curves look like if a large number of catalysts had been used? Since using only two catalysts produces large variation, what would population statistics indicate for variation and confidence limits if a large number of catalysts were used?

There are several ways to interpret the limited available Blaze King Prototype data. Using just the December 1983 data alone is not acceptable because it ignores over half the data bank. The same argument applies to just selecting the Summer 1983 data.

The DEQ has indicated that they want to use only the December 1983 data. They have done so for two reasons:

(1) The December 1983 catalyst was 50 hours old at the start of the tests following (protocol conditions). The Summer 1983 data is therefore, different, because an older catalyst was used.

(2) My work conducted for the DEQ in November 1983 concerning the effect of catalyst aging on emissions factors showed an increase in emissions as the catalyst aged from 0 to 120 hours. Therefore, the older Summer 1983 catalyst would be expected to produce higher emissions.

I will address these DEQ assertions in sequence.

(1) The Summer 1983 catalyst was in fact not significantly older than the December 1983 catalyst. The Summer 1983 catalyst was new when the stove was burned for the 1982 tests. The 1982 tests logged approximately the following hours:

3 preburns @ 6 hours	=	18
6 tests @ 6 hours	=	36
		54 Hours

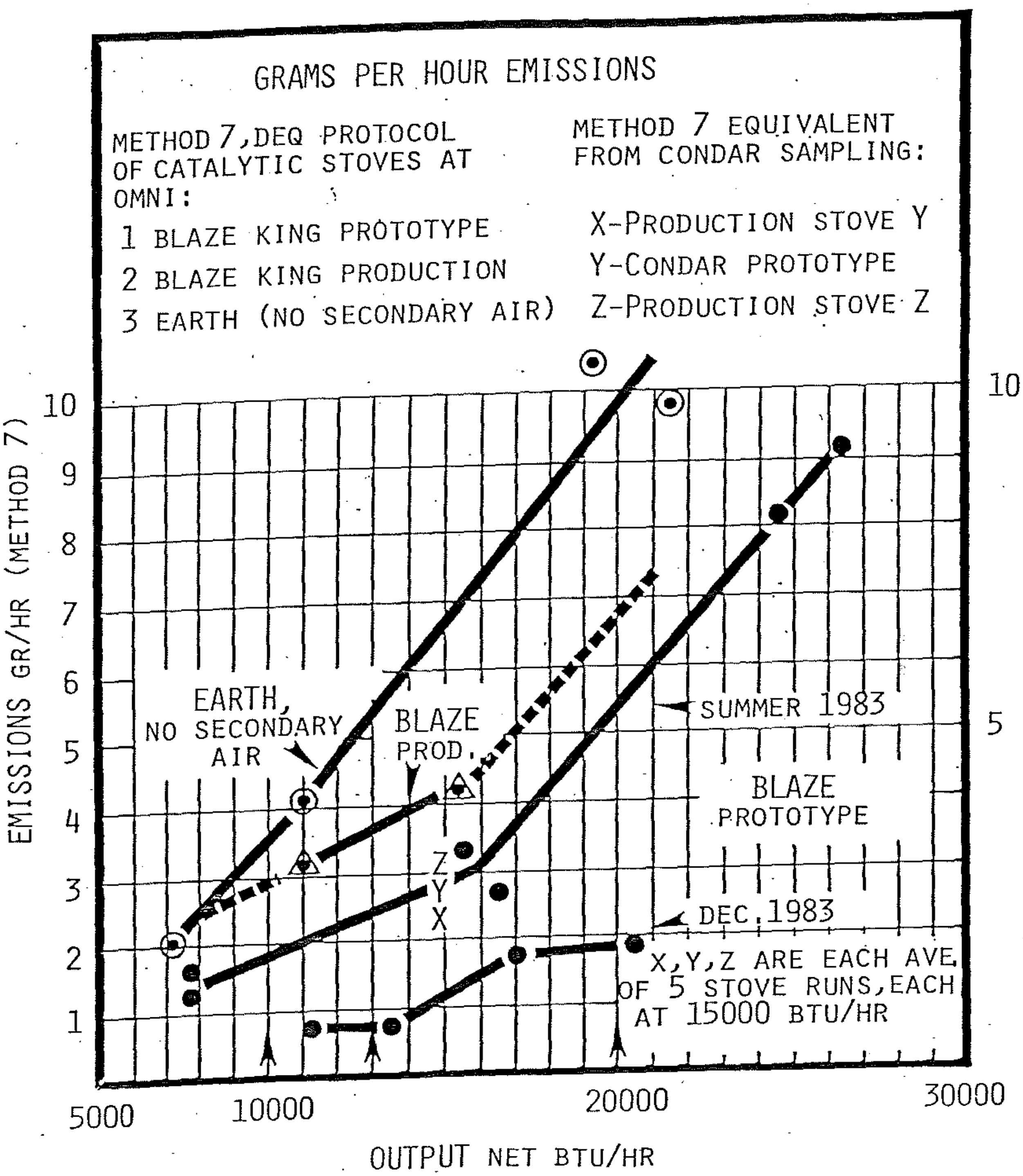
In addition there were 2-3 preburns in 1983 adding about 20 hours. The Summer 1983 catalyst was about 75 hours old when Summer 1983 tests began. Thus, the December 1983 catalyst was only about 25 hours younger when its tests began. By the end of the December 1983 tests (4 tests totaling about 35 hours) the age of that catalyst overlapped the age of the Summer 1983 catalyst. If the DEQ hypothesis is correct, there should be an overlap in emissions factors between the last December 1983 tests and the first Summer 1983 tests. This is clearly not the case. (See Figure 1)

(2) My work for the DEQ showed that there was some increase in emissions as a catalyst aged from 0 to 120 hours. However, the DEQ has only part of the available data. At Condar we were interested in learning how long this trend continued. We have conducted 8 tests with catalysts aged 100 - 1000 hours. Table 3 shows that the average emissions factors from these 8 tests are not greater than the average of the 0 - 120 hour tests for DEQ. Thus, it is clear that the catalyst "early degradation" ceases at about 100 hours and the catalyst's performance is stable thereafter to 1000 hours. Additionally, two tests were run on a 4000 hour old catalyst to evaluate maximum degredation. The emissions factors were only 1.7 times greater than those of new catalysts. (Table 3) In conclusion, DEQ is not justified in selecting only the December 1983 test data. The ages of the two catalysts were actually similar, and in fact overlapped during the tests. Also, initial catalyst degradation ceases at about 100 hours and performance is stable thereafter for many hundreds of hours. Catalyst age does not explain the difference in the catalysts performance.

I have chosen, what appears to be the most reasonable approach, to analyze the complete data bank of 10 tests (Summer plus December, 1983 tests). Regression analysis of this data is shown in figure 2. The best fit line produces a weighted average grams/hour value of 2.55 gram/hour (table 2.) I then conducted a test to determine the 95% confidence limits of this data. This limit is what could be used for setting an emission standard (Kowalczyk & Tombleson utilized this approach (although they used a more rigorous 99% confidence level) in their paper which analyzed DEQ 1982 data).

In the case of the analysis at hand, the upper 95% confidence limit is defined as a line two standard errors (in the y direction) above the best fit line (See figure 2). The weighted gram/hour emission average this line produces is 5.5 gram/hour (table 2). It can be argued that since this analysis is dominated by 6 tests with the original catalyst and only 4 with the second catalyst that the results are biased on the high side. Recognizing this, a more appropriate 95% confidence for weighted gram/hour might be closer to 5 gm/hour.

FIGURE 1



GRAMS PER HOUR EMISSIONS
METHOD 7, DEQ PROTOCOL OF CATALYTIC STOVES AT OMNI:
1 BLAZE KING PROTOTYPE
2 BLAZE KING PRODUCTION
3 EARTH (NO SECONDARY AIR)
METHOD 7 EQUIVALENT FROM CONDAR SAMPLING:
X-PRODUCTION STOVE Y
Y-CONDAR PROTOTYPE
Z-PRODUCTION STOVE Z
EARTH, NO SECONDARY AIR
BLAZE PROD.
SUMMER 1983
BLAZE PROTOTYPE
Z
Y
X
DEC.1983
X,Y,Z ARE EACH AVE. OF 5 STOVE RUNS, EACH AT 15000 BTU/HR
EMISSIONS GR/HR (METHOD 7)
1
2
3
4
5
6
7
8
9
10
5
10
5000
10000
20000
30000
OUTPUT NET BTU/HR

AVAILABLE DEQ PROTOCOL DATA ON CATALYTIC STOVES

Blaze Prototype, December, 1983

Method 7 Gm/Kg	Burn Rate Dry kg/hr.	Net Output BTU/Hr	Gm/Hr Emissions
1.5	1.2	16947	1.8
.9	.98	13467	.88
1.1	.8	11238	.88
1.5	1.47	20599	2.21

Blaze Prototype, Summer, 1983

Method 7 Gm/Kg	Burn Rate Dry kg/hr.	Net Output BTU/Hr	Gm/Hr Emissions
5.3	1.73	26200	9.17
5.1	1.59	24600	8.11
2.8	1.01	16600	2.83
3.0	1.07	15600	3.21
3.4	.48	7800	1.63
2.8	.47	7700	1.32

Production Blaze, October, 1983

Method 7 Gm/Kg	Burn Rate Dry kg/hr.	Net Output BTU/Hr	Gm/Hr Emissions
3.7	1.1	15566	4.6
3.7	.85	11806	3.11

Earth, No Secondary Air, Dec. 1983

Method 7 Gm/Kg	Burn Rate Dry kg/hr.	Net Output BTU/Hr	Gm/Hr Emissions
5	.82	10973	4.1
7.5	1.39	19244	10.4
6.1	1.6	20760	9.8
3.5	.56	7315	2.0

TABLE 1

WEIGHTED AVERAGE GRAMS/HOUR EMISSIONS: DEQ PROTOCOL DATA ON CATALYTIC STOVES

	Blaze King Prototype		Production Blaze King	Earth w/out Secondary Air
BTU/HOUR	December, 1983	Summer, 1983		
@10,000	.37 x .75 = .28	.37 x 1.9 = .70	.37 x 2.9 = 1.07	.37 x 3.5 = 1.30
@13,000	.35 x .85 = .30	.35 x 2.5 = .88	.35 x 3.6 = 1.26	.35 x 5.5 = 1.93
@20,000	.24 x2.15 = .52	.24 x 5.5 =1.32	.24 x 6.8e= 1.63	.24 x 10.1= 2.42
@30,000	.04 x 5e = .20	.04 x 10e = .40	.04 x 10e = .40	.04 x 10e = .40
DEQ Weighted Average	1.30	3.30	4.36	6.05

BTU/HR	Summer Plus December 1983 Blaze Prototype Best Fit Line	Summer Plus December 1983 Blaze Prototype Best Fit Line Plus 2 Standard Errors (95% Confidence)
@10,000	.37 x .84 = .31	.37 x 3.94 = 1.46
@13,000	.35 x 2.01 = .70	.35 x 5.11 = 1.79
@20,000	.24 x 4.73 = 1.14	.24 x 7.83 = 1.88
@30,000	.04 x 10e = .40	.04 x 10e = .40
DEQ Weighted Average	2.55	5.53

TABLE 2

CONDAR EMISSIONS FACTOR TESTS; CATALYTIC PROTOTYPE STOVE WITH CATALYSTS OF VARIOUS AGES.CATALYST; CORNING 3"x5.6"x16 CELL, BURNRATE; 3±.5 LB/HR, WOOD;HARDWOOD

	CATALYST AGE		
	0 - 120 HRS. (TESTS FOR DEQ)	100 - 1000 HRS.	4000 HRS.
AVE. EMISSION FACTOR (GM/KG)	1.05	.92	1.75
NUMBER OF TESTS	5	8	2

Table 3

THE SIGNIFICANCES OF THE BLAZE KING PROTOTYPE TESTS ARE:

a. The Blaze King Prototype, using catalysts no longer used in production, produced emission results an undetermined amount lower than conventionally used catalysts would produce.

b. Assuming the data is quite representative, statistical analysis of all the data indicate that, using the 95% confidence level as a criterion, that an emissions standard of 5 to 5.5 gram/hour might be statistically justified.

ANALYSIS APPROACH 3:

Examine the emissions data obtained on the Production Blaze Princess at Omni. Figure 2 shows that the limited data (2 tests) fall parallel to and above the Summer 1983 Prototype Blaze data. I have extended the line to cross the 10,000 and 20,000 BTU/hour points following the more abundant data pattern of the Prototype. The grams/hour were then calculated and shown in table 2 as 4.36 grams per hour. This stove would probably pass a 5 gram/hour standard but not a 4 or 3. Thus, this stove documents that a production model should pass a standard which is based on statistical analysis of DEQ test data. (See previous section)

ANALYSIS APPROACH 4:

Examine in figure 1 the results of 15 stove tests conducted at Condar for DEQ on three stoves. Each of these stoves represents our best practical technology (two of them are production models). The tests were run using the Condar Emissions Sampling System, and Method 7 equivalent values are shown. However, the tests were run using split hardwood (Beech) instead of dimensional fir. Firebox loading was 7 lb/cu. foot and the hot start method (DEQ approach) was used.

The main significances of these tests are:

a. Real world hardwood produces emissions levels that fall well within the range of DEQ results. Real world emissions levels are not likely to exceed (at least for hardwood cordwood) the DEQ laboratory predictions.

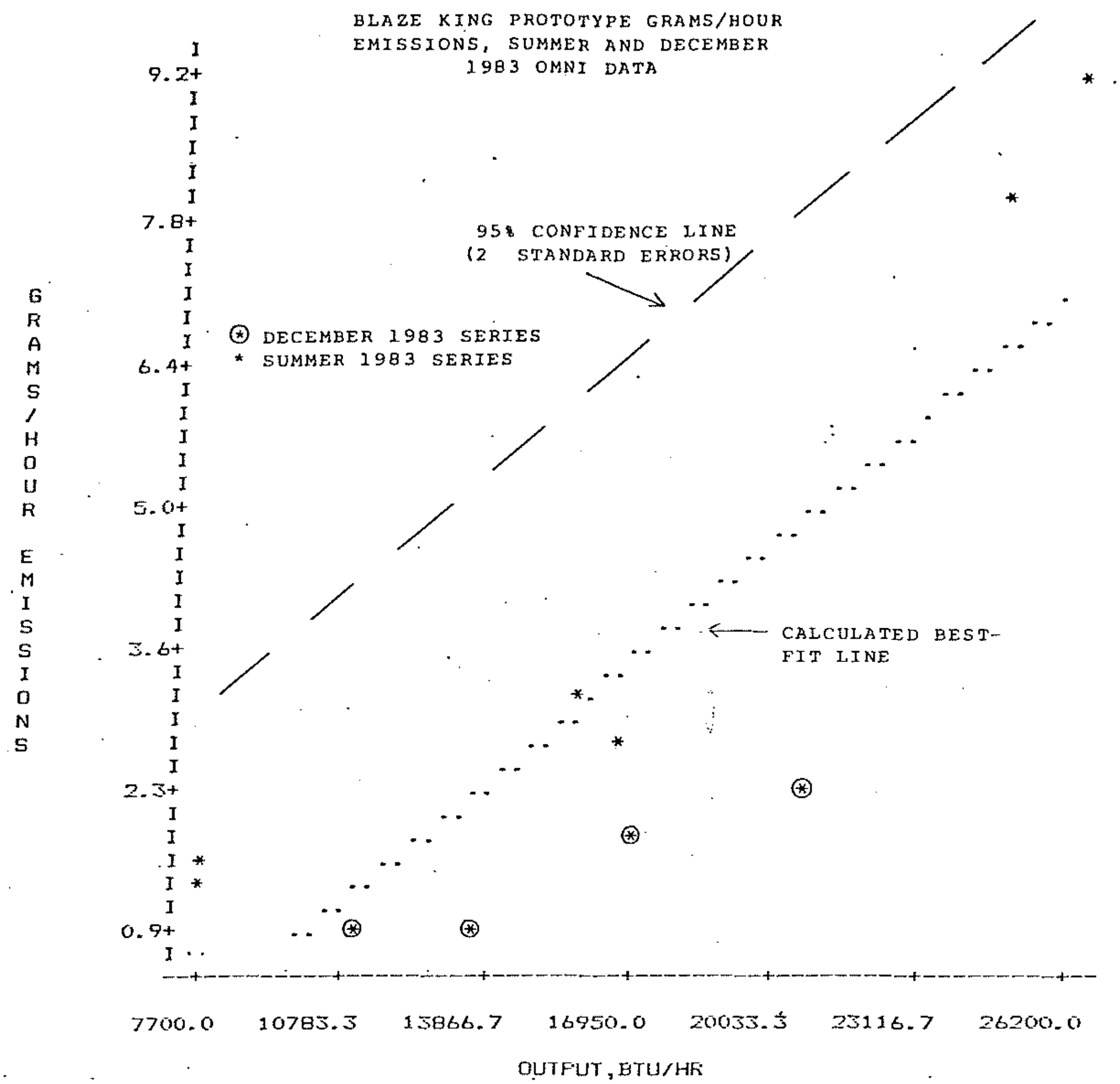
b. Emissions levels of 3 stoves, each of which externally looks different and is sized differently are quite close to one another. Stove performance apparently is quite robust. To put it another way, within limits, similar performance can be obtained from a variety of shapes and sizes of stoves.

c. The data is at least suggestive that 5, perhaps 4, but not 3, grams/hour is available from the best examples of our technology using split hardwood. This conclusion is based on the assumption that the emissions profiles of these stoves parallel that of the Blaze Prototype.

SUMMARY

By integrating all four analysis approaches to "best practical technology" theory the following conclusions can be drawn:
(1) The Earth stove with blocked secondary air demonstrated that 6 grams per hour is too high for a standard.

FIGURE 2



Mean of X = 16075.10	Correlation coefficient = 0.835	Valid cases = 10
S.D. of X = 6047.59	Degrees of freedom = 8	Missing cases = 0
Mean of Y = 3.20	Slope of regression line = 0.00039	Response % = 100
S.D. of Y = 2.82	Y intercept =-3.056	

Regression equation : Y' = 0.00039 X - 3.056
Standard error of estimate for regression = 1.554
Standard error of correlation coefficient = 0.333
Significance of correlation coefficient = 0.003

(2) Statistical analysis of all of the Blaze Prototype data suggests that a standard of about 5 grams/hour is indicated. However, this stove used a catalyst which converts more chemical energy than those used today in production. Thus, the data might well not support a standard as low as 5 grams/hour.

(3) Two tests on a Blaze Production stove suggest a 4.4 gram/hour value for it. This data supports a 5 gram/hour standard by virtue that a high performing production stove can pass it. It does not support a standard lower than 5 grams/hour.

(4) Fifteen tests conducted at Condar Company on three of our best performing stoves produced results (for split hardwood) which suggest values below 4 grams/hour may be possible but not below 3 grams.

(5) All 4 analyses of the DEQ data fall into a surprising close agreement. They indicate a final catalytic standard should not be set outside the 4 to 6 gram/hour range. Five grams/hour appears most appropriate.

(6) A Standard of 4 grams/hour or lower would probably force manufacturers to use approaches which are "best available" in nature, such as oversized 25 cell catalysts and/or too much secondary air. Such practices are actually detrimental to the airshed because catalyst life is dramatically reduced. Additionally, such an appliance is not user-friendly due to consumer frustrations over short catalyst life, excessive backpuffing etc. This would reduce consumer acceptance, reduce clean appliance sales and thereby have another net negative effect on the airshed.

My personal opinion is to base a standard on "best practical technology." It will actually produce the most positive effects on the airshed. I personally support the 5 gram/hour that the data suggests.

DRAFT 05/02/84

DETERMINING EFFICIENCY OF WOODSTOVES USING THE CONDAR EMISSIONS SAMPLING SYSTEM

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The following document is a draft of parts of a soon-to-be released handbook on "The Condar Emissions Sampling System." The two sections included herein are:

(1) How the Condar Woodstove Efficiency Measuring System was Developed.

(2) Making a Woodstove Efficiency Determination Using the Condar Emissions System.

ABSTRACT

Combustion Efficiency:

Now that clean burning woodstove legislation exists, the combustion efficiency of wood stoves has to be about 90% in order to meet emissions standards. Because testing is now being done on relatively high efficiency stoves, the stack loss test method becomes and effective tool for evaluating stove performance. Stack loss test methods actually measure efficiency losses, which for high efficiency stoves are very small. Therefore, measurement error is reduced.

The credibility of stack loss methods has historically suffered for two reasons: (1) direct measurement methodology for hydrocarbon losses has not been used heretofore and (2) measurement error when testing inefficient conventional stoves is potentially large.

Recently acquired data from the TVA demonstrates that their Method 5 analysis measures hydrocarbons accurately. By comparison, TVA Beckman hot F.I.D results are not reliable HC indicators. Similarily, C, H, O equations used by the DEQ do not produce valid HC results when compared to Method 7 data.

Combustion losses have been determined in this report by calculating directly measured CO and HC emission factors and relating their heat content to the gross energy of the burned wood. The test method using the Condar System produces combustible loss results that are highly correlated (R=.96) with HC plus CO combustable losses, because Condar emission factors correlate highly with both Method 7 emission factors (.96) and CO emissions factors (.92). Combustion efficiency can be readily calculated from Condar emission factors by a simple equation.

Heat Transfer Efficiency:

Again, due to the presence of cleaner burning stoves, valid heat transfer efficiency can be calculated using well established equations for dry gas loss, water of combustion loss (H loss), and wood moisture loss.

This information has now been computerized and presented in an easy-to-use heat transfer table similar to those used for natural gas and fuel oil furnaces.

In the process of heat transfer analysis, it has been documented that C, H, O balance and carbon balance stack flows are so highly correlated (.99) that either one can be used. Oregon DEQ's requirement that C, H, O balance only be used is not supported.

Accuracy:

The validity of Condar efficiency determinations has been verified by comparing results with real-world calorimeter houses results for the same or nearly identical stoves. The results are nearly identical. A high correlation also exists between this system's results and TVA's Phase 2 project and Shelton Energy Research data.

On the other hand, DEQ procedures do not produce results compatable with calorimeter house results. The difference in DEQ stove efficiencies between clean burning and conventional stoves is shown as less than half of what all the other analysis systems show.

Advantages:

The Condar system provides not only easily obtained accurate emissions results, but also easily obtained accurate efficiencies. All one needs to do is obtain the emissions factor, oxygen, and stack temperature values from the Emission Form (attached), input these values into two tables (see instruction section) and obtain combustion, heat transfer, and overall efficiency.

For certification testing, the Condar system provides all the information needed for stove certification in valid form. The maximum cost of running 4 certification tests does not exceed $2000. (This is not an estimate but is based on current commerical rates). The difference between $2000. and $6000. (for DEQ procedures) is highly significant to stove manufacturers and to the success of the entire woodstove emission cleanup program. If test costs are prohibitively high, few manufacturers will be willing and able to certify clean burning stoves and consumers will have fewer and more expensive stoves to chose from, thus slowing the rate of stove replacement.

DRAFT

APPENDIX

HOW THE CONDAR WOODSTOVE EFFICIENCY MEASURING SYSTEM WAS DEVELOPED

GENERAL: Now that clean burning woodstove legislation exists, most of the problems in determining woodstove efficiency are rapidly vanishing. This report describes a highly accurate low cost system which has been under development for the last 4 years. In the last year over 120 tests have been conducted.

The overall efficiency of any combustion appliance is the product of combustion efficiency times the heat transfer efficiency. Residential oil and gas furnaces have been easy to accurately evaluate for steady state overall efficiency using stack loss techniques because their combustion efficiency is essentially 100%. The only efficiency losses are due to heat transfer.

Heat transfer is easy to evaluate because well established formulas are available which have been used to create simple-to-use tables.

On the other hand, accurate stack loss woodstove efficiency determinations have been plagued by the difficulty in measuring combustion efficiency. Combustion efficiencies have been so low for conventional woodstoves that large potential errors can creep in when dealing with a molecule as complex as wood molecules. Additionally, errors in heat transfer efficiency measurements can develop due to the presence of unburned byproducts in the flue gas. Thus, overall efficiency determinations for woodstoves have suffered on two counts.

The situation is rapidly improving, because today, if a stove is able to pass an emission standard such as Oregon's, the stove <u>must</u> have a high combustion efficiency (generally about 90%). Error in making a combustion efficiency determination is now greatly reduced since the error is generally a function of the combustable <u>loss</u> (in this case the loss is 10%). If the error were inherently 20% of the combustable loss value, it would only be ±2%. In contrast, the combustion efficiency of a conventional woodstove is generally about 70% (combustable loss of 30%). The error in this case would be ±6%, or triple that for the more efficient stove. Equally significant is the fact that during the last year or so, <u>direct</u> (as opposed to <u>indirect</u>) measurements of unburned combustables have been made. These measurements have helped to reduce the potential error in measuring combustable losses.

In short, more efficient burning, and better measurement allows "combustable loss" type stack loss analysis to become an effective method of measuring combustion efficiency. This analysis type is facilitated by the more common use now of a complete burn cycle for testing. Complete burn cycle testing allows the amount of chemical energy contained in the total combustable losses to be compared with the total available chemical energy in the wood that was burned during the cycle. This eliminates the problem of having to deal with the changing chemical nature of burning wood when only a part of a burn cycle is used.

Another advantage clean burning stoves offer is that heat transfer can be more accurately calculated since the flue gas products reflect nearly complete combustion. A heat transfer table like those commonly used for residential oil and gas furnace analysis has been constructed for wood. This provides easy-to-obtain and accurate results. The table provided here (see Determining Woodstove Efficiency section) was calculated using long- established heat loss equations of the A.S.M.E. and North American Combustion Handbook.

<u>DERIVATION OF THE COMBUSTION EFFICIENCY EQUATIONS</u>

The two combustable losses from wood burning are unburned CO and unburned hydrocarbons (HC). Since the Oregon DEQ woodstove testing procedure utilizes a complete burn cycle, (a distinct advantage) an accurate relationship between the amount of energy in these unburned combustables and the total available energy in the wood charge can be established. The key in the begining of such an analysis is to <u>directly</u> measure CO and HC and determine an emission factor for each (In gm/kg). CO measurements are commonly obtained, but the validity of these results is linked to the accuracy of the standard gas cylinders that are used for meter calibration. According to Curkeet (personal communication, 1983) "standard" cylinders often vary considerably from their stated concentration.

Setting these uncertainties aside, the combustable loss due to CO is calculated by multiplying the CO emission factor by the well established 4347 BTU/lb. higher heating value of CO. This loss is then expressed as a percentage loss by comparing it to the higher heating value of the wood burned (8600 BTU for both hardwood and Douglas Fir).

Hydrocarbon losses have rarely been adequately determined. They have generally been determined by either:

(1) Using a hydrocarbon analyzer to count carbon atoms (and calculating hydrocarbons using an assumed H to C ratio). The systems have either a hot feed F.I.D. (which allows essentially all hydrocarbons to pass through the analyzer) or a cold F.I.D., which has the marked disadvantage of allowing condensation of a large percentage of the hydrocarbons to occur in the sample line. This cold F.I.D. approach is clearly not appropriate and only the hot F.I.D. will be discussed.

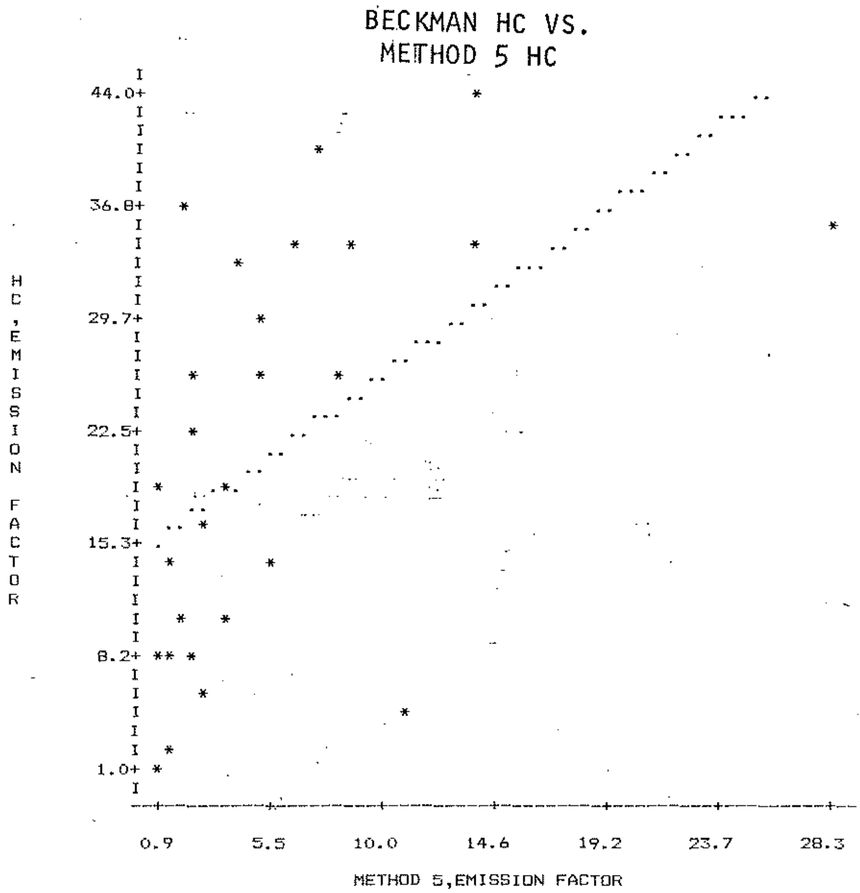
(2) The second approach is an indirect system of balancing C, H, and O in chemical equations which use measured values of variables <u>other</u> than hydrocarbons. The DEQ uses this procedure.

Data is now available to evaluate both approaches of hydrocarbon measurement. The TVA Phase 2 program (1983) results contain 30 sample runs in which both Beckman hot F.I.D. hydrocarbon results and EPA Woodstove Protocol Method 5 results are available for comparison. The extraordinary significance of these tests lies in the fact that their final Method 5 filter was backed up by the hot F.I.D. analyzer which measured any hydrocarbons exiting from the sample train. Their results show that an average of <u>only</u> 3.5% of the total hydrocarbons escape Method 5 train collection). This means that the TVA's Method 5 is an accurate <u>direct</u> total hydrocarbon measurement system.

It is possible to evaluate the effectiveness of measuring total hydrocarbons by the TVA's Beckman hot F.I.D. by comparing those results to the directly measured Method 5 hydrocarbons. The large degree of scatter shown in Appendix Figure 1 demonstrates that the Beckman hot F.I.D. total hydrocarbon measurements are not reliable. Unfortunately, these results have historically been used to calculate combustable losses.

The second approach used to determine hydrocarbons, using equations to balance C, H, and O from non-hydrocarbon measurements can also be evaluated using new data. The December 1983 WHA - Omni (DEQ) tests contain numerous tests in which both calculated hydrocarbons and Method 7 measured hydrocarbons were obtained. It must be noted that Method 7 is not identical to TVA's Method 5.

Method 7 lacks the resin trap of TVA's sample train and therefore some revolitization off the Method 7 back filter undoubtably occurs. However, since TVA's Method 5 is remarkably efficient in collecting total hydrocarbons, Method 7, with its nearly identical sampling train, is unquestionably a highly efficient hydrocarbon trap. Method 7 has also been demonstrated in these tests to be highly precise. Only when emission factors are very low (and the volatile fraction is at a significant percentage) would Method 7 be expected not to collect a very high percentage of the total hydrocarbons.

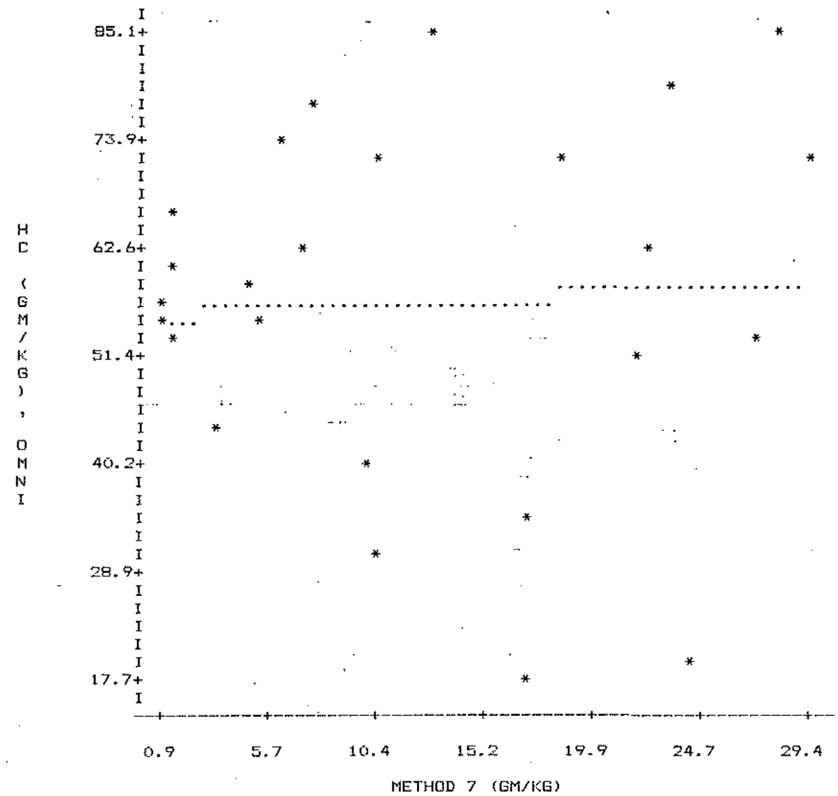


Mean of X = 5.40	Correlation coefficient = 0.528	Valid cases = 27
S.D. of X = 5.78	Degrees of freedom = 25	Missing cases = 0
Mean of Y = 21.00	Slope of regression line = 1.164	Response % = 100
S.D. of Y = 12.73	Y intercept = 14.713	

Regression equation : Y' = 1.164 X + 14.713
Standard error of estimate for regression = 10.813
Standard error of correlation coefficient = 0.196
Significance of correlation coefficient = 0.005

APPENDIX FIGURE 1
TVA PHASE 2 DATA

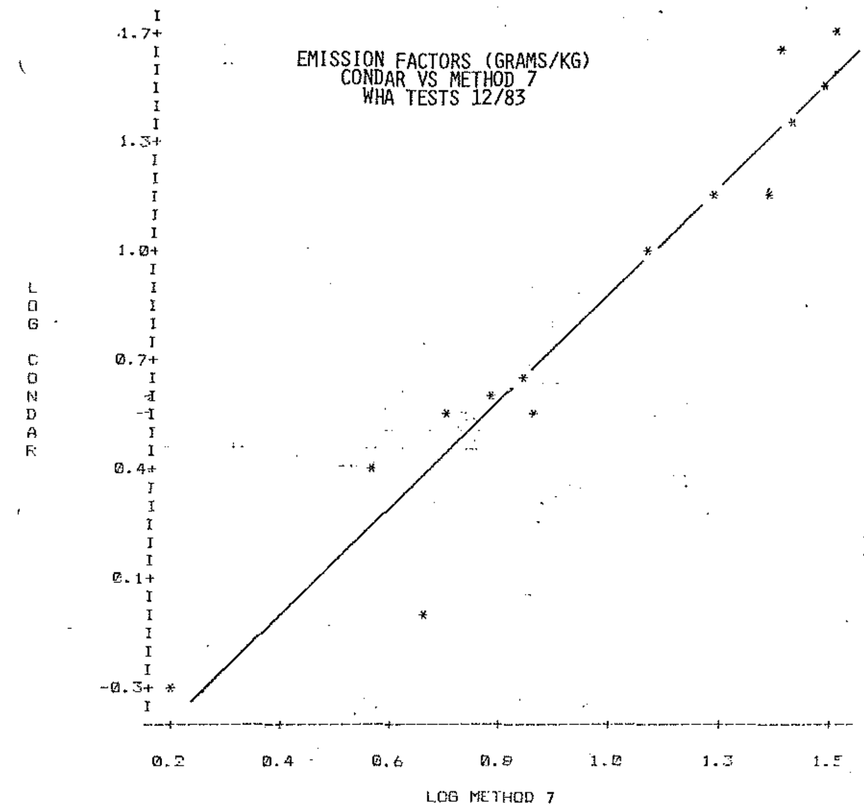
CALCULATED HC VS.
METHOD 7 HC



Mean of X = 12.13	Correlation coefficient = 0.063	Valid cases = 26
S.D. of X = 9.36	Degrees of freedom = 24	Missing cases = 0
Mean of Y = 57.23	Slope of regression line = 0.120	Response % = 100
S.D. of Y = 17.92	Y intercept = 55.774	

Regression equation : Y' = 0.120 X + 55.774
Standard error of estimate for regression = 17.886
Standard error of correlation coefficient = 0.200
Significance of correlation coefficient = 0.242

APPENDIX FIGURE 2
DEC. 1983 DEQ TESTS




```
Mean of X = 0.99      Correlation coefficient   = 0.96    Valid cases    = 14
S.D. of X = 0.39      Degrees of freedom        = 12      Missing cases  = 0
Mean of Y = 0.86      Slope of regression line  = 1.44    Response %     = 100
S.D. of Y = 0.58      Y intercept               =-0.58
```

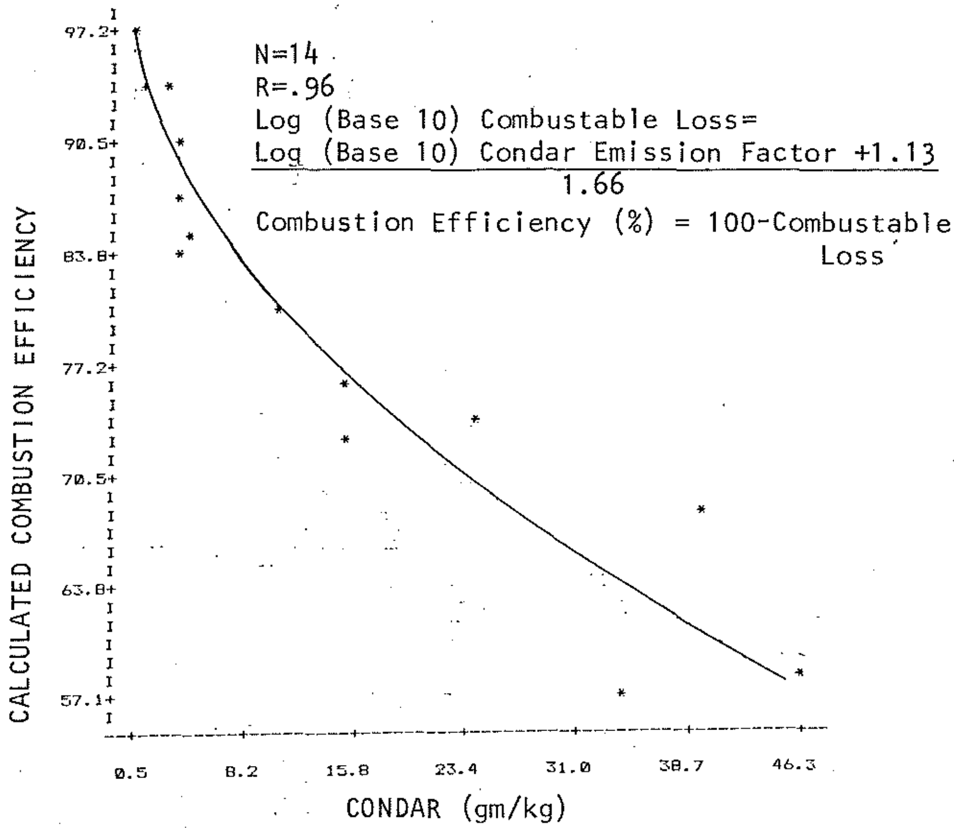
Reduced Major Axis Equation

Y = 1.487x - .61

```
Regression equation :  Y' = 1.44 X - 0.58
Standard error of estimate for regression  = 0.159
S  ndard error of correlation coefficient  = 0.277
Significance of correlation coefficient    = 0.000
```

APPENDIX FIGURE 3

COMBUSTION EFFICIENCY vs. CONDAR EMISSION FACTOR



APPENDIX FIGURE 4

The calculated hydrocarbon results can be evaluated by comparing them with Method 7 hydrocarbon results. The results shown in Appendix Figure 2 dramatically demonstrate that determining hydrocarbons by this type of equation-balancing is not reliable. Unfortunately, the DEQ has used this data rather than Method 7 hydrocarbon data to calculate combustion efficiency.

The question arises: What techniques can be used to measure hydrocarbon combustion losses? The above analysis has demonstrated that techniques which directly capture and weigh the hydrocarbons such as Method 5 and 7 are most appropriate. This should have been expected since time and time again direct measurement is shown to be superior to indirect measurement.

Are there other similar techniques which may be used? There are, and one of them has proved to be the Condar Direct Emission Catch Sampling System. In the December 1983 WHA - Omni (DEQ) tests Method 7 and Condar emission factor results were compared for 14 simultaneous tests. The results shown in Appendix Figure 3 displays a very high correlation coefficient of .96 between these systems. Each system can be used to predict results for the other.

The best fit equation is:

$$\text{Log (base 10) Method 7} = \frac{\text{Log(base 10) Condar Emission Factor} + .61}{1.487}$$

The hydrocarbon combustable losses for the tests in the WHA - Omni data were calculated in a computer by multiplying the Method 7 emission factor by a higher heating value of 15,000 BTU/lb. and comparing it as a percent of the chemical energy of the wood that was burned. The hydrocarbon combustable losses were then added to the CO losses (using the CO procedure described above) to obtain total combustable loss. Combustable total loss was subtracted from 100 to obtain combustion efficiency.

These combustion efficiency values were then compared with the Condar emission factors to determine if the Condar emissions values (a direct measure of hydrocarbons) can be used as a predictor of combustion efficiency. The results (Appendix Figure 4) illustrate a very high .96 correlation coefficient, indicating that Condar emissions values can be used effectively to determine combustion efficiency. The equation is shown in Appendix Figure 4. The reason the correlation is so high is that Condar emission factors are highly correlated with both Method 7 emission factors (R=.96) and CO emission factors (R=.93)

DERIVATION OF HEAT TRANSFER EQUATIONS

The heat transfer losses from burning of any hydrocarbon fuel at a relatively high combustion efficiency (as is the case for stoves that will pass an emission standard such as Oregon's) are easily defined. Standard equations for hydrocarbon fuels will be presented below.

Heat transfer losses fall into two general categories:

(1) The amount of energy needed to heat the flue gases other than water vapor from room temperature to the stack temperature where the flue gases leave the building's intended heated space. This is called Dry Gas Loss. These gases are almost entirely nitrogen (the dominant gas), carbon dioxide and oxygen.

(2) The amount of energy needed to boil the water in the fuel (present in wood but not fossil fuels) and the water formed by the combustion process. Additional energy is used to heat the water vapor from the boiling point to the exciting stack temperature. These two forms of water will be treated separately as wood moisture loss and water of combustion loss (often referred to as hydrogen loss).

DRY GAS LOSS:

The first information that is needed to conduct dry gas loss analysis is how much dry gas is produced by combustion of a given amount of fuel. There are several types of equations which are in common use. One used by the A.S.M.E. (commonly called the carbon balance equation) is:

Dry gas (lb.) per as-fired dry pound of fuel =

$$\frac{11\ (\%CO_2) + 8\ (\%O_2) + 7\ (\%N_2 + \%CO)}{3\ (\%CO_2 + \%CO)} \times \%\ \text{carbon}$$

Where % carbon is the carbon in the fuel minus carbon in unburned hydrocarbons (the subtraction value is less than about 1% for clean burning stoves). Average wood contains: 50% Carbon, 6.5% Hydrogen, 43.5% Oxygen. Douglas Fir contains about 7% Hydrogen and that is why a heat transfer correction for fir is made (see Heat Transfer Efficiency Table). The A.S.M.E. equation yields a ratio of flue products to fuel weight for wood of 6.2 : 1 on a weight basis.

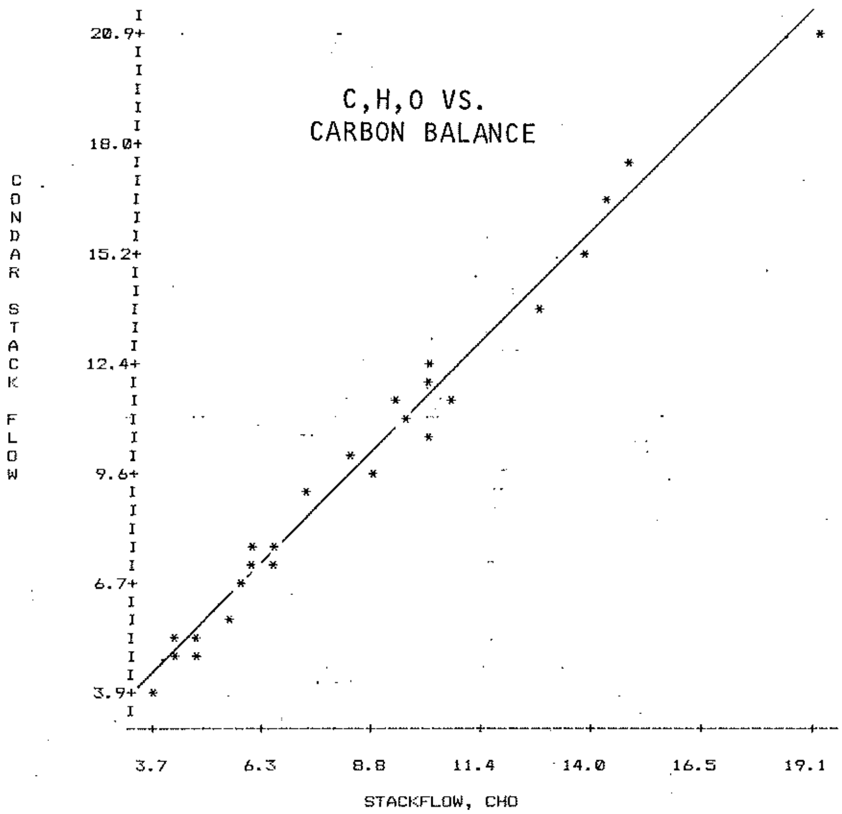
The North American Combustion Handbook provides another equation for calculating the ratio of fluegas products to fuel weight. It attempts to balance C, H, and O and the equation is given in a different form which is easily converted to A.S.M.E. results:

$$\frac{\text{Cu. ft. of Combustion air required}}{\text{Lb. Fuel}} = (\%C \times 1.514) + (\%H \times 4.54) - (\%O \times .568)$$

Using the standard density of air at S.T.P. of 0.0763, this equation produces a result for wood within 5% of the A.S.M.E. equation.

A third approach is to use a C,H,O balance used by the DEQ. A comparison of combustion byproducts (expressed as stack flows) for carbon loss vs. the DEQ C,H,O equation for the WHA - DEQ tests (Appendix Figure 5) indicates an extremely highly correlated relationship is present (correlation coefficient = .99). The A.S.M.E. equation calculates about 10% greater combustion byproducts than DEQ's C, H, O equation. Clearly, there is no justification for requiring one system over the other. The A.S.M.E. approach has been adopted here because it is extremely consistent with the C,H,O approach and far simpler.

Dry gas loss equation: The equation for dry gas loss has been well established in the literature.



Mean of X = 8.58	Correlation coefficient = 0.99	Valid cases = 26
S.D. of X = 3.80	Degrees of freedom = 24	Missing cases = 0
Mean of Y = 9.83	Slope of regression line = 1.10	Response % = 100
S.D. of Y = 4.22	Y intercept = 0.37	

Regression equation : Y' = 1.10 X + 0.37
Standard error of estimate for regression = 0.538
Standard error of correlation coefficient = 0.200
Significance of correlation coefficient = 0.000

APPENDIX FIGURE 5
STACK FLOW COMPARISONS

$$\text{DRY GAS LOSS}(\%) = \frac{(\text{Combustion product:Fuel ratio (wt.basis)}) \times (\text{Stack dilution Factor}) \times (\text{Specific heat of flue gases}) \times (\text{Stack Temp}(^\circ F) - \text{Room Temp})}{\text{Higher heating value of the fuel}}$$

Where:

Combustion:Fuel ratio = 6.2 (A.S.M.E. carbon loss equation)

$$\text{Stack Dilution factor} = \frac{20.9}{(20.9 - \text{average stack oxygen value})}$$

Specific heat of flue gases = .239

Higher heating value = 8600 BTU/lb. for wood

WATER OF COMBUSTION LOSS:

There is a standard equation for this loss for hydrocarbon fuels:

$$\text{WATER OF COMBUSTION LOSS} = \frac{9x\ (\%\ H) \times (1089)}{\text{Higher heating value of fuel}} + \frac{.49 \times (\text{Stack Temp}\ (^\circ F) - 212^\circ F) \times (\%H) \times 9}{\text{Higher heating value of fuel}}$$

Where: 9 = Ratio of H_2O to H (based on relative molecular wts.)

1089 = BTU/lb. needed to boil water

.49 = Specific heat of steam at temperatures below 600°F

The first part of the equation deals with boiling the water and the second part deals with the energy needed to heat the steam to the exit stack temperature.

WOOD MOISTURE LOSS:

The equation for this loss is reminiscent of the previous water of combustion loss equation.

WOOD MOISTURE LOSS (%) =

$$\frac{(\text{Moisture}\ \%) \times 1089}{\text{Higher heating value of fuel}} + \frac{.49(\text{Moisture}\ \%)(\text{Stack Temp} - 212^\circ F)}{\text{Higher heating value of fuel}}$$

HEAT TRANSFER EFFICIENCY:

The three heat transfer losses are summed and subtracted from 100 to obtain heat transfer efficiency. Since these formulas are very time consuming to compute, they have been entered into a computer along with a complete matrix of stack temperature and oxygen values to produce a table of heat transfer values for wood. This table is presented in the Determining Woodstove Efficiency section. It is as easy to use as fuel oil and natural gas tables, and requires only stack temperature and oxygen values as input.

DRAFT

HOW VALID ARE EFFICIENCY DETERMINATIONS USING THE CONDAR EMISSIONS SAMPLING SYSTEM?

Evaluating laboratory techniques is often a difficult task. Scientifically, laboratory techniques are "models" (analogous to computer models) which are only as valid as how well they predict performance in the real world.

To quote Barnett (1982), "In the final analysis, woodstove performance must be evaluated in representative test homes, under carefully controlled and measured conditions. The writer's research in other scientific fields has emphasized that measurement in the real world is crucial to the development of adequate models (all lab tests are models of the real world and need verification and calibration)."

To my knowledge the only such real world tests are those conducted from 1978 - 1982 (Barnett, 1982, 1983). For a detailed description of the procedures see Barnett 1983 (attached). To summarize the procedures, the calorimeter test house is calibrated over a three week continuous period using only electric heat. The effects of solar gain, domestic electric usage and wind are quantified. Then, only a woodstove heats the house for periods of weeks to months and average woodstove efficiency is determined.

The results of these tests showed that six conventional stoves all produced essentially identical overall efficiencies in the 8000 - 15000 BTU/hour output range. With manual control, efficiency averaged 50%. In the same output range, a Condar catalytic prototype stove produced efficiencies of 81% with a 25 cell 3" high catalyst and 78% with a 16 cell equivalent catalyst.

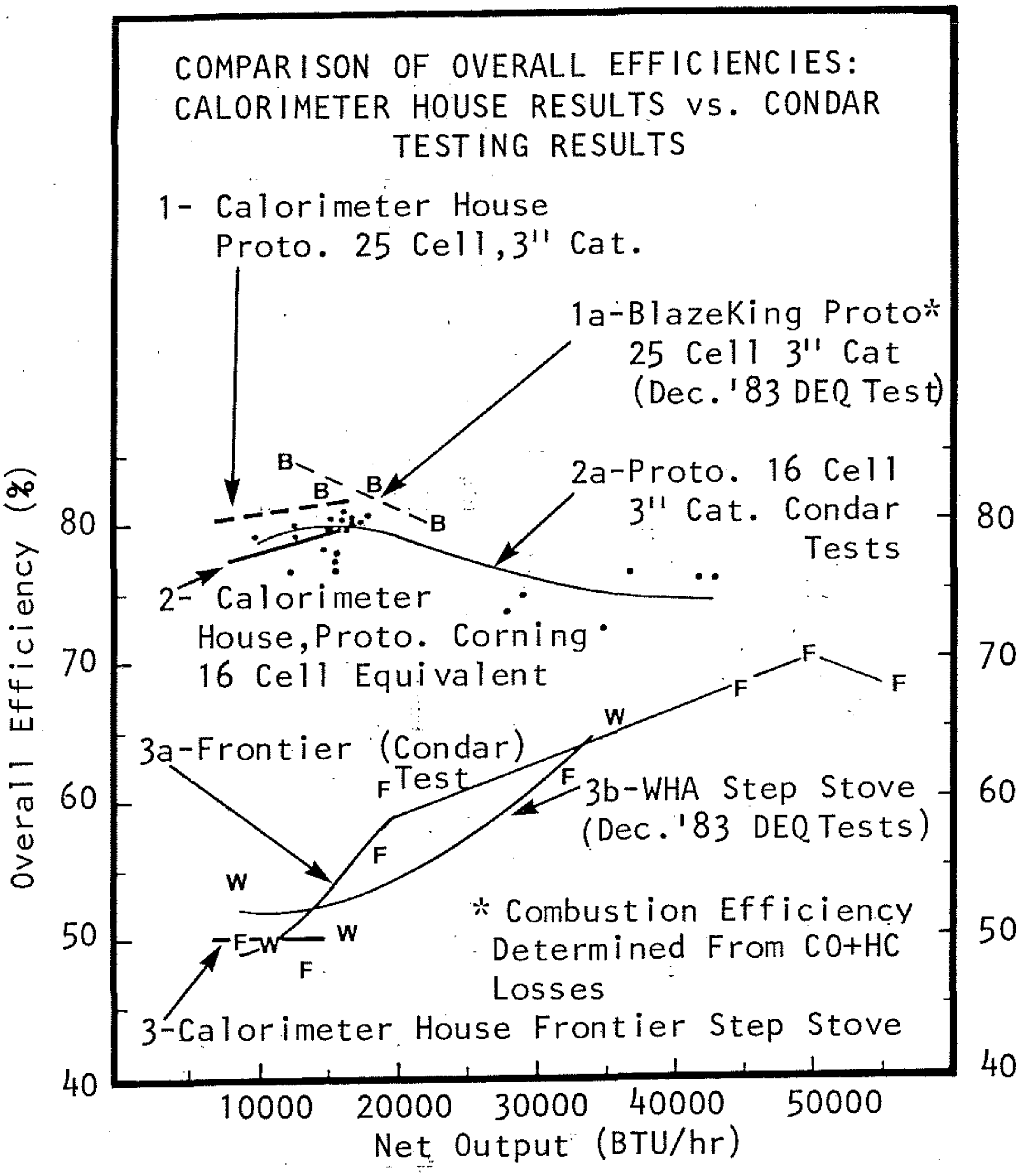
In recent months three of these stove types have been tested for efficiency using the Condar emissions sampling system described herein. These are the Frontier step stove (manual control), catalytic prototype stove (with both 25 cell & 16 cell catalysts). The comparison of these results is shown in Appendix Figure 6. Note the close correspondence of all three comparisons: Frontier lab and house results (#3, 3a), Catalytic Prototype 16 cell results (#2, 2a), Catalytic prototype 25 cell results (#1, 1a). Note: Number 1a is the Blaze King Prototype (essentially identical to the Condar Prototype) with a 25 cell catalyst which was tested in the WHA - DEQ tests in December 1983.

An additional test has been included in this graph (the WHA generic step stove) because it is nearly identical to the Frontier, and the calorimeter house tests indicated little efficiency sensitivity to stove design at low burn rates. The results, part of the WHA - DEQ tests again show close correspondence to calorimeter house results for the Frontier step stove in the 8000 - 15000 BTU/hour range.

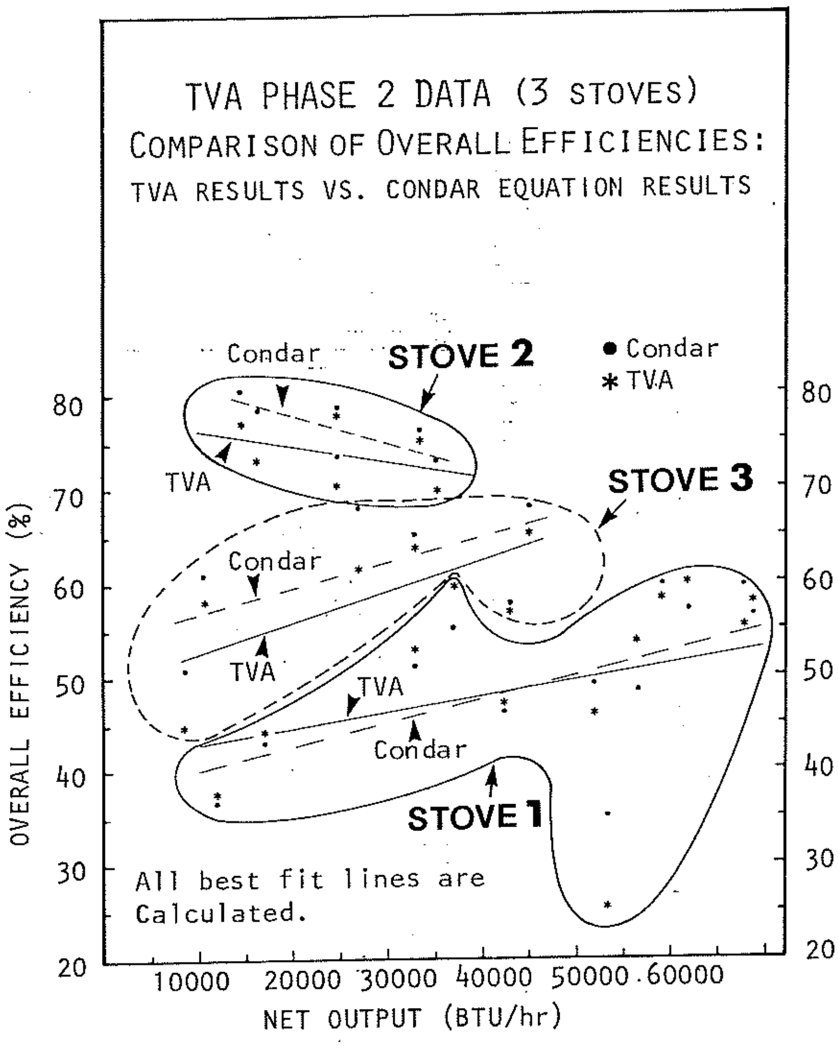
In conclusion, comparison of Condar emission system efficiency results with calorimeter house results for a wide range of stove types indicates that the Condar lab test procedure produces highly accurate efficiency determinations.

Some comparisons with other laboratory techniques are now possible also. The TVA Phase 2 data contains 30 tests to which the equations used herein have been applied. Method 5, rather than Condar emissions factors were used in the combustion efficiency equation. A comparison of the results (Appendix Figure 5) indicates that TVA's own efficiency values correspond very closely (R=.95).

Other comparisons can be made, Calorimeter room results from Shelton Energy Research have indicated quite consistent efficiencies for conventional stoves in the low output range of 50% ± about 5%.



APPENDIX FIGURE 6

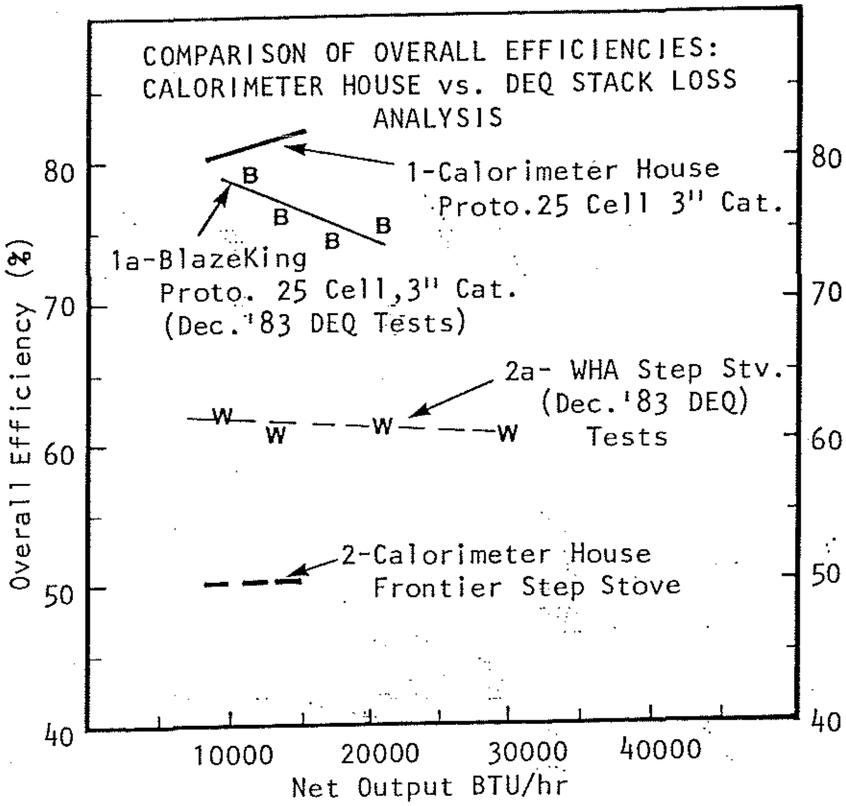


APPENDIX FIGURE 7

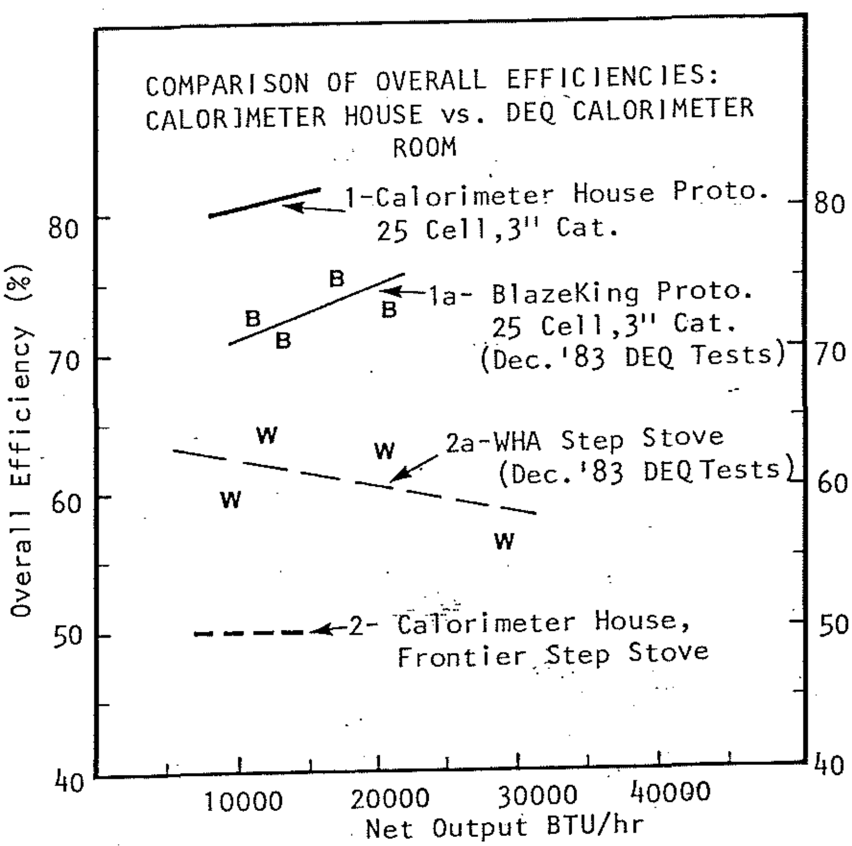
They tested an American Eagle stove which is nearly identical to our catalytic prototype stove with a 16 cell catalyst. Their overall efficiency value of 74% compares quite closely to both average Condar emissions and calorimeter house values of 78%. The Shelton calorimeter room uses a cold start and then cools the stove to room temperature at the end of the test. This is a distortion of a burn pattern relative to home burning, especially for long burning stoves like the American Eagle which operate in houses in a "hot start" mode. Cold start performance has been documented by both the DEQ and work at Condar to produce higher emissions and hence lower combustion efficiency than the hot start procedure for catalytic stoves. Thus, it is safe to assume that the agreement between Shelton and Condar results is even closer when the "cold start" - "hot start" operating difference is accounted for.

Still, another laboratory comparison is the December 1983, WHA - DEQ data. Both calorimeter room and stack loss analysis was used. Both the Blaze King prototype and WHA generic stove results can be compared with calorimeter house data. The results for the stack loss analysis are shown in Appendix Figure 8 and those for the calorimeter room in Appendix Figure 9. By comparing number 1 with 1a and 2 with 2a it is clear that all DEQ results understate the efficiency of the catalytic stove (especially calorimeter room results) and over-state the efficiency of the WHA step stove. In fact, the difference in efficiency between these two stove types is shown to be less than half of what actually exists. These results contrast sharply with those shown for the same stoves using the Condar system in Appendix Figure 6 (where the calorimeter house difference is duplicated by the lab technique).

In summary, comparisons of Condar system efficiency measurements with calorimeter house results for the same, or nearly identical stoves, indicates an extremely close comparison. This method of analysis, documents that these lab results are highly valid. This system also agrees closely with results from the TVA phase 2 and Shelton Energy Research. On the other hand, the DEQ procedures produce unique lab results that do not closely correlate with calorimeter house results. The difference in stove efficiencies between clean burning and conventional stoves using DEQ procedures, is shown as less than half of what all the other analysis systems show.



APPENDIX FIGURE 8



APPENDIX FIGURE 9

MAKING A WOODSTOVE EFFICIENCY DETERMINATION USING THE CONDAR EMISSIONS SYSTEM

The overall efficiency of a woodstove is the product of combustion efficiency times heat transfer efficiency. These instructions will treat combustion efficiency first, then heat transfer efficiency and finally, overall efficiency. If you are interested in the scientific background of these procedures consult the Appendix.

COMBUSTION EFFICIENCY

Combustion efficiency is easily determined by using the table below. (For the basic equation and its derivation see the Appendix) Simply locate your Condar emission factor on the table and read the corresponding combustion efficiency. The data base for emission factors above 20 gm/kg is limited, so corresponding combustion efficiencies must be considered approximate.

COMBUSTION EFFICIENCY USING CONDAR EMISSIONS FACTORS
(VALUES ABOVE 20GM/KG ARE APPROXIMATE, HAVING BEEN DERIVED FROM LIMITED DEQ AND TVA DATA)

CONDAR EMISSION FACTOR GM/KG	COMBUSTION EFFICIENCY (%)	CONDAR EMISSION FACTOR GM/KG	COMBUSTION EFFICIENCY (%)
.4	97.3	10	80.8
.6	96.5	11	79.7
.8	95.8	12	78.6
1.0	95.2	13	77.5
1.5	93.9	14	76.5
2.0	92.7	15	75.5
2.5	91.7	16	74.5
3.0	90.7	17	73.6
3.5	89.8	18	72.7
4.0	88.9	19	71.7
4.5	88.1	20	70.9
5.0	87.4	25	67.5
6.0	85.9	30	65.0
7.0	84.5	35	63.0
8.0	83.2	40	61.0
9.0	82.0	45	59.5
		50	58.0

Example:

Condar emission factor = 5.0 gm/kg
Combustion efficiency from table = 87.4%

HEAT TRANSFER EFFICIENCY

Use the table below. All you need to know is the average flue gas oxygen % and the average stack temperature. See the box below the table for an example.

HEAT TRANSFER EFFICIENCY (PERCENT) FOR HARDWOOD * ** ***

AVERAGE OXYGEN PERCENT	AVERAGE STACK TEMPERATURE (°F) 150	200	250	300	350	400	450	500	550	600	650
4	87.8	86.5	85.2	83.9	82.6	81.3	80.1	78.7	77.5	76.1	74.9
5	87.7	86.3	85.0	83.6	82.3	80.9	79.6	78.2	76.9	75.5	74.1
6	87.5	86.1	84.7	83.3	81.9	80.3	79.0	77.5	76.2	74.7	73.2
7	87.4	85.9	84.4	82.9	81.4	79.8	78.4	76.8	75.3	73.7	72.2
8	87.2	85.6	84.0	82.4	80.8	79.1	77.6	75.9	74.3	72.6	71.0
9	87.0	85.3	83.6	81.8	80.1	78.3	76.6	74.8	73.2	71.3	69.6
10	86.8	84.9	83.1	81.2	79.3	77.3	75.6	73.6	71.8	69.9	68.0
11	86.6	84.5	82.5	80.4	78.4	76.3	74.3	72.2	70.2	68.1	66.1
12	86.2	84.0	81.7	79.5	77.2	74.9	72.7	70.6	68.2	65.9	63.6
13	85.8	83.3	80.8	78.3	75.8	73.1	70.7	68.1	65.7	63.1	60.6
14	85.3	82.4	79.6	76.7	73.9	71.0	68.2	65.3	62.5	59.6	56.7
15	84.6	81.3	78.0	74.7	71.4	68.0	64.8	61.5	58.3	54.9	51.6
16	83.5	79.6	75.7	71.8	67.8	63.8	60.0	56.0	52.2	48.1	44.2
17	82.0	77.1	72.3	67.4	62.5	57.5	52.8	47.8	43.2	38.1	33.2
18	79.4	73.0	66.5	60.0	53.5	46.9	40.5	33.9	27.6	20.9	14.5

CORRECTION FACTORS

(1) * For Douglas Fir Subtract 0.5%

(2) ** Table's Values are for 20% (Moist Basis) Wood Moisture.

Correction For Wood Of Different Wood Moisture.

Stack Temp.	Heat Transfer Correction For Each 10% Difference In Wood Moisture
200	1.4%
300	1.4%
400	1.5%
500	1.5%
600	1.6%

Add the wood moisture correction to your heat transfer % if your wood is dryer than 20% moisture and subtract if your wood is wetter.

Example: From A Douglas Fir Test Your test results show:

Average Stack Temperature = 400°
Average Oxygen = 13%
Average Wood Moisture = 25%
Heat Transfer Value From Table = 73.1
Fir Correction = -0.5
Wood Moisture Correction = - .75
Your Heat Transfer % = 71.85

*** The values in the table are derived from typical hardwood containing 6.5% hydrogen, 50% carbon. Moisture content, 20%.

HINT: If you have oxygen and stack temperature values that are in between the chart values, the easiest way to interpolate is to look at the chart values that are diagonal in a lower left to upper right direction to the intersection point of your oxygen and stack temperature values.

Example: Stack Temperature 275°F, Oxygen 10.5%

Pertinent Part of Heat Transfer Chart:

	250°F	300°F
10%	83.1	81.2
11%	82.5	80.4

10.5%, 275°F Intersection Point

The upwardly assending diagonal to the right indicates you should average 82.5 and 81.2% to give an 81.8% value. The spread in the values along this diagonal is much less than the spread along the other diagonal and hence, it is easier to estimate the appropriate value by simple inspection.

OVERALL EFFICIENCY

Multiply your combustion efficiency times your heat transfer efficiency.

To continue your example:

Combustion efficiency =	87.4%	(from previous example)
Heat transfer efficiency =	71.9%	(" " ")
Overall efficiency =	62.8%	

NET HEAT OUTPUT OF YOUR STOVE

Obtain net heat output (BTU/hour) by the following formula:

Net output(BTU/hour) = 8600x(1 - wood moisture(decimal))x (Burn rate in wet (as weighed) lb./hr.) x (Overall efficiency %/100)

PERFORMANCE TABLE FOR YOUR STOVE

STOVE TYPE	TEST NO.	AVERAGE O_2	AVERAGE STACK TEMP.	CONDAR EMI-SSIONS FACTOR GM/KG	EQUIVALENT* METHOD 7 EMISSIONS FACTOR GM/KG	EMISSIONS:* GM/HOUR METHOD 7 OR CONDAR	COMBUSTION EFFICIENCY (%)	HEAT TRAN-SFER EFFI-CIENCY (%)	OVERALL EFFIC-IENCY (%)	NET OUTPUT (BTU/ HOUR)	WEIGHTED* EMISSIONS; GM/HOUR: OREGON FORMULA

*See Section on Determining Method 7 Equivalency.

In-Home Evaluations of Advanced Stove Designs

It must be remembered that lab techniques are models of the real world which need verifying.

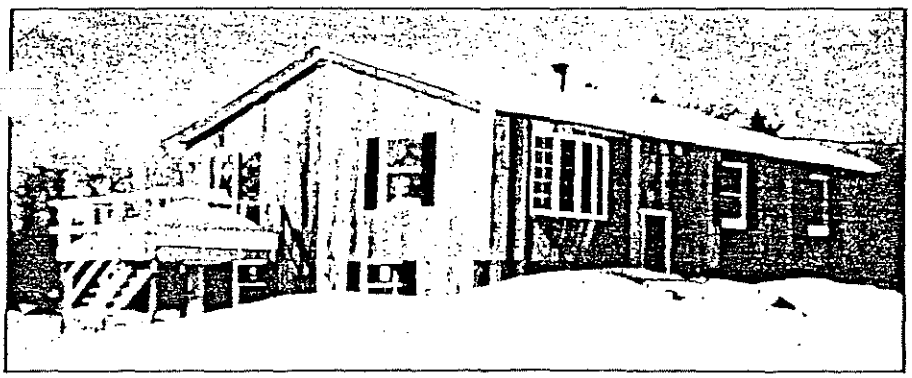


Figure 1. Calorimeter test house

by Stockton Barnett

ONCE a stove designer is satisfied that a particular stove design has acceptably low emissions, adequate residual oxygen levels and heat transfer characteristics (using the techniques described in *Wood 'n Energy*, December 1982, pp. 54-57), then field testing in homes should take place.

Five to 10 stoves operated for at least half a burning season generally are needed for adequate data. The stoves should be placed in a variety of house settings with low to high draft chimneys, low to high heat demand and ...ng various wood type and wood moisture situations. The wood burners themselves should range from inexperienced to highly experienced. The homeowners should be asked to burn as they normally would. The most candid responses seem to result when the homeowners are left to their own devices.

Visit the test homes periodically to learn the homeowners' reactions to the product. Their suggestions undoubtedly will cause changes in the product that could not be foreseen in the lab testing phase. Make these changes in the test stoves and solicit further feedback.

Each homeowner probably will take an interest in certain aspects of the stove. These unique interests can be nurtured and result in valuable data for you. For instance, one homeowner might be interested in weighing his wood usage and comparing your new stove with his previous one. Another may be interested in monitoring the steadiness of the output, and another interested in the ease of starting the stove or testing the upper and lower limits of the effectiveness of the stove.

Notes should be taken on homeowner reactions. A way to utilize this field information effectively is to periodically incorporate it in an evolving instruction manual for the stove.

Measuring Net Delivered Efficiency:

House Calorimeter Technique.

Accurate and precise testing of wood stove efficiency is still in its infancy. Although several techniques such as calorimeter room, Orsat gas analysis, and continuous gas analysis have been used, there is nothing in the literature to verify these results under "in-home" conditions. In the final analysis, wood stove performance must be evaluated in representative test houses under carefully controlled and measured conditions. It must be remembered that lab techniques are models of the real world which need verifying. Lab techniques must be able to give accurate results as well as to preserve the real world ranking of various heating appliances.

There are a number of problems with applying laboratory results to real world houses, all of which indicate that laboratory/real world correlations are needed.

1. There is difficulty in estimating unburned hydrocarbons using the Or-

Figure 2. Electric heaters placed where stove will be located.

sal method. The difficulties start with the accuracy of measuring carbon monoxide (CO) and are compounded by problems in calculating estimated hydrocarbons from CO measurements (all this assumes CO is highly correlated to ·drocarbons).

2. Lab tests typically have been too short to average out variations in the wood-burning process or to duplicate a homeowner's daily burn patterns.

3. Most laboratory tests have been conducted at burning rates that are considerably higher than those commonly used in houses. (About 12,000-13,000 BTUs/hour net output is the most common output in houses.)

4. Calorimeter room tests include a cold stove start-up as well as a cool-down back to room temperature at the end of the test. This is a distortion from the more steady state of home burning procedures associated, particularly, with the new, more efficient long-burning stoves.

5. Lab tests use stacks vented indoors into a hood. This produces draft levels lower than any part of the range of drafts found in homes. This results in artificially stable (and hence efficient) burns for those stoves which would otherwise burn unstably in homes.

The technique used today is considerably more sophisticated than the older, so-called "in situ" coheating method.

IT IS POSSIBLE for the stove designer to sidestep these lab-related problems and measure the net delivered efficiency of his new wood stove in a highly accurate manner by using a test calorimeter house (in all probability, his own house). The technique used today is considerably more sophisticated than the older, so-called "in situ" coheating method. It involves calibrating a house ı a calorimeter room — hence, the ..m calorimeter house technique.

The author has established three such calorimeter test houses over a four-year period and found that almost any desired range of accuracy of the "net efficiency determination" can be obtained from a high level (±2%) using expensive monitoring equipment to approximations (at a ±5% to 10%) level using less sophisticated equipment. Both approaches will be described here. Computer modeling involving sensitivity analysis has revealed the accuracy level to which each variable must be measured for successful analysis. This type of analysis avoids measurement overkill on the one hand and insufficient measurement accuracy on the other hand. This information is provided in the procedural description below.

Procedures for Conducting Calorimeter House Testing

• **Selection of the House.** Almost any house will suffice. The more open the living space the better the heat distribution will be. It is most important that the stove not be located in an isolated part of the house where heat cannot be distributed effectively. The stove should not be placed near an unu[illegible]ally large heat loss area such as a large window. Houses with excessive air infiltration cannot be used. Standard HUD construction houses built since the 1950s are usually sufficiently airtight (Figure 1). By comparison, old farmhouses are not. Computer sensitivity analysis shows that measurement of wind is rarely necessary when using HUD houses. The reason is that wind perturbations are so short in duration that they average out quite effectively over two to three week periods.

• **Solar Gain.** Solar input *must* be measured. It can vary too much over long periods to be ignored. Daily solar recorders work best. A Bacharach disc-type Tempscribe recorder with the front door opened and the bimetal coil painted black works well. Expose the recorder to the sun a few inches away from a south-facing window. It is also acceptable to obtain percent sunshine data from a nearby National Weather Service station. By using tables found in solar energy reference books, you can find daily BTUs/sq. ft./day of solar energy for any latitude at any time of the year for any window compass orientation. (For example, see "The Homeowner's Energy Guide," p. 196, by John Murphy.) Know the window areas for each orientation and you can calculate the solar input for a completely sunny day. Multiply this value times the percent sunshine per day to obtain solar input in BTUs for each day.

• **Temperature Measurements.** Best results are derived from continuous recordings of outside temperatures using several representative temperature locations in the house on a chart recorder. However, hourly outdoor readings are available by visiting your nearest National Weather Service office. In a pinch, a maximum-minimum thermometer will help. A single drum recorder (for example a Bacharach Tempscribe) placed at a central location (away from the sun) in the house can provide sufficient indoor temperature information.

• **Calibrating the house with electric heaters.** Place three to five electric space heaters where the stove will be located. (Figure 2). Operate these heaters as the house's sole heat source to keep the house warm. Within a day or two a balance can be developed and you will be amazed at the steady house temperatures. Keep house temperatures as steady as possible by regulating the heaters occasionally. Use a small electric fan to distribute the heat from the heaters toward the rest of the house. If these procedures are followed, you will be directly measuring the efficiency of your stove rather than a stove-house interaction.

In this day of high energy costs, measurements of net delivered efficiencies of many types of heating appliances are needed.

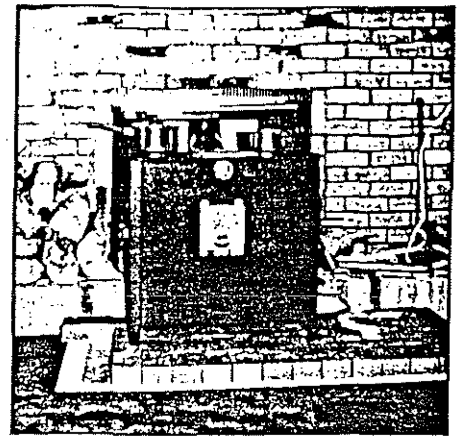
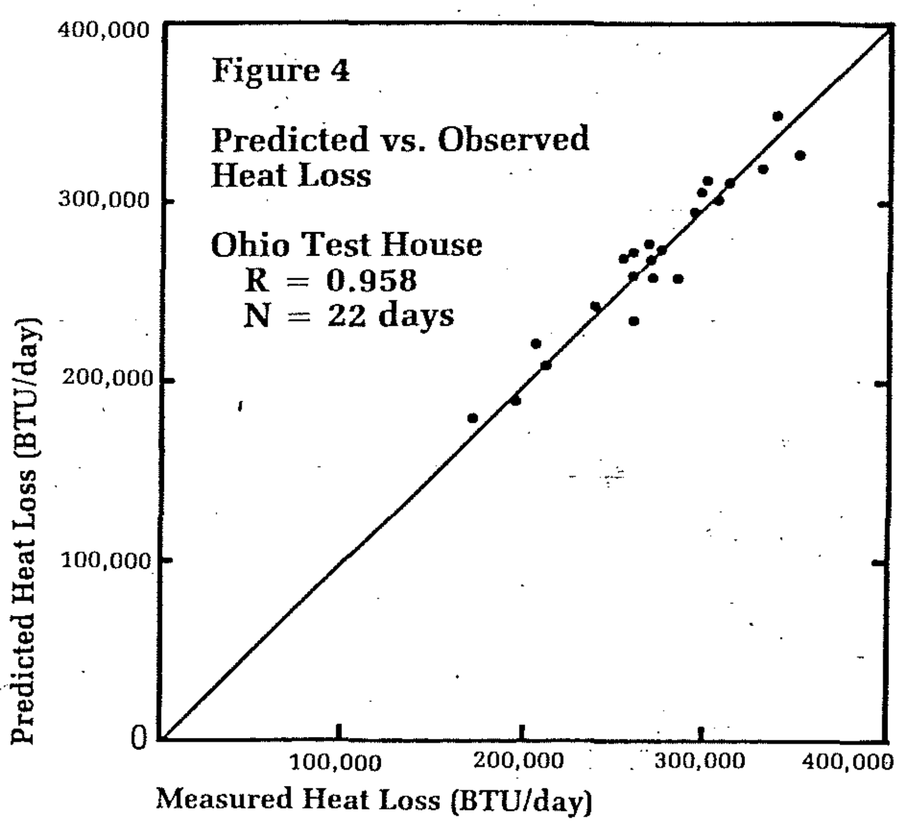


Figure 5. Wood stove in operation

Install an electric meter on your hot water heater (this is necessary only for highly refined results). For each 24-hour day measure the amount of electricity used to heat the house and the hot water by reading your electric meters (take all readings at the same time each day). Subtract the electricity used for the water heater because this heat largely escapes the house. Measure the solar energy. Determine the average inside and outside temperature using hourly data if possible. Subtract average outside temperatures from average inside temperatures to obtain the degree days. Record data on a log, e.g., Figure 3 on page 58.

For a given day the heat loss for the house (BTU) = (total elec. KWH x 3414) − (Hot water KWH x 3414) + solar BTUs. Divide this heat loss by the degree days to get heat loss per degree day. This is your BTU per degree day factor.

Repeat this procedure for 10 to 20 consecutive days and calculate your *average BTU per degree day factor.* Figures typically range from 5,000 to 15,000 BTUs per degree day. With abundant scientific collection instrumentation, this factor can be calculated to within one percent accuracy using a 20-day period (see Figure 4).



• **Wood stove operation.** Install the wood stove and remove the electric heaters (Figure 5). Keep the small electric fan running. Burn the wood stove for one day before taking a new set of measurements in order to stabilize all thermal masses. Weigh all the wood

Figure 3
Calorimeter House Data Collection Sheet
(Both Electric Heat Calibration and Wood Stove Efficiency Determination)

	Date	Avg. Outside Temp.	Avg. Inside Temp	Degree Days	Percent Sunshine	Wood Used (lb.)	Wood Moisture (percent)	Elec. Meter Reading (KWH)	Total Elec. Used (KWH)	Hot Water Meter Reading (KWH)	Hot Water Elec. Used (KWH)	Net Elec. Used (KWH)	Solar BTU	Net Electric BTU	Heat Loss (for elec. heat) or Stove's Heat Contribution	Available Fuel Energy (BTU)	Efficiency (percent)	BTU/Degree Day Factor
Electric Heat Calibration	Dec. 3 1981	22	65	43	50			190	110	30	10	100	40,000	341,400	381,400			8,870
Wood Stove Calibration	Jan. 10 '82	28	65	37	25	55.2	25	428	20	210	10	10	20,000	34,140	274,050	356,040	77%	8,870

An Example

TO ILLUSTRATE, let's take an example of both a day used for electric heat calibration of the house and then a later day when the wood stove is being evaluated.

For the **electric heat calibration** day the average outside and inside temperatures were 22° and 65° respectively. By subtraction, the degree days were 43°.

The percent sunshine was 50 percent. Let's say that you had earlier calculated that on a completely sunny day solar gain was 80,000 BTUs. Therefore, solar gain for this day was 40,000 BTUs.

The electric meter reading of 190 indicates a total of 110 KWH was used since the reading of 80 on the previous day. The water heater's reading of 30 indicates 10 KWH had been used for hot water heating since the previous day's reading of 20. Subtracting hot water electric usage from total electric usage yields net electric usage of 100 KWH, and this figure is multiplied by 3,414 BTUs/KWH to obtain the net electric BTU contribution of 341,400.

Total daily heat loss for the day = solar BTUs (40,000) + net electric BTUs (341,400), or 381,400 BTUs. The BTU/degree day factor = Heat loss (381,400) ÷ degree days (43), or 8,870.

For the **wood stove evaluation** we will assume that the average BTU/degree day factor is 8,870. The average outside and inside temperatures were 28° and 65° respectively, therefore providing 37 degree days.

Sunshine percent was 25 percent, so solar BTU gain was 20,000 BTUs.

Wood usage was 55.2 pounds with moisture content 25 percent. Gross fuel BTU available that day = (.75 × 8,600 or 6,450 BTUs per weighed pound) × 55.2 pounds, or 356,040 BTUs.

Electric usage is treated the same as in the electric heat calibration example. Net electric usage = (10 KWH × 3,414 BTUs/KWH), or 34,140 BTUs.

The stove's heat contribution = [the average degree day factor × degree days] − solar BTUs − net electric BTUs, or [8,870 × 37°] (328,190) − 20,000 BTUs − 34,140 BTUs = 274,050 BTUs (stove heat's contribution).

The net delivered efficiency of the stove was 274,050 BTUs (col. 14) ÷ 356,040 BTUs (col. 15), or 77 percent (col. 15). This means that 77 percent of the wood's available energy was converted into heat energy delivered to the house's heated space. □

burned each day. Synchronize your d. ly weighing cycle to your electric meter reading schedule. Continue to measure solar energy and obtain degree days from temperature data.

For a given day the net heat contribution of the stove = [(the average BTUs per degree day factor calculated during the electric heat tests) × (degree days)] – (solar input in BTUs) – (net electric energy in BTUs). Calculate this each day and sum up the daily values for the total wood-burning period to obtain the total net heat contribution of the stove.

In order to calculate the stove's net efficiency, the gross amount of energy in the wood first must be obtained. If you used hardwood, each *dry* pound contains 8,600 BTUs of potential energy. However, wood moisture reduces the available gross energy. For example, if you weighed a piece of wood at one pound which contained 25 percent moisture, it really contained ¾ pound of wood and ¼ pound water. The BTU content of that "pound of wood" is really $0.75 \times 8{,}600 = 6{,}450$ BTUs — a far cry from 8,600 BTUs. Therefore, accurate measurement of wood moisture is needed.

Computer sensitivity analysis over four years of collecting such data indicates that two randomly selected pieces of wood taken daily from the wood pile is adequate for moisture determination. One accepted moisture measuring procedure is to cut a ¾-inch wafer cross-section about 40 percent down from the end to the center of the log. You can later burn the log(s). Weigh the wafer immediately on a beam balance, then dry it on the edge of the stove top overnight (do not burn) and reweigh immediately. Moisture = 1 – (dry weight ÷ wet weight). A wood moisture meter may be substituted if you can demonstrate its accuracy.

Average the wood moisture for the entire test burn period (10 to 20 days). The average gross heat available per weighed pound of wood = (1 – average wood moisture) × 8,600 BTUs. Multiply this value times the total weight of wood used in the experiment to obtain the total gross fuel energy content.

The stove's average net efficiency = total net heat contribution of stove in BTUs ÷ total gross fuel energy content in BTUs. Conventional stoves average about 50 percent. An advanced stove design should average 70 percent or higher.

This calorimeter house technique can be used to evaluate the efficiency of other forms of heat including coal stoves, fireplace inserts, central heating systems (oil, gas, wood, coal) and even kerosene space heaters. Even though the calorimeter house technique can take 30 to 45 days to complete, it still is usually faster than sending the stove to a laboratory. The expense is very modest by comparison and the results will have real world validity. The house can be reused more easily a second time to evaluate your next efficient stove design.

This technique can be used to evaluate the efficiency of other forms of heat including coal stoves, fireplace inserts, central heating systems (oil, gas, wood, coal) and even kerosene space heaters. Energy saving add-ons (to furnaces) can be evaluated as well as comparisons between an existing furnace and its new, more efficiency replacement unit. You also can use this technique to evaluate energy efficiency modifications (insulation, weather stripping) made to a house. A comparison of "before" and "after" electric heat calibrations will reveal the heat loss reduction.

This technique is not restricted to use by stove designers. In this day of high energy costs, measurements of net delivered efficiencies of many types of heating appliances are needed. Accurate research data is lacking and this technique can provide it. A homeowner or dealer also may find it interesting and informative to discover how efficient his wood stove really is. □

THE EFFECTS OF STOVE DESIGN AND CONTROL MODE ON CONDENSABLE PARTICULATE EMISSIONS, FLUE PIPE CREOSOTE ACCUMULATION AND THE EFFICIENCY OF WOODSTOVES IN HOMES

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March, 1982

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ABSTRACT

Four years of woodstove research utilizing a mixture of laboratory and in-home investigations has lead to both the development at Condar Co. of a new extremely clean burning and efficient, commercially viable, catalytic woodstove as well as a new stove control system. Results are presented in four research areas: characterization of home burning rates, particulate emissions, in-home creosote accumulation rates, and in-home efficiency evaluations.

Home Wood Burning Conditions

Burn rates in homes are lower than expected. They average only 3.5 pounds/hour in 10 diverse New York homes.

These low burn rates and their associated high emissions and creosote accumulation rates dictate the difficult parameters designers of future stoves must satisfy.

On the other hand, the significance of wood energy use in the U.S. residential sector is greater than generally assumed. Energy use amounts to 0.8 - 1.0 Quad annually, or over one-third the total biomass energy usage in the U.S. Growth rate has been rapid; almost 0.1 Quad per year since the mid 1970's.

Condensable Particulate Emissions

A simple, effective and low cost technique of measurement is presented. Results indicate:

(1) Emission factors decrease dramatically as burn rate is increased.

(2) Within the variables under control by the homeowner, wood piece size, burn rate, and avoidance of wet wood have the most effect on emissions.

(3) Emission factors of 14 different stoves wer determined. Most stoves produced very similar results. Only a thin-walled convective heater with its very high emissions and the new Condar designed catalytic stove with its dramatically lower emissions (85% reduction) deviated significantly.

Fluepipe Creosote Accumulation Rates

Results from two test homes indicate a very high correlation between this variable and the emission factors of the stoves which were tested. The new catalytic stove is characterized by an approximate 85% reduction in creosote accumulation relative to the conventional stoves.

Within the range of home burning rates, as burn rate increases, creosote accumulation rates first increase, then peak, and finally, at high burn rates, decline. Unfortunately, peak creosote accumulation rates occur near average home burn rate. This phenomenon tricks the homeowner and could well explain the common rash of late fall chimney fires.

Net Delivered Efficiency

[A technique of measuring the delivered efficiency of woodstoves in real world settings is presented.] Winter heat loss per degree day, for a typical northern New York State house and an Ohio house, was measured b relating daily electric heat loads over three to six week periods t inside-outside temperature differences, solar gain, and wind conditions.

Woodstove efficiency was determined by comparing the energy content of daily wood burned (adjusted for moisture content) with net daily heat loss for the house over continuous periods of 5-59 days per stove tested.

Three stove control modes were compared: manual control, conventional thermostatic control, and a new type of proprotional control (the Stovetemp™ Thermostat) developed by the author. Only the new control device produced positive results, and these were significant. Stove efficiency increase accounted for about 13% wood savings. Better ability to target woodstove energy output to match house heat demand adds another 10-11% saving in wood use, totalling 23-24%.

When the new control was applied to six diverse stove types, five of the six produced essentially identical efficiencies (56-58%). A thin-walled convective heater was slightly less efficient.

The new clean burning Condar design catalytic stove, which incorporates the Stovetemp control for carburation, is currently being evaluated for efficiency in the two test homes and one laboratory. Results to date indicate a large increase in net delivered efficiency to greater than 75%. A typical northeastern home, which previously used 1000 gallons of fuel oil, can be heated with this stove by using only 2-3 cords of wood per year. The New York house now uses 1.5 and the Ohio house 2.5 cords.

At this time, both improvements in woodstove design and control appear to offer promise for significantly reducing wood use, especially when both aspects are incorporated in the same stove.

Although a wide variety of conventional stove designs produced only minimal variation in performance, the opposite was the case for catalytic stoves. For example, the early "Concord type " catalytic stove did not improve performance relative to conventional stoves unless burn rates greater than those encountered in homes are used. An intermediate design advancement at Condar produced a 50% reduction in emissions and the final design reduced emissions by 85% relative to conventional stoves.

WOODSTOVE DESIGN AND CONTROL MODE AS DETERMINANTS OF EFFICIENCY, CREOSOTE ACCUMULATION, AND CONDENSABLE PARTICULATE EMISSIONS

INTRODUCTION

The recent realization of an energy crisis in the U.S. has resulted in a dramatic increase in the use of wood for home heating. Although wood may be less costly than other fuels, and is a renewable resource, its long range success depends on more than this. Future stoves will have to produce far less fluepipe creosote for safety reasons, emission factors must be significantly reduced for pollution requirements, and efficiency must increase for a sustainable balanced use of the wood resource to take place.

This paper reviews the evaluation of a wide variety of commercially available stove types for emissions, fluepipe creosote accumulation, and in-home net delivered efficiency. Using the same methods both a new proportional control (Condar's Stovetemp™ Thermostat), and an entirely new, highly efficient, essentially smokeless, catalytic stove developed at Condar Co was evaluated. It cannot be overemphasized that parameters of in-home burning had to be both learned and followed for successful results. Of paramount importance were fuel type, size, moisture content, appropriate burn rates, and efficiency evaluation in actual homes. For detailed research methodology, see Barnett and Shea[1] and Barnett[2].

WOOD USAGE IN THE U. S. AND BURN RATES OF WOODSTOVES IN HOMES

The significance of wood energy use in the U.S. residential sector is greater than generally assumed. Tillman[3] indicated usage rate in 1976 to be 0.4 Quad. Since 19[illegible]6 almost 1 million stoves have been sold annually. At 3 1/2 cords average usage per stove, total residential usage has increased almost 0.1 Quad per year to 0.8-1.0 Quad in 1981-1982. The U. S. House of Representatives report corcurrs, stating usage is now 1.[illegible] Quad. This means that residential woodburning accounts for over one-third of the total biomass energy usage (generally assumed to be 2.0 - 2.4 Quads) in the U. S.

Since emission factors, creosote accumulation, and net delivered efficiency, are highly correlated with burn rate, it is imperative that woodstove testing be conducted at rates encountered most frequently in hom use.

In response to a lack of wood burning rate data, Barnett and Shea investigated woodburning rates in ten very different houses in Plattsburgh, NY. Nine of the stoves had 20-22 sq. ft. area, and were free standing in the living room. The tenth was much larger, and basement installed. Wood weights were recorded daily. Stoves in eight of the homes were controlled with prototypes of the new Condar Stovetemp control.

Average daily burn rates are plotted vs. degree days in Figure 1. The lines represent a best fit calculation to the experimental data. Burn rates for other geographical areas can be read off in comparison with benchmarks shown for New York City, which is close to the U. S. average of 5000 seasonal degree days, and Plattsburgh, NY, which is colder at 8,000. The average burn rate for the nine living room installations was 3.0 lb/hr, or 10,000-11,000 BTU/hr output. In an average U. S. climate, like NYC, the average would be 2.0-2.5 lb/hr. The exceptionally high burn rate was for the large basement stove. Clearly, such installation cancelled the "energy efficient" design of this new house Note that burn rates correlate with size and style of house and are lower than is generally expected.

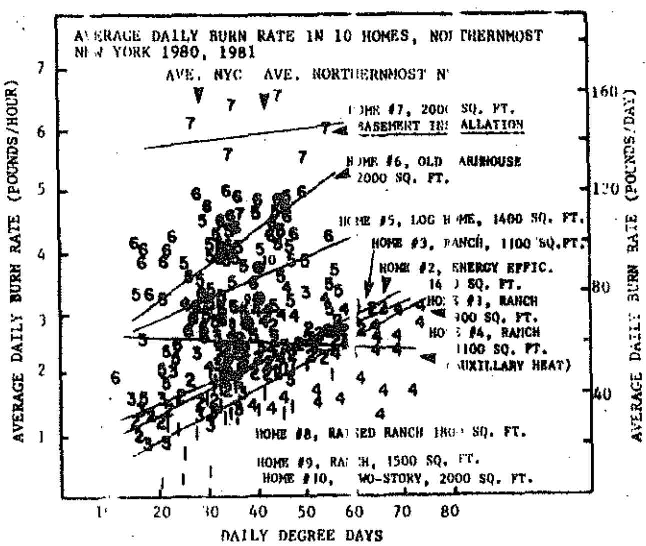

Figure 1. Woodburning rates vs. average degree days.

Why are the observed burning rates so much lower than expected? Estimation of home heat loss from heating bills and generally accepted efficiencies of conventional heating systems, would suggest a 50-100% greater wood usage than was observed. The net delivered efficiency o.

conventional oil, or gas fired heating systems is generally less than assumed, and this results in an overestimation of the wood burning rate. For example, one test home used twice as much oil energy per degree day as was used with the woodstove. Conventional systems are handicapped by distribution line losses, and this is an inherant limitation of wood furnaces as well.

In most cases, wood heat is used in conjunction with other sources, and homeowners are not aware of the portions of energy from each. In only three of the test homes, was the heat from wood estimated to be over 90% of the total. Also, people tend to recall the coldest days, when their stove is burned hot, and most burning is during transitional seasons, where this is not the case. Time of day studies indicate that burning in excess of six lb/hr occurs for less than one percent of the season. Biased perceptions of burning rate apply to time of day as well. Observation is generally limited to about one third of the day, and during unattended times, the loaded stove is set at low rates to carry through until the next loading. This practice greatly reduces average burn rates, and those measured during the studies averaged 2.8-4.0 lb/hr. In the transitional seasons, night burn rates were even less. Use of a prototype Stovetemp control in eight out of ten of these houses reduced wood consumption by 20%. With conventional control, average winter wood usage in northernmost New York is probably 3.5 - 3.75 lb/hr.

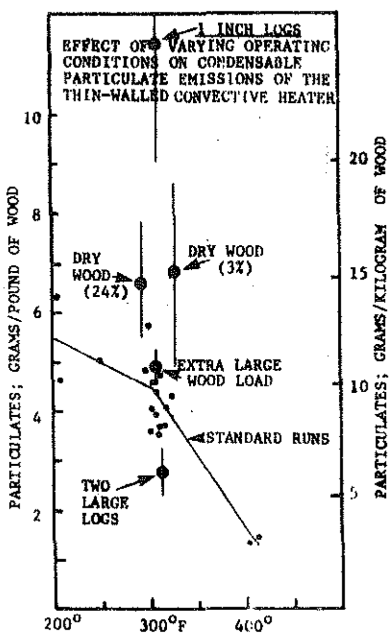

Figure 2. The effect of varying of operating conditions on condensable particulate emissions of the thin-walled convective heater. Dots represent sample means & vertical bars represent 95% confidence limits.

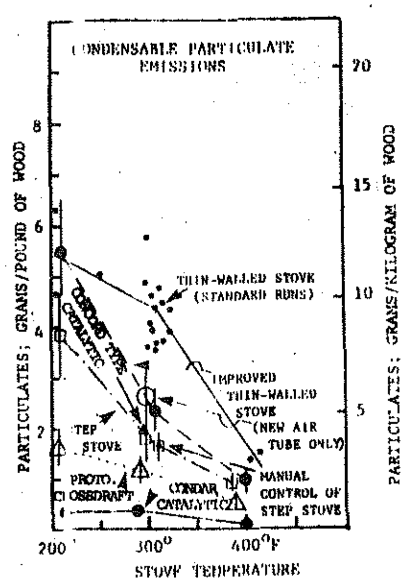

Figure 3. Condensable particulate emission factors of various stove types. Dots, squares, triangles & circles are mean values and vertical bars are 95% confidence limits.

In summary, average wood burning rates are less than expected in upstate New York, for reasons presented above. This indicates that woodstove testing (efficiency, emissions, and creosote) and new stove development must be based on burn rates of 1.5 - 6.0 lb/hr, for the commor 20-22 sq.ft. stoves, with special empahsis at about 3.5 lb/hr. Thus, Barnett and Shea[1] conducted emission tests in this range with stove temperatures of 200, 300, and 400 F, corresponding to about 1.5, 4.0, and 6.0 lb/hr respectively.

Condensable Particulate Emissions

Results of a simple, effective, and low cost technique for measuring condensable particulates in woodstove fluegas, reported by Barnett and Shea[1], are summarized here, with the addition of recent findings on a new Condar design catalytic stove using the same methods. Native hardwoods, representing average home use, with moisture content of 23-30%, were used in four to six inch diameter sizes. After stove temperature stabilized, wood was added and continuous 60 second samples were taken at ten minute intervals over a five-hour burn.

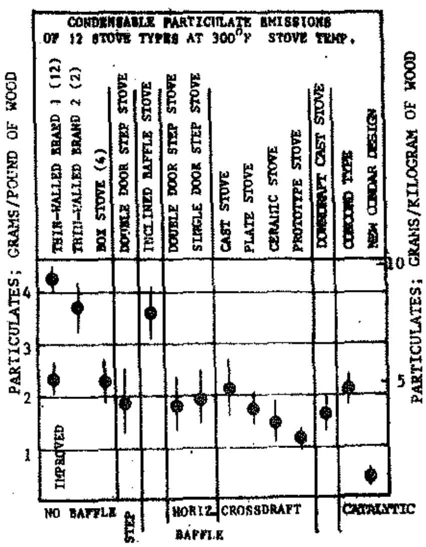

Figure 4. Condensable particulate emissions of 14 stove types burned at about 300°F sidewall temperature. Dots represent mean values & vertical bars represent 95% confidence limits of the mean. Numbers in parentheses indicate number of sample runs in cases where more than one run was made.

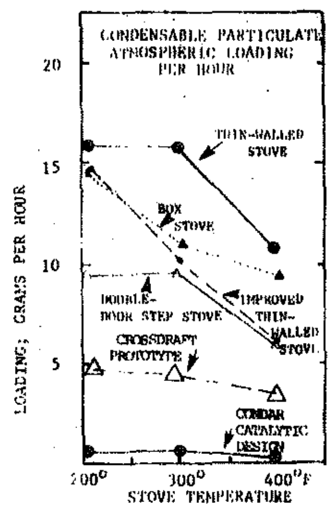

Figure 5. Condensable particulate' atmospheric loading vs. stove temperature.

The following results and conclusions are based on 65 sample emission runs: Emission factor, the weight of particulates per unit of wood burned, for this technique has a probable error of +20-25% of the value reported. Emissions release is generally greatest near the beginning of a burn cycle, and emission factors decrease dramatically as burn rate is increased. Moisture content has little effect, except that very wet wood may produce higher emissions due to smoldering, and reduced burn rate. Dry wood may (less than 20%) increase emission factors. Markedly increased emissions were generated with one-inch logs as opposed to normal 4-6 inch logs (Figure 2). Thus, log size, burn rate, and avoidance of wet wood are the most important variables under homeowner control.

Emission measurements of 14 stove types, summarized in Figures 3 and 4, disclose that within conventional stoves, stove configuration has little effect on emission factors. For example, the cleanest burning conventional types include such widely varying types as box, step, horizontal baffle, and crossdraft. Only a thin-walled convective heater and an inclined baffle stove produced significantly higher emission factors, while emissions from the new catalytic stove showed about 85% reduction, as compared with presently available stoves.

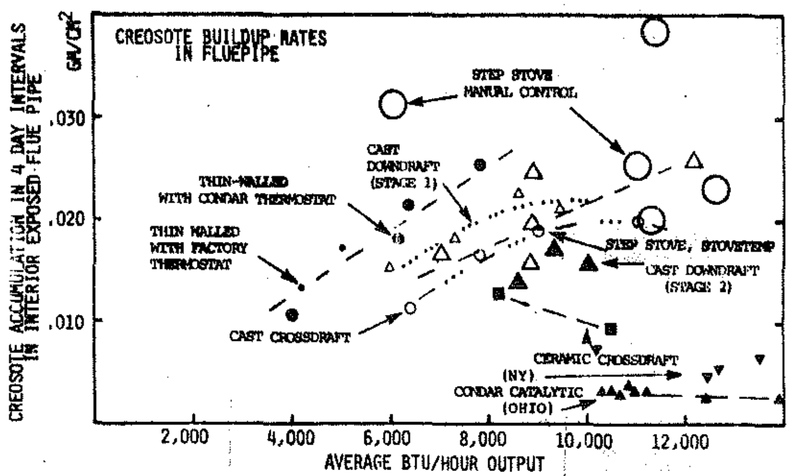

Figure 6. Creosote accumulation rate vs. average stove output.

Atmospheric particulate loading reflects emission factors, as shown in Figure 5. Differences among individual designs are accentuated in this regard, as stoves with high emission factors burn more wood than others, due to their inefficiency. Thus, a thin-walled convective heater pollutes over 20 times, and an average step stove about 15 times, as much as the new catalytic design.

Changes in draft air location and degree of preheating, tried on a typical box stove, produced no appreciable change in emission factors. Three stoves fitted with the prototype Condar control showed no change in emission factors. However, since this control reduces wood burned by 20%, total atmospheric particulate loading is reduced accordingly.

Creosote Accumulation in Fluepipes

Unable to find quantitive data in the literature on in-home creosote accumulation, the author devised a method which has been used, along with tests of woodstove efficiency, in homes since 1979. Initially, a section of fluepipe was weighed before and after collection 4 days later. A second technique involved cutting two 1 x 2 inch sections from the pipe, covering them with a cover plate, and reinserting in their original position in the pipe. Since the results were identical for both techniques, the test plate method was adopted for subsequent use in testing numerous stoves and control methods.

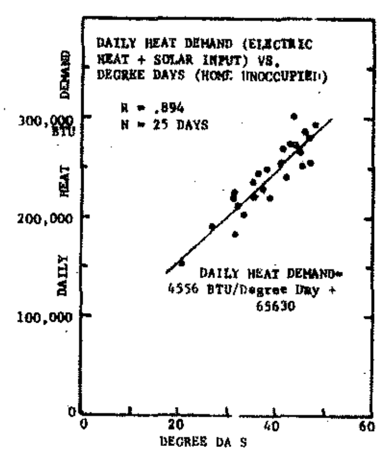

Figure 7. Daily heat demand vs. degree days (New York test house).

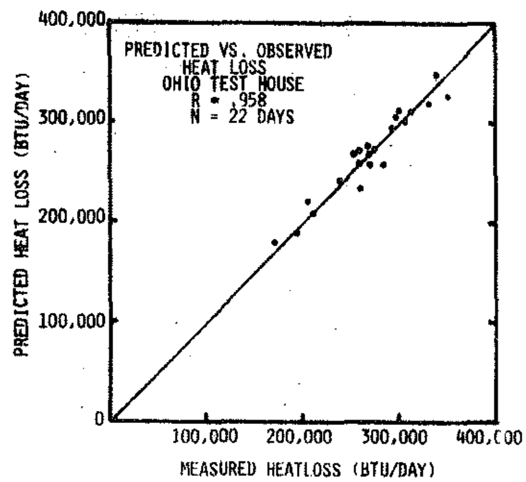

Figure 8. Predicted vs. observed heat demand (Ohio test house).

The results (Figure 6) surprisingly indicate that, within the range of some burning rates, creosote accumulation rates first increase, then peak and finally, at high burn rates, declines. A bell shaped curve is produced with the peak accumulation rate coinciding unfortunately with the commonly occuring stove sidewall temperature range of 250-300°F in the New York house. This stove temperature range varies somewhat dependent upon stove type, length and diameter of exposed fluepipe, and air circulation patterns. Observations on about 15 additional stove installations indicates the the range is from about 250 to 400°F sidewall temperature. The inescapable conclusion is that unfortunaltely, maximum creosote accumulation rate coincides all to close to the average burn conditions in most houses. This phenomenon could well explain abundant destructive chimney fires which typically occur late in the Fall. As the weather becomes colder, the homeowner feels that his somewhat hotter burning is producing less creosote when in fact more creosote is forming. Then, when the first cold snap hits, his very hot fires ignite the fluepipe.

The results indicate that creosote accumulation rates are highly correlated with the emission factors shown in Figure 4. Stoves with high emission factors tend to accumulate more fluepipe creosote. This relationship (long assumed but never demonstrated) is shown in Figure 14. (The inter-relationship of these two variables with net delivered efficiency is also illustrated.)

The thin-walled convective heater stands out for its high emission factors and creosote accumulation rates, and the new Condar design catalytic stove for its low levels. Relative to the group of commercially available tested stoves, the new catalytic stove provides about an 85% reduction of both condensable particulates and creosote accumulation rate.

The results also indicate that the use of the Condar control does not cause a significant change in creosote accumulation rates when compared to other means of control. Results are shown for the thin-walled convective heater and the step stove. The data does suggest however, that the new control may reduce the creosote accumulation rate somewhat for the step stove when compared to manual control.

Experimental Methods - Woodstove Efficiency

Accurate and precise proper testing of woodstove efficiency is still in its infancy. Although several techniques such as calorimeter room, Orsat gas analysis, and continuous gas analysis have been used, there is nothing in the literature to verify these results under in-home conditions. In the final analysis, woodstove performance must be evaluated in representative test houses, under carefully controlled and measured conditions.

Some of the problems with applying laboratory results to real world houses include:

* The indirect nature of gas analysis. It is not a direct measure of efficiency and results must be verified.
* Probable error of measurement from making gas analysis of several gases is compounded.
* The difficulty in hydrocarbon analysis.
* Air temperature and air flow distribution in the test room.

* The failure of published results to account for and measure the effect of heating draft make-up air to room temperature (air coming from outdoors). Lab tests are done in a room temperature environment and draft air is not preheated (from outdoor conditions). In homes outdoor air must be heated to room temperature before it enters the stove. Lab tests therefore produce results which are higher than those attainable in homes. In addition, leaky stove results will be particularly favorably distorted by lab tests.
* Tests too short to average out variations in the woodburning process. (Tests for Orsat analysis generally are less than 6 hours and calorimeter room tests contain only about 12 hours of active burning).
* These short lab tests make no attempt to replicate a homeowner's daily burn patterns.
* Lack of probable error measurements for the techniques used. The author has made a probable error investigation of published Orsat analysis data. Probable error at the 95% confidence level generally exceeds +8 percentage points, an amount greater than the inherent efficiency difference between most stoves.
* Nonrepresentative wood type, size, and moisture content is generally used.
* Stove control patterns different from homeowner patterns are generally used.
* Lab stacks vent indoors into a ventilated hood. Draft levels are thus low and equivalent to summer conditions with no wind. These unrepresentative conditions cause stoves to burn steady and, hence, more efficiently, than when they are heating homes during the winter.
* Tests at burning rates higher than commonly used in the house.
* Calorimeter room tests include a cold stove startup as well as a cool-down back to room temperature at the end of the test. This is a distortion of general home burning procedures and affects efficiency readings by an undetermined amount.
* Other errors not yet determined.

This long list of potential errors in laboratory work serves as a warning that reported results may lack accuracy as well as tend to be biased in favor of certain stove types. This underlines the necessity for careful research under typical in-home conditions.

The writer's research in other scientific fields has emphasized that measurement in the real world is crucial to the development of adequate models (all lab tests are models of the real world and need verification and calibration). Recent landmark studies of home energy use have utilized real homes, including: The Arkansas project, HUD's Mt. Airy Maryland project, Dow Corning's wall insulation project, and the Minneapolis Honeywell thermostat setback project. A similarly rigorous approach is required with woodstoves, before definitive statements of efficiency can be made.

This report describes a technique which has been used to evaluate the delivered efficiency of woodstoves in real world settings. Heating tests were conducted on a representative single residence in cold upstate New York, where total annual degree days average 8000 and a second home in Ohio where annual degree days average 6000.

New York Test House

The (1400 sq.ft.) New York test house has been in operation since January, 1978. It is of recent "energy efficient" construction, well insulated, with R19 in the walls and R38 in the ceiling, double glazed, and air tight (about 0.2 air exchange per hour). Woodstoves were tested in the center of the living area with 5 feet of exposed fluepipe. A small 25 watt fan circulated air around the stoves, to compensate for differences in stove and room configuration. Efficiency tests were conducted on seven common stoves for periods of 6-50 days per type. Heat loss for both unoccupied and occupied conditions was determined by operating electric heaters near the woodstove location. Power consumption was recorded daily for continuous periods of 10 to 15 days. Degree days were determined from an inside continuous recording thermograph, and hourly local weather service records. A moderate correlation between degree days and power consumption indicated that sources other than electric heat were involved in the total house heat demand. To identify other factors, a stepwise multiple regression model was developed including the following: percent of possible sunshine, wind data, and a heat storage factor. Solar input was highly significant and estimated at 75,000 BTU per day of full sunshine. This was later confirmed with direct solar measurements. Other factors were either insignificant, or cancelled out over the long sample periods. These were: heat storage factor, wind conditions (confirming a tight house), and occupied or unoccupied status. See Figure 7 for the heatloss relationship and equation.

Ohio Test House

The Garrettsville, Ohio house is a 1700 square foot split level of standard construction (R13 walls, R19 ceilings) with double pane windows. Portable electric heaters were installed at the woodstove location, for baseline measurements. A thermocouple and chart recording system continuously monitored temperatures inside (3 locations) and out. A black body solar meter continuously recorded solar energy, and hourly wind data were obtained from local weather stations. The same computer program, as for the New York house, was used. Main differences between the houses were a higher heat loss and a signficant wind factor in the Ohio house. As before, domestic hot water was eliminated from the comparison.

Stove Types and Operating Conditions

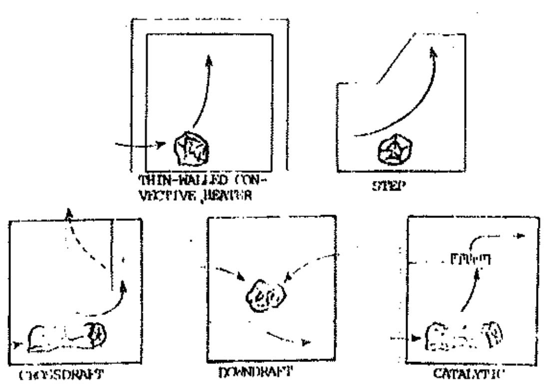

Figure 9. Stove types tested for efficiency.

Five main stove types (Figure 9) were tested: thin-walled convective, step, crossdraft, downdraft, and a new catalytic stove, designed to burn cleanly at the typically low burn rates associated with home heating. Th thin-walled convective heater and the unbaffled step stove are mos popular, representing more than half of all woodstoves in use in America today.

Native hardwoods, of representative moisture content and split to typical log size, were burned in all stoves.

Results

Test results, comparing manual draft control and present factory thermostatic control with the new Stovetemp control, were highly significant, as illustrated by the smooth time-temperature profiles shown in Figures 10 & 11. These encouraging results lead to the hypothesis that more even burning with the new control would increase net delivered stove efficiency.

A repeat test (of 42 days duration) confirmed the marked improvement in stove efficiency, as comparied with manual control on the same stove (Figure 12). As shown in Table I, the improvement is about 7 percentage points, relative to manual control, which represents a 13 percent saving in wood use. This difference is significant at the 99.99% probability level (t-test). Additional wood saving is realized by the ability of the new control to more closely match stove output to the homes heat demand. Thus, total wood savings for these tests was 23-24% in the New York house.

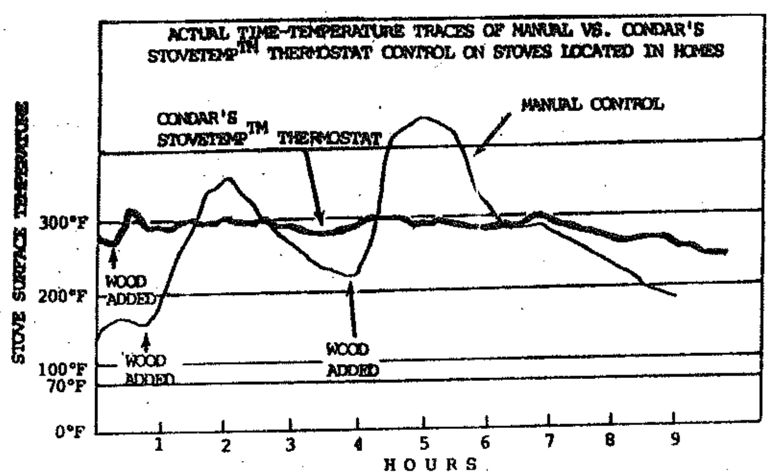

Figure 10. Stove temperature comparison using manual and Stovetemp control.

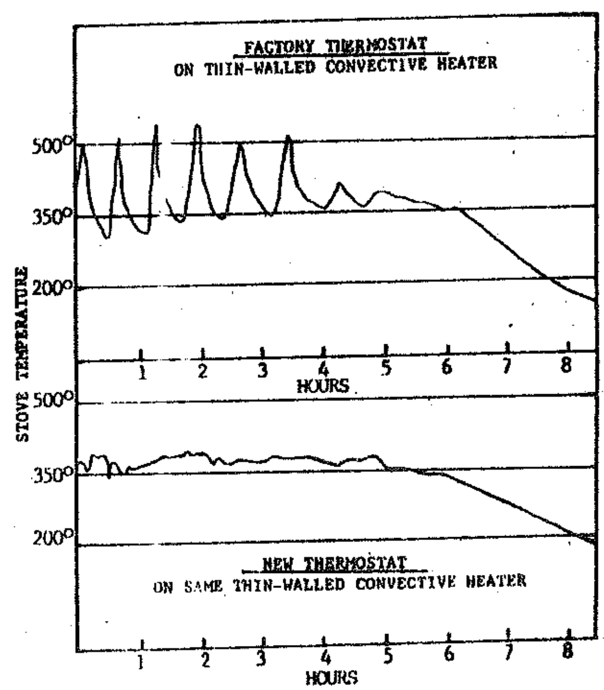

Figure 11. Temperature comparison of a thin-walled convective heater using the new thermostat and factory stock thermostat.

Since these tests demonstrated that draft control mode clearly affects woodstove burning efficiency, woodstove efficiencies from various laboratories are not directly comparable, unless control mode is consistant. To control this variable, all subsequent tests were conducted using the new thermostat.

Test results (Table 1 and Figure 13) truly reflect the ability of each stove to deliver useful heat from the wood burned. Note here the low efficiency of the thin-walled convective heater and the high efficiency of the new catalytic stove as compared with all other common types. This stove is characterized by dramatically reduced emissions and fluepipe creosote accumulation and was expected to produce a significant increase efficiency. It was therefore tested in both New York and Ohio. Results were dramatic, 79% efficiency in Ohio (20 percentage points above the most efficient conventional stove) and 80% (preliminary data) in New York! The extreme efficiency of this new stove at burn rates as low as 1.5 pounds/hour has been demonstrated. In fact, the marked efficiency increase causes average burn rates to be very low indeed; about 2.0 pounds/hour for the New York house and 2.5 pounds/hour for the Ohio house (a typical northeastern U.S. house). These homes now need only 1.5 (New York house) to 2.5 (Ohio house) cords to completely heat them for a heating season.

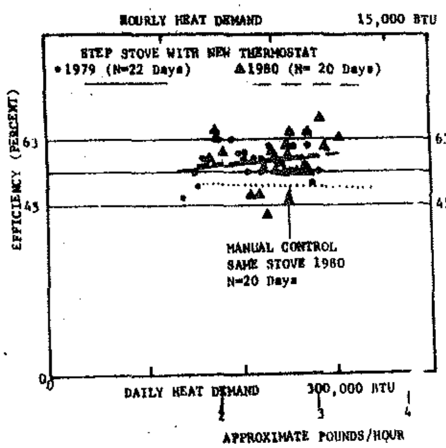

Figure 12. Efficiency vs. daily heat demand for the double door step stove equipped with the new thermostat and manually controlled. See Table I for error determinations.

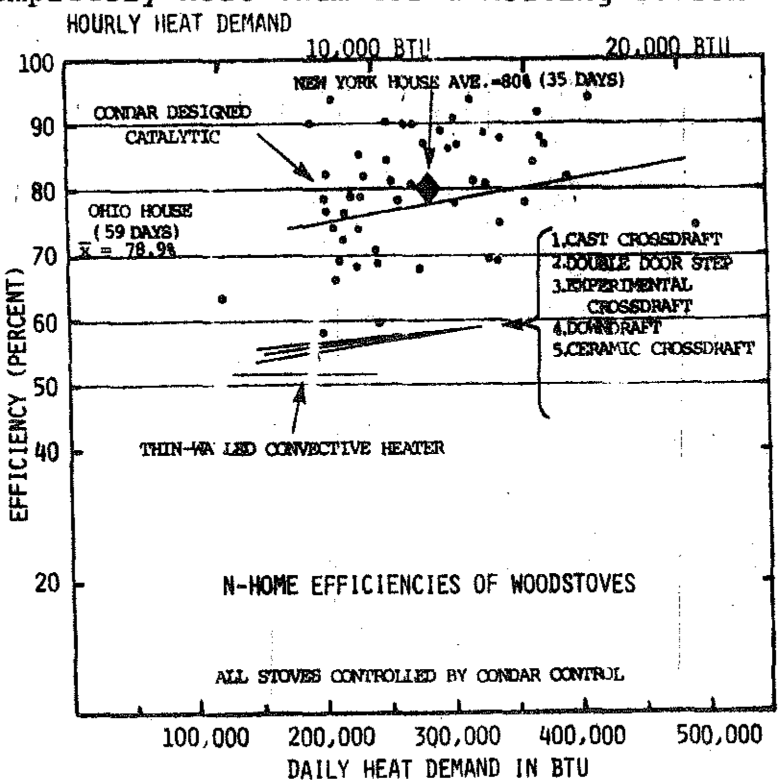

Figure 13. Best-fit efficiency profiles of seven woodstove types.

Catalysts representing the three available brands were evaluated in the Ohio house. A rather small but significant difference in performance is present. Their efficiencies ranged from 75% to 82%. Since the difference between conventional and the new catalytic stoves' efficiency is about 20 percentage points, internal stove design has a more significant effect on performance than does catalyst type.

For all stoves there is a very high correlation between emission factors, fluepipe creosote accumulation rates and net delivered efficiency (Figure 14). The thin-walled convective heater with the highest emission factor, produces the most creosote and is the least efficient. The new catalytic stove had the lowest emission factor, least creosote production, and was the most efficient. The other stoves, which produced nearly identical efficiencies cluster in a middle ground between these two stoves.

Table I. WOODSTOVE EFFICIENCIES FOR DAYS WHEN NET OUTPUT WAS GREATER THAN 180,000 BTU/DAY

YEAR OF TEST	STOVE	MEAN EFFIC.	STAND. DEV.	95% CONF. LIMIT	# OF DAYS	MOIST BASIS MOISTURE CONTENT
1978	STEP STOVE* (MANUAL)	.479	.077	.081	6	29%
1980	STEP STOVE (MANUAL)	.499	.041	.019	17	22%
1979	STEP STOVE (AUTO)	.567	.066	.032	19	20%
1980	STEP STOVE (AUTO)	.575	.036	.019	16	21%
1979	CAST CROSSDRAFT	.590	.067	.070	6	20%
1980	CERAMIC CROSSDRAFT**	.569	.068	.052	9	27%
1981	EXPERIMENTAL PROTOTYPE**	.577	.070	.034	16	21%
1980	TRUE DOWNDRAFT	.565	.098	.041	24	25%
1980	THIN-WALLED CONVECTIVE HEATER**	.523	.075	.079	6	26%
1981/1982	NEW CONDAR CATALYTIC, OHIO**	.789	.102	.027	59	28%
1982	NEW CONDAR CATALYTIC, NY**	.80	Preliminary Data		34	21%

*Door ungasketed

**Used 6 inch instead of 8 inch stovepipe.

Higher heating values for wood have been used.

Discussion

By way of methodology, it is noted that the heat loss factor of a relatively air tight house can be accurately determined by monitoring electric heat used over periods of 20 days or more, if inside and outside temperatures, solar gain and wind are continuously monitored. The electric heaters should be located in the area where the woodstove will be tested. The use of a small fan to circulate air around both the elctric and the wood heaters, permits application of the heat demand and woodstove efficiency data to other houses with this common type of stove installation. Shelton[5] (p.1130) stated "the main value of (in-home efficiency) testing is in quantifying the appliance/house interactions, not in quantifying the performance of the appliances' themselves". On the contrary, the close agreement between efficiency data from the New York and Ohio houses as well as a third house (unpublished data) in New York indicates that these test results are not house specific to any significant degree. This is guaranteed by placement of the electric heaters where the stove will be located to specifically eliminate house interaction effects and having a small fan circulate air during all tests. Only a small percentage of homes will deviate significantly. These houses would have significantly longer or shorter exposed fluepipe than those of the test houses, have the stove next to an uninsulated wall, or window, or not use any means to circulate room air.

Improved stove draft control, via the new thermostat, permits homes to be heated with significantly less wood. This is possible because stove efficiency curves typically show a plateau in the output range 150,000 to 350,000 BTU per day. The unusual response sensitivity of the new draft control holds operating conditions within this range, in contrast with manual control and most commercial thermostats. These cause large changes in draft air quantity and subsequent oscillations in stove temperature, above and below this, into ranges of inefficient operation.

Total home heating energy is affected not only by appliance efficiency, but also by use and control pattern as well. With conventional heating systems, the homeowner can target, or match, the amount of energy used to the house's heat demand, through thermostatic control. This conventional heating system ability has been so taken for granted, that the significance of this lack of control, with wood stoves, has not been heretofore recognized. The lack of uniform control for most woodstoves makes matching burning rates to house heat loss demand impossible. Woodstoves often overheat houses during moderate weather, as well as in the middle of long unattended burns, wasting significant amounts of energy.

The 12 to 13% wood saving, solely from increased thermal efficiency measured during the tests, is significantly less than overall wood savings reported during field testing of the prototype control. Thirteen users of a variety of stoves, over 1 to 3 heating seasons, unanimously reported savings of 15 to 30%, based on the wood used during the heating season, and adjusted for degree days. These additional savings were realized from the ability of the new control to match stove output to anticipated heat demand. This effect, shown in Figure 15, was documented in 2 homes, with continuous recording thermograph data, operating under conventional manual control, and with the Stovetemp prototype for comparison. In the test home wood saving from increased energy targetability was 10-11%. Total wood saving was 23-24%, 13% from increased efficiency of the stove, plus 10-11% from targetability.

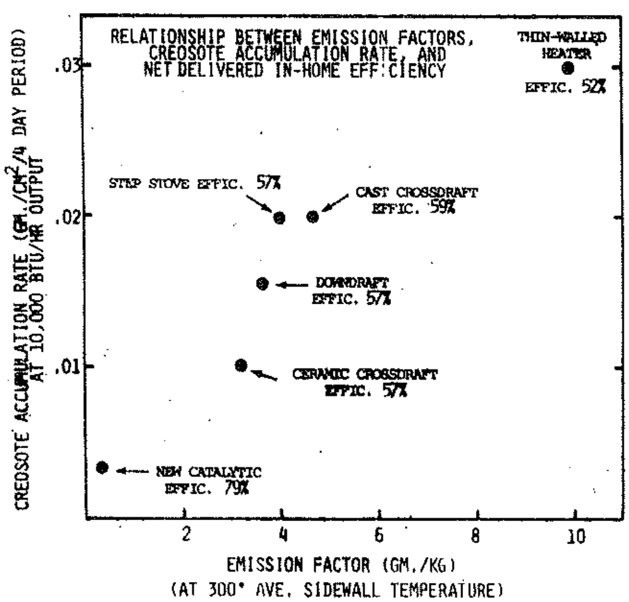

Figure 14. The relationship between emission factor, creosote accumulation rate, and net delivered in-home efficiency.

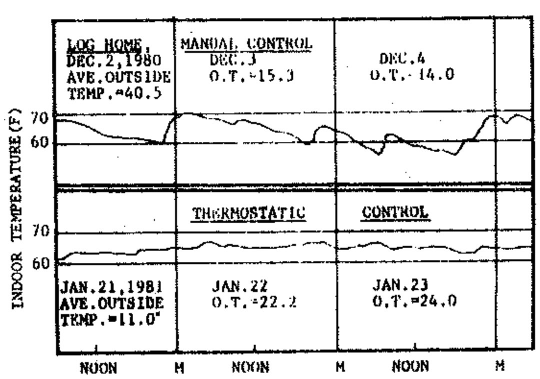

Figure 15. Indoor temperature comparison under manual and thermostatic control in a log test house.

There is general confusion as to whether a house actually increases its air infiltration when a woodstove is operated vs. electric heat. Although increased infiltration is generally assumed, it has not been demonstrated. Figure 16 illustrates results of humidity monitoring in the New York test house. Electric heat produced a well defined humidit pattern. When woodstoves were used in place of electric heat, lowe humidity patterns developed. This indicates significantly increased infiltration. In fact, the humidity patterns of the three stoves are in the same order as lab measurements of their stack flow (relative excess air) measurements would suggest.

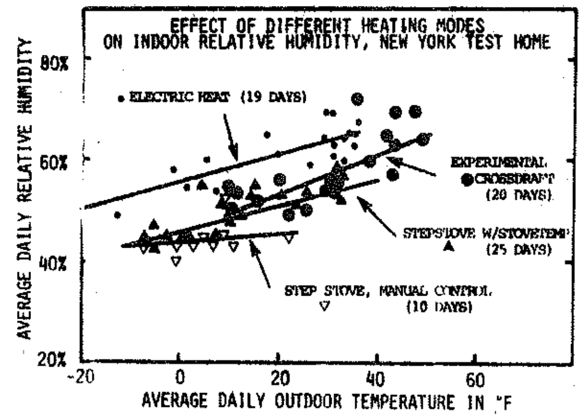

Figure 16. The effect of different heating modes on indoor relative humidity (and hence, infiltration rate) in the new York test house.

CONCLUSIONS

(1) Woodburning rates in homes are lower than expected. An investigation of 10 homes in northern New York revealed an average of only about 3.5 pounds/hour.

a. These low burn rates and their associated extremely high emissions and creosote accumulation rates dictate difficult parameters for designers of future stoves. These stoves must burn clean and do so at very low burn rates in order to satisfy homeowners.

(2) A simple, effective and low cost technique to measure condensable particulate emissions is presented. Results indicate:

a. Emission factors decrease dramatically as burn rate i increased.

b. Within the variables under control by the homeowner, piece size, burn rate, and the avoidance of wet wood have the most effect on emission factors.

c. Emission factors of 14 different stoves were determined. Most stoves produced very similar results. Only the thin-walled convective heater with its very high emissions and a new Condar design catalytic stove with its dramatically lower emissions deviate significantly.

(3) Fluepipe creosote accumulation rates in test homes were highly correlated with the emission factors of the particular stoves.

(4) The heat loss factor of a relatively air tight house can be accurately determined by monitoring electric heat used over periods of 20 days or more, if inside and outside temperatures, solar gain and wind are continuously monitored. The electric heaters should be located in the area where the woodstove will be tested. The use of a small fan to circulate air around both the elctric and the wood heaters, will permit application of the heat demand and woodstove efficiency data to other houses with this common type of stove installation. Shelton (1981, p. 1130) claimed "the main value of (in-home efficiency) testing is in quantifying the appliance/house interactions, not in quantifying the performance of the appliances' themselves. This claim was, however, supported by no data. On the contrary, the close agreement between efficiency data from the New York (preliminary) and Ohio houses as well as a third house (unpublished data) in New York indicates that these test results are not house specific to any significant degree. This is guaranteed by placement of the electric heaters where the stove will be located to specifically eliminate house interaction effects and having a small fan circulate air during all tests. Only a small percentage of homes will deviate significantly. These houses would have significantly longer or shorter exposed fluepipe than those of the test houses, have the stove next to an uninsulated wall, or window, or not use any means to circulate room air.

5. Daily woodburning rates can be related to heat loss factors to determine woodstove efficiencies with an error of only $\pm$ 2 to 4 percentage points over 20 day test periods.

6. Conventional woodstove efficiency decreases markedly at burn rates below about 2 pounds per hour. Efficiency generally reaches a steady state plateau at burn rates from 2 to 4 pounds per hour. Higher burn rates than were reported here would be necessary to define the decline in efficiency, which is believed to occur under such conditions.

7. The manner in which a stove is controlled significantly affects total energy used. Controlling a step stove and a thin-walled stove with the new Stovetemp control produced several additive positive effects. Delivered thermal efficiency increased for both stoves; 13 and 12% less wood was burned respectively. Better control also eliminates overheating, adding an additional 10-11% in wood saving for a total savings of 23-24%.

8. The Stovetemp control was installed on 6 conventional stove types for evaluation. All 5 of the heavy-walled stoves were almost equally efficient when so controlled. At outputs above 180,000 BTU per day, they burned at respectable efficiencies from 57 to 59%. The thin-walled convective heater was 5 to 6 percentage points less efficient.

9. Relatively large differences in combustion chamber design of heavy construction conventional stoves have negligible effect on net delivered efficiency. The ability to produce a uniform burning rate has a more significant effect on efficiency than does internal design.

10. Even with the new control, the thin-walled convective heater is significantly less efficient than the heavy stoves (about 52% efficient). When controlled by its original conventional thermostat, it probably operates below 50% efficiency much of the time. Under these conditions, it uses about 12% more wood than when controlled by the new thermostat.

11. A new sophisticated, catalytic stove was evaluated in the New York and Ohio test homes. Dramatic efficiency increases to over 75% have been obtained.

12. There is a highly significant correlation between emission factors, fluepipe creosote accumulation rate, and net delivered efficiency. Fortunately, clean burning stoves can be built which have the best of all three worlds. They have low emissions, little creosote accumulation, and unusually high efficiency.

13. There is a critical need for careful application of laboratory techniques to field determination of woodstove efficiencies in typical residences. Relationships between laboratory and home heating conditions must be better understood, so that laboratory findings can be applied with confidence in the real world. As test conditons were realistic and nearly ideal in this study, results reported herein probably represent near maximum actual efficiencies. The stove was not near an outside wall or fireplace, 5 feet of fluepipe was exposed, and a small fan was used for air circulation around the stove. This is, however, a common stove arrangemen in many homes, and this report's efficiencies are indicative of values to be expected in such homes.

14. When comparing woodstove burning with the electric heat baseline, an adjustment must be made for infiltration of combustion air. The energy to warm this air was considered in the present analysis as a liability of the stove. Reports of laboratory tests conducted in warm ambient air generally do not take this into account. At a combustion draft flow of 17 c.f.m. (measured average, from Barnett and Shea, 1981) on a day with 40 degree days, heating combustion air to room temperature requires about 17,600 BTU per day. This is 9% of the total house heat loss. A similar percentage of total heat loss is obtained for 40 and 60 degree days as well. Thus, heating draft air to indoor temperature results in 0.09 X .58 (stove efficiency), or actually about 5 percentage points lower in value than laboratory results would show.

15. The future for wood in home heating will be strongly influenced by appliance efficiency and use patterns. Good data are beginning to appear and efficiencies vary widely. As reported here, quite acceptable efficiencies of about 58% are attainable under real life conditions for conventional stoves and greater than 75% from the new catalytic stove. Island Energy Associates (1980) evaluated 9 wood furnaces under in-home conditions. Some of these incorporated recent technological advances, but efficiencies averaged only about 40%. The newer designs did not significantly outperform the more conventional ones. Since their analysis used the lower heat value for wood, the 40% figure should be adjusted to 35% for comparison with results in this report. Thus, on the average, these furnaces used 60% more wood per delivered BTU than the evenly controlled conventional free standing stoves of this report and twice that of the new Condar designed catalytic stove.

Indeed, in home heating there is a wide range of wood use efficiency depending upon the appliance, how it is installed, and how it is used. The future for correctly applied free standing stoves is promising (the Condar catalytic is actually significantly more efficient than conventional gas and oil furnace installations), but it is discouraging for traditionally controlled thin-walled convective heaters, and central furnace applications, unless large improvements are made.

ACKNOWLEDGEMENTS

I wish to thank P. Szydlik of the Physics Department at SUNY Plattsburgh for discussions on measuring solar energy and the loan of a solar meter. G. Myer and G. Greundling of the same institution kindly loaned me a continuous recording thermograph and solar meter, respectively. D. Bruner volunteered his log home as a third test home. Mr. J. Jefferys of New York State Electric and Gas kindly lent electric meters for use in test homes. D. Schawe and E. Durocher of SUNY Plattsburgh provided invaluable help in computer analysis. C. Paige and B. Ferguson of Vermont Castings provided invaluable discussion. My wife Lucy contributed extensively to the project by monitoring stoves, preparing diagrams, editing the manuscript, and putting up with the stoves being continually transported across her living room rug. The editorial expertise of Dr. H. Kerber and the extensive efforts of the Condar staff is greatly appreciated.

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05/03/84

ROUGH DRAFT STANDARD FOR MEASURING THE EMISSIONS AND EFFICIENCIES OF WOODSTOVES

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GENERAL

This document follows paragraph by paragraph the DEQ's proposed standard,(dated Feb. 3, 1984) but revises it to conform to use of the Condar Emissions Sampling and Efficiency System. The cost of four tests using the Condar System is $2000.00 maximum, compared to $6000.00 for the DEQ system.

The Condar System provides these benefits:

(1) Emissions measurements are equivalent to Method 7 in precision and better in accuracy.

(2) Efficiency measurements are more accurate and reflect real-world conditions better than the DEQ System.

NOTE: The words "No Change" indicate complete agreement with the DEQ proposed standard.

SECTION 1: SCOPE AND PURPOSE

1.1 SCOPE

No Change

1.2 PURPOSE

No Change

1.3 METHOD FOR USING THIS STANDARD

No Change

2.1 DESCRIPTION OF TESTING FACILITY

2.1.1 No Change

2.1.2 No Change

2.1.3 No Change

2.1.4 No Change

2.1.5 Calorimeter room not needed.

2.2 APPLIANCE INSTALLATION FOR FREE STANDING STOVES

2.2.1 No Change

2.2.2 Add: Pipe cracks and joints shall be sealed with high temperature RTV gasket cement or equivalent.

2.2.3 No Change

2.3 APPLIANCE INSTALLATION FOR FIREPLACE INSERTS

No Change

SECTION 3: TEST EQUIPMENT AND INSTALLATION

3.1 TEST EQUIPMENT SET-UP

No Change

3.2 TEST FUEL WEIGHT

3.2.1 No Change

3.2.2 No Change

3.3 FLUE GAS TEMPERATURES

No Change, except that thermocouple shall be checked once daily in boiling water and shall not deviate more than 2°F from the boiling water temperature.

3.4 STOVE SURFACE TEMPERATURES

No Change

3.5 STOVE COMBUSTION TEMPERATURES

No Change, except shielded sensors should not be used. Follow U.L. 1482.

3.6 FLUE GAS COMPOSITION

3.6.1 Only oxygen need be measured. Samples shall be extracted at the same height as the flue gas temperature measurements are made and particulate sampling nozzle is located. A probe and tubing made of inert materials shall withdraw the sample.

3.6.2 The gas stream shall be conditioned by a condensation trap and standard cotton cylinder filters.

3.6.3 No change except only oxygen criteria apply.

3.7 FLUE MOISTURE CONTENT DETERMINATION

Flue moisture content is not needed. Wet-bulb - Dry-bulb measurements are not considered sufficiently accurate in a flue environment in any event.

3.8 DRAFT

No Change

3.9 RELATIVE HUMIDITY

No Change

3.10 DATA RECORDING INTERVALS

No Change

3.11 INSTRUMENT CALIBRATION

No Change

3.11.3 Gas analyzer audit, no change.

3.11.4 Platform scale auditing, no change.

3.11.5 Tracer gas flow measurement. Tracer gases are not needed since the WHA - DEQ tests demonstrated that the Condar system (which operated at constant sampler flow rate) produced results highly correlated (R=.96) with Method 7 (which did change sampler flow). Given this convincing data, the burden of proof is on the DEQ to prove (with simultaneous dual sampling) that (1) changing sampler flow produces significantly different results and (2) that if these results are different they are in fact better.

SECTION 4: TEST FUEL REQUIREMENTS

4.1.1 Air dried cordwood shall be used with 16 - 22 % moisture on a wet basis. Years of emissions testing at Condar has demonstrated that variation in results is not significant (no greater than with Method 7). DEQ has also not demonstrated greater variation. They have not run enough tests to establish statistical significance.

A distinct advantage of cordwood is that no stove (or manufacturer thereof) is biased by fuel type as undoubtably is the case with dimensional lumber. The wood is the same as is used in home burning and so is the wood spacing. (DEQ's spacing requirements are too far apart to even approximate home conditions).

We have undoubtably worked with more manufacturers in the development of clean burning stoves than anyone. We feel obligated to note that when the public perceived that the DEQ had settled on dimensional lumber and 1 1/2" spacing, manufacturers immediately began burning this fuel almost exclusively in their test stoves.

Use of dimensional lumber has had a dramatically negative effect on stove development, because in addition to helping them reduce emissions levels, we have been helping stove manufacturers optimize five to ten equally important user-friendly criteria for their stoves. Progress on these fronts halted when the artificial fuel was used. The whole experience has been net negative because of the difficulty I have had in getting manufacturers to burn cordwood.

The proper type of wood to use for testing needs immediate resolution with consideration given to the following:

(1) Recent surveys indicate even Oregon uses greater than 50% hardwood.

(2) Fir is difficult (in places impossible) to obtain and extremely expensive, in the East.

(3) Hardwood is the dominant fuel outside of Oregon.

(4) One must look at National interests not just Oregon's interests. Hardwood (probably oak) seems to be the preferred fuel, in diameters ranging from 4 to 8 inches.

4.1.2 Test fuel moisture content shall range from 16 - 22 percent wet basis. Moisture determinations shall be made by the oven dry method of slices of the fuel.

4.1.3 Not Applicable

4.1.4 One moisture content determination per fuel piece shall be made.

4.1.5 No Change

4.1.6 No Change

4.1.7 The higher heating value of the fuel shall be taken as 8600 BTU/dry pound.

Currently, the DEQ's lab is using the sawdust from the saw cut as a sample for bomb calorimetry. A saw cut is 1/8" wide and the log is about 16 inches long. The sample represents only .8% of the log; hardly representative. No one to my knowledge has taken the time to saw up <u>entire logs</u>, homogenize the entire sawdust pile and then compare a single cut sample to one or several taken from the large pile to determine if there is any validity to the current practice. The burden of proof is on DEQ to demonstrate that the current procedure has scientific validity.

Add to this uncertainty (1) the difficulty in completely drying wood without releasing any volatile hydrocarbons, (2) the marked historic differences in interlab results. It is clear that the long term well established figure of 8600 BTU/lb. is most fair to manufacturers.

4.2 TEST FUEL PIECES

4.2.1 Not applicable for cordwood

4.2.2 " " " "

4.2.3 " " " "

4.2.4 " " " "

4.2.5 No Change

4.2.6 Test fuel pieces shall be arranged in the firebox in conformance with the manufacturers published written instructions.

4.2.7 Not applicable for cordwood

4.2.8 No Change

4.3.1 No change, except; Fuel load shall be 9 pounds per cubic foot for fireboxes less than 1.5 cu. ft. This modification reflects field observations with small fireboxes. People almost always stuff it full because they want to get a reasonable burn length from small stoves.

For larger than 1.5 cu. ft. We support the DEQ's value. We do so because we have had as extensive experience as anyone in requiring homeowners to record the weight of their wood loads. Homeowner's overnight loads of hardwood in the Fall and Spring average 7 - 8 lb./cu. ft. and 9 - 10 lb./cu. ft. in the coldest parts of winter. Why are they not greater?

(1) Ash buildup in a residential stove is several inches deep (and more irregular) than in lab stoves most of the time (reducing usable firebox volume).

(2) Logs are often of non-optimum and variable length to fully utilize firebox length.

(3) Log diameters and irregular cross section geometries make tight packing impossible.

Day time loads are usually less than 7 lb./cu. ft. when the occupants are in the house. Adding a log or two at a time is common. For these reasons 7 lb./cu. ft. appears to be a reasonable average. A value of greater than 9 would be inappropriate.

4.3.2 No Change

4.3.3 No Change

SECTION 5: APPLIANCE OPERATING PROCEDURE

5.1 Pretest Startup

No Change

5.2 Test Cycle Operation

5.2.1 Stop at end of line 6.

5.2.2 No Change

5.3 Test Fuel Loading

5.3.1 No Change

5.3.2 No Change

5.4 Air Supply Control

5.4.1 The stove door may be held open for up to 2 minutes into the test. Primary air supply controls may be adjusted for up to 5 minutes into the test to insure good ignition of the test charge and catalyst if so equipped. No changes to remainder of paragraph.

5.4.2 No Change

5.4.3 " "

5.4.4 " "

5.4.5. " "

5.5 TEST CYCLE COMPLETION

No Change

5.6 BLOWERS, FANS

No Change

5.7 OTHER APPURTENANCES

No Change

5.8 NUMBER OF TESTS REQUIRED

No Change

6.1 EMISSION TESTING

6.1.1 Particulate emission testing shall be conducted in conformance to the Condar Emissions Sampling Protocol (attached).

(1) No traverse of the flue is necessary

(2) Sample extraction shall occur at a height 8 feet above the top surface of the scale.

(3) Stack gas velocity measurements are not necessary. Stack dilution and temperature factors are obtained from the instruction sheets. (A.S.M.E. carbon balance method is used). Sample extraction rates shall be maintained at 0.4 C.F.M.

6.2 TRACER GAS DILUTION METHOD

This expensive and sensitive procedure is not needed (see section 3.11.5)

6.3 STOICHIOMETRIC CARBON, HYDROGEN AND OXYGEN BALANCE METHOD

This complicated and time consuming procedure is not needed (see paper on Determining Efficiency of Woodstoves using the Condar Emissions Sampling System (section on Dry Gas Loss). The equally adequate carbon balance system is to be used (see section 6.1)

6.4 EFFICIENCY TESTING AND CALCULATIONS

6.4.1 Efficiency is determined by using the average emission factor, average oxygen and average stack temperature values (all three are on the recording data sheet). (Sample included)

6.4.2 a. Combustion Efficiency

Combustion efficiency is the percentage represented by the actual heat produced in the firebox relative to the total heat production potential for the fuel comsumed. Actual heat production in the firebox is calculated as the difference between the heat value of the incompletely combusted stack gas constituents (carbon monoxide and unburned hydrocarbons) and the gross chemical heat content of the fuel burned.

Combustion efficiency is obtained from the Combustion Efficiency table in the Combustion Efficiency section of the Condar Emissions System Handbook. (Included) The only input data that is needed is the emission factor.

b. Heat Transfer Efficiency

Heat transfer efficiencies are calculated as the percentage represented by the useful heat released to the room relative to the actual heat produced in the firebox. The useful heat released to the room is calculated as the difference between the actual heat produced in the firebox and the sensible and latent heat losses out the stack.

Heat transfer efficiency losses are dry gas loss, water of combustion loss, and wood moisture loss.

Heat transfer efficiency is obtained from the Heat Transfer Table in the Heat Transfer section of the Condar Emissions Systems Handbook. (included) The only input data that is needed is average stack temperature and average oxygen.

c. Overall Efficiency

Overall efficiency = combustion efficiency x heat transfer efficiency

6.4.3 Not needed

SECTION 7: TEST DATA

7.1 DATA TO BE REPORTED

7.1.1 No Changes

7.1.2 a. Emission factor: gm./kg. (dry fuel wt. basis)

b. Emission rate: gm./hr.

c. Emission process rate: gm./million joule useful heat.

d. Total mass captured.

7.1.3 No Change

7.1.4 No Change

7.1.5 Burn Rate for each test cycle. The average values (kg./hr. wet and dry basis) over the entire test cycle.

7.1.6 Average fuel moisture for each test cycle.

a. Test fuel (wet basis %)

7.1.7 Stack dilution factor.

7.1.8 Average stack gas composition for each test cycle.

a. Oxygen Percent.
b. Excess Air% = 100 x (Stack dilution factor - 1)

7.1.9 Average Stack gas flow and draft.

a. Average flow rate C.F.M. = 3.04 x stack dilution factor x burn rate (kg./hour dry basis)
b. Draft, inches H_2O

7.1.10 Average stack gas emission factors and process rates for each test cycle.

a. Hydrocarbons (use conversion equation in Derivation of the Combustion Efficiency system of the Condar Emissions System Handbook.
b. Carbon monoxide

7.1.11 Average stack temperatures of each test cycle.
No change, except catalyst temperature should be obtained with thermocouple placed 3/4 inch down from catalyst top and in the geometric center of the catalyst.

SECTION 8: CATALYTIC COMPONENT CERTIFICATION REQUIREMENTS

No changes. Tests should be made with much older catalysts (analogous to EPA testing of auto catalysts). To parallel the analogy, catalysts 5000 hours old should be tested.

ROUGH DRA OF CONDAR EMISSIONS SYSTEM PRC COL

by
WOOD HEATING ALLIANCE

3.9 Particulate Measurement

3.9.1 The sampling system described in this section measures particulate emissions using dilution air and a constant volume sampling system. The mass of particulate emissions is determined from a sample collected on two filters. The system consists of a sampling nozzle, a dilution tunnel, filters and a pump. An adequate system is available from the Condar Company, Hiram, Ohio.

3.9.2 The calibrated sharp edged orifice of the sampling nozzle shall have a diameter of 0.375 inches. The probe shall be made of an inert material.

3.9.2.1 The probe shall be inserted to the stove centerline 4 feet beyond the stove collar.

3.9.2.2 The probes shall not be located in the wake of any obstruction.

3.9.2.3 The distance from the probe to the dilution tunnel shall be less than 4 inches.

3.9.2.4 The sample nozzle shall be cleaned of accumulation after each filter sample with a reverse gentle motion of a 3/8" drill. If the inside diameter becomes greater than .380 a new nozzle shall be used.

3.9.3 The dilution tunnel shall be 6 inches in diameter and 5-7 inches long.

3.9.3.1 The nozzle shall be centered in the dilution tunnel.

3.9.3.2 Dilution holes shall be drilled in the tunnel at the locations shown in Figure ____.

3.9.4 Dilution air shall be provided in an amount sufficient to keep the temperature on the filters below 125 F during any test.

3.9.5 The flow through the sample nozzle shall be 0.4 CFM ± 5 percent.

3.9.5.1 The pressure differential in the probe shall be monitored by a manometer capable of being read to ____ inches of water.

3.9.5.2 The manometer's zero shall be checked when each filter pair is being changed.

3.9.6 The temperature of flue gases shall be measured with a shielded type K thermocouple or equivalent at the same level as the sampling probe.

3.9.6.1 The temperature probe shall be located 3/4 inches from the stove pipe wall.

3.9.6.2 The accuracy of the temperature sensing device and associated readout equipment shall be at least $\pm 3^\circ$ F ($\pm 1.6^\circ$ C).

3.9.7 The primary and backup particulate filters shall have a diameter of at least 33 inches (13.0 cm).

3.9.8 The filters shall be glass fiber filters with a binder and shall have a D.O.P. rating of at least 99.99%.

3.9.9 The following procedures shall be followed in handling filters.

3.9.9.1 The temperature of the chamber in which the particulate filters are conditioned and weighed shall be maintained to within $\pm 10^\circ$ F ($\pm 6^\circ$ C) of a set point between 60 F (and 78° F (16° C) and 26° C) during all filter conditioning and weighing.

3.9.9.2 The relative humidity of the chamber in which the particulate filters are conditioned and weighed shall be maintained to within $\pm$ 5 percentage points of a set point between 20 and 80 percent during all filter conditioning and weighing. The chamber shall be free from contaminants such as dust that would disturb the stabilization of the filters.

3.9.9.3 Filters shall be conditioned in the environment described in 3.9.9.1 and 3.9.9.2 for at least 8 hours but less than 56 hours prior to the test.

3.9.9.4 If a filter is not used within eight hours of its removal from the conditioning environment, it shall be re-weighted.

3.9.9.5 After the test the filter(s) are returned within 3 days to the conditioning environment where they shall be conditioned for at least 12 hours but less than 24 hours.

3.9.9.6 Filters from which particulate matter becomes dislodged shall be discarded.

3.9.10 Filter weight shall be measured with a device having a resolution of at least 1 mg.

3.9.11 The backup filter shall be located 1 inch to 6 inches downstream from the primary filter holder. The net weight of material collected shall be the combined weight gain of both filters.

3.9.12 The sampling assembly shall be inserted in the stack just prior to the addition of the test fuel load.

3.9.12.1 The filters shall be removed and a new pair added between 13 and 29 minutes.

3.9.12.2 Removal and reloading of new filters shall be done in a maximum of 2 minutes. Emission factors shall be increased by an amount proportional to the time that the sampling system is inoperative.

3.9.12.3 The test shall end when the test fuel load is consumed.

DATA FORM FOR BULK-WEIGHED FILTERS
(F erglass Front and Fiberglass B up)

CONDAR EMISSIONS AND EFFICIENCY FORM

FORM #50184

Stove ______________

Date ______________

S. ewall Temperature or Output ____________

Filter No.	O_2 %	Stack Temp. (°F)	Stove Wall Temp.	Sampler Flow (CFM)	Fuel Added (kg)	Sample Start and Finish Time

Front Fiberglass Filter:

Clean Wt.= __________ gm.

Dirty Wt.= __________ gm.

Particulates = __________ gm. (Front Filter)

Backup Fiberglass Filters (Labeled B):

Clean Wt.= __________ gm.

Dirty Wt.= __________ gm.

Particulates = __________ gm. (Backup Filter)

Total Particulates = __________ gm.

Front & Backup Filters Combined in on pile:

Clean Wt. = __________ gm.

Dirty Wt. = __________ gm.

Total Particulates = __________ gm. (Front & Backup)

Discrepancy between bulk weighing front & back vs. one pile:(± .002gm allowed)

Clean Wt. = __________ gm.

Dirty Wt. = __________ gm.

Use a quarter or car key to determine standard weight:

Before Sampling = __________ gm

After Sampling = __________ gm.

Correction Factor = __________ gm.

Ave. Sampler Flow =

Ave. Stack Temp. =

Stack Temp. Factor =

Ave. 02 =

Stack Dilution Factor =

Total Particulates =

Particulates/hr =

Burn Rate =

Emission Factor =

Combustion Efficiency = %

Heat Transfer Efficiency = %

Overall Efficiency = %

Stockton Gordon Barnett III

11782 Mills Rd., Garrettsville, OH 44234 Home: (216)527-2364
Office: (216)569-3245

Professional Experience:

Director of Research & Development, Condar Co., Hiram, Ohio (1981-)

Professor of Geology, State University of New York College At Plattsburgh. (1976-1983) Department of Earth Sciences.

Consultant, Lake Champlain Committee. (1978)

Consultant: expert witness. State of New York Attorney General's Office. (1977, 1978)

Temporary Consultant Geologist. Signal Oil and Gas Company. (1968)

Associate Professor of Geology, State University of New York College at Plattsburgh. (1972-1976)

Assistant Professor of Geology, State University of New York College at Plattsburgh. (1966-1972)

Temporary Geologist, Mobil Oil Company, Oklahoma City, Oklahoma. (June-September 1964)

Teaching Assistant, Department of Geology, Ohio State Univeristy. (1963-1965)

Teaching Assistant, Department of Geology, State University of Iowa. (1961-1963)

Education:

Ph.D. in Geology, Ohio State University (1966)

M.S. in Geology, State University of Iowa (1964)

B.A. in Geology, Dartmouth College (1961)

Energy Related Experiences:

1980 to Present: Developed the first smokeless woodstove. (Patents Pending) This catalytic design was evaluated in 8 homes and several labs during the 1981-1984 winters. Emissions and creosote are reduced by 95% compared to conventional stoves and net delivered efficiency is 80%, a heretofore unattainable level. As of 1983 this stove design is the only catalytic stove design being used by the State of Oregon to set woodstove emissions standards. Twelve stove companies representing 1/4 of the country's stove production have joined this woodstove design program.

1980 to Present: Developed a new less expensive but highly accurate woodstove emissions sampler which Condar has made commercially available. It is being investigated in state, federal and industry-wide programs by the TVA and the state of Oregon for use as a standard procedure for woodstove emissions. I have developed a solar meter and high temperature catalytic probe thermometer which Condar is now selling.

Developed on my own time a thermostat for woodburning stoves. Tests indicate that it produces a more-even burn than any other model available. As a result, it produces savings of 20-25% on wood use as compared to both manual controlled burning and other available thermostatic controls. My thermostat is being manufactured for factory installation and retrofit by Condar Company. This thermostat has patent status.

1978 to Present: Have conducted research on the efficiency of wood stoves using homes rather than test labs. This research led to the development of a calorimeter house method of energy efficiency evaluation, preferable to lab techniques. In addition, a project relating woodstove air pollution to stove design and owner use patterns is being conducted. Both of these projects have received national attention, and I have been invited to present papers on these projects at major meetings in 1981 and 1982.

1977: Constructed a new energy-efficient home which is heated entirely with wood.

1975-1979: Taught the course <u>Energy Resources and Their Conservation</u> at SUNY/Plattsburgh.

1976: Worked with store owners in Pyramid Mall, Plattsburgh on conservation of energy.

1976: Spearheaded a program on our SUNY campus to install insulation and weatherstrip to campus buildings. The State granted us $18,000 for this project. I also worked with the campus planners primarily in the area of reducing lighting loads.

1972-1975: Conducted a study of the relative effectiveness of systematically applying various energy conservation measures to our home. These included insulation (two types), weather stripping and adjusting furnace temperatures.

Environmental Geology Experience:	My involvement began as an outgrowth of my research activities in paleoecology in the 1960's (many of the publications listed). Most of my environmental work has been directed toward solving particular problems needing immediate solutions.

May 1976-1981: Actively investigated causes of flooding on Lake Champlain and along the Richelieu River which drains the lake northward into Canada. Consultant for the Lake Champlain Committee on this matter in 1978. The International Joint Commission deliberated what action should be taken to alleviate this flooding which has caused increasingly more damage in recent years. In their $2.5 million study the I.J.C.'s Board did not, however, initiate investigations of the causes of flooding, assuming they were entirely natural. My work has revealed that very significant man-induced causes have been introduced since 1970. The Richelieu River's cross section has been reduced both by man-made navigation works encroachments, and seasonally, by aquatic bottom vegetation. The I.J.C. made their decision in January 1981, and their earlier favored plan of building a flood control was not accepted. It is now possible that the man-made causes of the flooding can be alleviated at less expense, and a comparable amount of flood relief will result.

June 1979: Granted an award by the EPA in recognition of this research.

Developed a computer flood prediction model for Lake Champlain which the National Weather Service River Forecast Center now uses for flood warnings. It has been estimated by the I.J.C.'s Board that such forecasts, previously never made, will reduce flood damages by $450,000 annually.

1981: Discovered the presence of carcinogenic coal tar seeping from the New York State Electric and Gas property into the Saranac River in 1973. After years of study and negotiations, NYSGE has at the expense of 1 million dollars built a containment structure to eliminate seepage.

1977: Expert witness for State of New York in a court case involving flood damages in Saranac Lake in spring of 1971 and 1972. I produced an analysis of the hydrologic conditions which had significant bearing on the case.

1976/1978: Taught the course Environmental Geology at SUNY/Plattsburgh.

1975: Investigated nutrient loading on Lake Champlain (publication 14). This data was presented as testimony in hearings concerning a bill before the Vermont State Senate to remove phosphates from detergents sold in that state. The bill narrowly missed passage that year by one vote but was passed in 1977.
1974: Appointed by Plattsburgh Mayor as co-chairman of a committee which investigated reasons why that city's new secondary sewage plant was not functioning properly. As a result of this committee's work, within several months the plant's performance improved markedly and remains good to the present day.

Fellowships and Awards:	Grant-in-Aid, Ohio Academy of Science (1965)...Summer Fellowships Research Foundation of State University of New York (1976, 1969).. and Grant-in-Aid, Research Foundation of State University of New York (1967,1968,1969)...Lake Champlain Committee Award for my contribution to the Lake Champlain Lake Level Hearing (1978)...EPA Award for my Lake Level research (1979).
Professional Affiliations:	Sigma Gamma Epsilon...Paleontological Society...Society of Economic Paleontologists and Meteorologists...Sigma XI...Paleontological Research Association...American Association for the Advancement of Science.

Publications:

(1) Barnett, S.G., 1965, Conodonts of the Jacksonburg Limestone (Middle Ordovician) of northwestern New Jersey and eastern Pennsylvania: Micropaleontology, V. 11, pp. 59-80.

(2) Barnett, S.G., Kohut, J.J., Rust, C.C., and Sweet, W.C., 1966, Conodonts from Nowshera Reef Limestones (Uppermost Silurian of Lowermost Devonian), West Pakistan: Journal of Paleontology, V. 40, pp. 435-438.

(3) Barnett, S.G., 1968, Taconian Islands and the shores of Appalachia: Appendix to Trip E: New York State Geological Association, Guidebook to Field Excursions.

(4) Barnett, S.G., 1969, editor: New York State Geological Association, Guidebook to Field Excursions.

(5) Barnett, S.G., 1970, Upper Cayugan and Helderbergian Stratigraphy of southeastern New York and northern New Jersey: Geological Society of America,V. 81, pp. 2375-2402.

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(9) Barnett, S.G., 1971, Determination of the Silurian-Devonian Boundary in the Central Appalachians using conodonts: Abstract, Geological Society of America, Southeastern Meeting, p. 293.

(10) Barnett, S.G., 1971, The evolution of Spathognathodus remscheidensis in New York, New Jersey, Nevada, and Czechoslovakia: Journal of Paleontology, V. 46, pp. 900-917

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(15) Barnett, S.G., 1976, Geology of the Green Pond Outlier: New Jersey Geologic Survey.

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(20) Mehrtens, C.J. and Barnett, S.G., 1979, Evolutionary change in the Bryozoan genus Prasopora as a tool for correlating within the Trenton Group (Middle Ordovician): Geological Society of America, Northeast Meeting.

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(37) Barnett, S.G., 1983, Ranking of home heating systems using calorimeter houses: system net efficiencies and fuel cost per delivered BTU: Wood Heating Alliance Technical Session. Also printed in March 1984, Wood'n Energy.

50

3412 SE 160
Portland, OR 97236
May 1, 1984

Mr. Fred Hansen
Director, DEQ
P.O. Box 1760
Portland, OR 97207

RECEIVED

MAY 04 1984

PUBLIC AFFAIRS

Dear Mr. Hansen:

I support the DEQ's regulation of wood stove emissions.

The January 1983 (vol. 71, no. 1) journal of PEDIATRICS contained an article on "Infant Respiratory Illness and Indoor Air Pollution from a Woodburning Stove." The article cited an article by Cooper (1980), wherein he "reported that 51% of the respirable ($< 2.5\ \mu m$) air-pollutant particulates ($35\ \mu g/m^3$) in a Portland, Oregon residential area were from residential wood combustion sources. A family furnace burning 0.5×10^6 BTU of natural gas per day replaced by a woodburning stove of 50% efficiency would emit between 10 to 1,000 times more carbon monoxide, benzopyrene, and respirable particulates than other residential fuels." In New England the number of homes with woodburning stoves doubled between 1976 and 1981; I believe the same is true for the Portland area.

I grew up on the East Coast, where I can remember opening windows in the winter time. That is oftentimes impossible here in the Portland area, as someone's chimney smoke is invariably blowing in your direction. I have had this problem many times trying to ventilate my attic.

Education on how to burn wood correctly seems not to have kept pace with the desire for low heating bills. A too large number of people are burning green and/or wet wood; many chimneys smoke continuously. I have not seen anything on TV addressing these problems. That would certainly help right now, before things get as bad as Billings Montana.

The proposed regulations, which I support, may be too little too late, since they won't take any affect until 1986. I think DEQ should also focus attention on reducing emissions from presently installed woodstoves. Below are some points I feel should be pursued:

(a) wood stoves should be banned from new construction as a source of heating (with new construction putting houses closer and closer together, emissions are going to increase dramatically)

(b) emission standards should be established for presently operating wood stoves and fireplaces, just as we have done for automobiles. Pollution control devices (flue scrubbers) should be required for chimneys not meeting standards; burning of creosoted railroad ties and wood should be prohibited.

(c) wood fuels should be taxed, with revenue going toward research, education and enforecement costs.

(d) Property owners should have "smoke-free" rights; just as it is not permitted to block a neighbor's access to solar energy, it shouldn't be permissable to be sending dense smoke clouds into other peoples' living space.

(e) Use of woodburning heating stoves and fireplaces should be prohibited on days of poor air quality.

The environmental quality of Portland neighborhoods has certainly deteriorated during the past 5 or 6 years. This is mostly due to the dramatic increase in the number of woodburning stoves. The number of people burning green and wet wood is significantly too large.

I work outside most of the time, and I bicyle alot for exercise. On many days I am experiencing headaches, sore throat, and respiratory tract irritation. I resent being forced to subsidize other peoples' heating bills with my health.

I would like your recommendation on what type of face mask I should buy to protect my respiratory system from the respirable air-pollutant particulates from residential wood combustion sources. Thank you.

Sincerely

James Bela

Robert D. Jones
3657 S.E. Connor
Gresham, Or. 97030

1

5-2-84

PORTLAND, OR 972
PM
7 MAY
1984

To The Environmental Quality Commission:

"I would like these comments to be part of the Public Recored".

The Woodstove Industry at the present time is at About half of what it was in 1978. The other half being forced out of business by the ailling economy. Now, Because people living in a "Free" country (meaning Freedom) have found a means to heat their homes Economicly, rather than pay Ever increasing Electric cost's instigated by the B.P.A, You People want to take that Away. I personally feel that to take away an entire industry such as the woodstove Industry; is in direct Violation of A persons rights!

#1. Your proposed standards should always remain an Attainable Standard, that with a little Engineering A manufacturer can meet!

#2. People will just go out of State and purchase an inefficient, Dirty Burning Woodstove, Driving Commerce out of State and virtually the loss of

Jobs for Retailers and manufacturers right with the Commerce.

#3 People who purchase Catalytic Stoves will not properly maintain their stoves or replase / worn Catalytics (IE. Dirty Burning stoves.)

This Action will not clean-up the Air, ONLY Ruin part of Oregons Employment Force!, By putting more people out looking for Jobs!

Please think about what you ARE Doing before you do it??

Don't TAKE AWAY my Job!

P.S. What about used woodstoves or Home-mades, you'll still see a lot of these around!

Yours trully,

Robert D Jones

a Woodstove Advocate! not pollution advocate!

WOODSTOVE
SHOWROOM
OVER 100 MODELS
BOB JONES
(503) 282-7797
2702 N. E. BROADWAY PORTLAND, OREGON 97232

To make room in the Air shed is Bull! the time the air is bad is in the Summer months, now you tell me Whoo burns their stove that time of year. It's Factories People!!

(2)

AUSTIN, TX 787 PM 6 MAY 1984

LAWRENCE CRANBERG, PH.D.
CONSULTING PHYSICIST

RECEIVED

MAY 09 1984

PUBLIC AFFAIRS

1205 CONSTANT SPRINGS DR.
AUSTIN, TEXAS 78746
(512) 327-1794

May 6, 1984

Margaret McCue
Information Representative
Air Quality Division
Department of Environmental Quality
Box 1760
Portland, OR 97207

Re: Request for Hearing before Environmental Quality Commission

Dear Ms. McCue,

I am extremely disappointed to learn from your letter of Apr. 26, 1984, that it may not be possible for me to be heard by the Environmental Quality Commission in person on the question of the forthcoming Rules, but I am renewing my request for an opportunity to do so.

It is appropriate to explain why I was not able to be present for the hearings scheduled for the first week of May, 1984. Starting in the morning of Apr. 30, 1984, and until 4:30 P. M., May 4, 1984, I was in attendance at the Court of the Honorable Robert M. M. Seto, of the U. S. Court of Claims in Washington, D. C. as plaintiff acting pro se in the suit Lawrence Cranberg V. United States of America, Case No. 417-81C. This trial had already been postponed once, and I deemed it impractical to request a second postponement, which would have been necessary to attend one of the scheduled hearings of the EQC.

I am enclosing some additional material for transmission to the members of the Commission, and I am grateful that there is the opportunity to submit written material. However, I feel that the substance of my presentation is unique in its technical aspects and in its implications for the rules about to be adopted by the Commission, and nothing less than a full-dress, personal presentation would be effective in conveying it. I therefore respectfully request the opportunity to be heard in person by the Commission.

Sincerely yours,

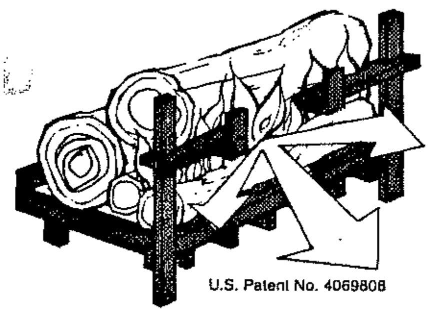
Lawrence Cranberg

Lawrence Cranberg

Encl.

TEXAS FIREFRAME® GRATE

Turns your fireplace into a real heating unit.



- Throws much more heat into room.
- Starts Easily with unsplit logs.
- No log-turning to keep the fire going.
- It saves fuel.
- Sizes for every fireplace and Franklin Stove.
- Feel warmth 10–12 feet from fire.
- Control the rate of burning with height-adjustable arms.
- Reduces risk of chimney fires.
- Engineered for convenience and durability.
- Simple, copyrighted instructions.

"It channels an amazing amount of heat from a fireplace directly into the room, without any moving parts." *Better Homes and Gardens*

"Easy lighting is a side benefit of this grate arrangement; the big advantage is the slow-burning steady fire that results . . ." *The New York Times*

"Forces a fire not only to burn better but to send more of its heat into the room." *Time Magazine*

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TEXAS FIREFRAME Co.

P.O. Box 3435 Austin, Texas 78764
Phone 512-327-1794

PRESS RELEASE Jan. 30, 1984

Texas Fireframe Co. of Austin, Texas, home of the slot fire or "The Physicist's Fire" and the Texas Fireframe® Grate, a patented method and apparatus for making efficient, safe, log fires in the fireplace, based on modern physics, is pleased to announce results of a new series of tests by Terralab Engineers of Salt Lake City, as reported to the San Antonio Meeting of the American Physical Society on Jan. 31, 1984, by physicist Dr. Lawrence Cranberg.

An extensively tested Calorimeter Room gave the following average results on five runs: fuel combustion rate, 4.5 lbs/hr; air draw, 40 lbs/hr; radiant energy output in a horizontal beam, 11,800 BTU/hr; fuel efficiency, 31%; flue gas temperatures, 620 F.

The energy efficiency is about three times greater than for a conventional fire. The air draw is about one-third that for an air-tight wood stove, and is about 7% of the normal air draw of a winterized home, representing an inappreciable energy load in winter.

Low flue-gas temperature reflects the negligible risk of over-firing with the slot fire, and is consistent with the well-established safety record of the Texas Fireframe grate.

Measurements of carcinogens in the flue gases of the slot fire gave a result of less than five parts per billion. A very low result is to be expected since the slot fire operates at a uniform temperature of about 2,000 F, which assures full combustion of the fuel.

Details of the foregoing results and of the methods used can be obtained by contacting Texas Fireframe Co. or Terralab Engineers, at 3585 Via Terra, Salt Lake City, UT, 84115, (801)262-0094.

"...A FIRED WOOD STOVE IS VERY MUCH A LIVING THING, ONE THAT MUST BE ATTENDED CAREFULLY - OR IT MAY JUST KILL YOU." John Vivian, "Wood Heat", Rodale Press, 1976, p. xiv.

The Washington Post
SUNDAY, JANUARY 3, 198

Keeping Warm

FIREWOOD, according to one calculation, is now producing much more heat for Americans than all the nuclear reactors put together. That's an arresting thought, but it deserves examination. There has been a sharp trend to the use of wood stoves in the past few years. The atavistic appeal of that crackling fire is powerful. But the comparison with nuclear energy seems to imply that it's possible to dispense with the reactors altogether by turning back to man's earliest fuel.

The federal Consumer Product Safety Commission keeps a count of serious injuries reported by hospital emergency rooms. In 1974 the commission estimated about 40 injuries from fires started by wood stoves or open fireplaces. Five years later the figure was about 400. Those numbers do not count burns to people falling on stoves, or cases of carbon monoxide poisoning.

The National Fire Protection Association in 1980 counted 26 fires started by wood stoves, fireplaces or chimneys, in each of which three or more persons died. Can you imagine the state of the nuclear industry if there had been 26 reactor accidents in which three or more persons had died?

As we have observed before, nuclear power has a very thin future in this country, and in most others, for reasons that are essentially economic. But perhaps it's necessary to repeat that no method of staying warm in winter is entirely safe. Nuclear energy brings with it a well-known catalog of risks. It remains curious that people who are deeply frightened by those hypothetical risks are prepared to shrug off the reports on fatal fires. There's one standard for the familiar and simple; there's another for the unfamiliar and esoteric.

Even the safest and best-managed of reactors produces radioactive wastes, and the country can't make up its mind how to dispose of them. A wood fire is simpler; a lot of the waste simply vanishes into the atmosphere in the form of air pollution. One of the pollutants is carbon dioxide, which, as it accumulates, may eventually begin to change the climate of the planet. Carbon dioxide overloading may ultimately prove to be the compelling reason to work with energy technologies, including nuclear technologies, that do not require combustion.

Or perhaps this country will eventually decide to do without nuclear power altogether. But it would be foolish to think that a wood stove is better than a reactor because it is safer and cleaner. It is neither.

Ohio father dies in effort to save children from fire

MCDERMOTT, Ohio (AP) — His clothes on fire, Harold Spencer escaped from his burning house Friday but returned to get his three children. He and the children died.

A neighbor restrained Spencer's wife, Sharon, 23, to make certain she didn't go back into the flames that destroyed the three-room house in view of the Rush Township Volunteer Fire Station.

"The wife and I were drinking coffee when she looked out the window and said, 'Oh, my God,' and I looked and the whole house was in flames," said Homer Hubbard, another neighbor.

"I ran out on the porch and saw a man and he was on fire," said Hubbard, 52. "There were two people and I assumed one was the wife. She was screaming about the kids. They both ran around to the back of the house."

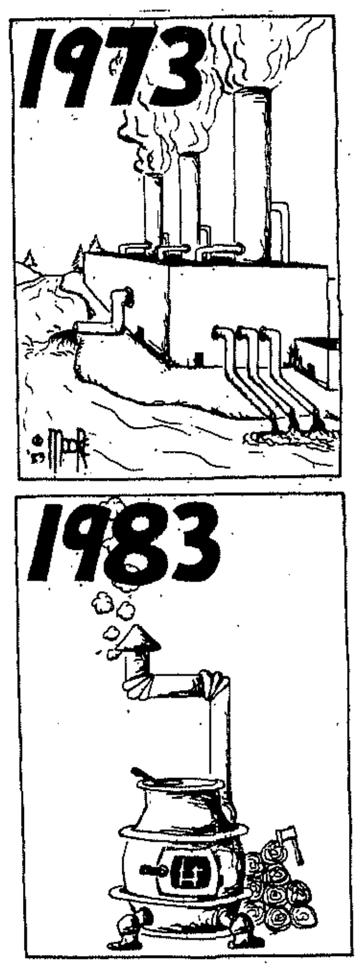
Bernice Goodson, 61, who lives next to the fire station and handles its alarm and radio, said Mrs. Spencer awoke her at 5:45 a.m. by shouting that the house was on fire.

"I sounded the alarm," Goodson said. "Then I held her here at my house until the fire trucks left. I didn't want her running back in that house."

Firefighters found Spencer's body four feet inside the back door. The bodies of the children — Jennifer, 4, Amanda, 3, and Harold Jr., 2 — were in a front bedroom.

Firefighters said the house had no utilities. The fire was believed to have been caused by an overheated wood stove.

AUSTIN AMERICAN-STATESMAN, Feb. 19, 1983



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BEND RESEARCH, INC.

May 7, 1984

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
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AIR QUALITY CONTROL

Ms. Barbara Tombleson
Air Quality Division
Department of Environmental Quality
P.O. Box 1760
Portland, Oregon 97207

Dear Ms. Tombleson:

I regret that I was unable to attend the hearings held in Bend recently on the subject of air quality in Central Oregon and, in particular, emissions from wood stoves. I would like to belatedly offer this observation: while it is true that smoke from wood stoves adds particulates to our local airshed, those stoves benefit literally thousands of local homeowners, many of whom would be financially hard pressed to heat their homes adequately by alternate means through our long winters. And the air pollution occurs during the winter months, when outdoor activities are at a minimum.

A far greater problem, here, to my way of thinking, is field burning, both on the east side of the Cascades and in the Willamette Valley. Valley smoke reaches our area in substantial amounts, and it occurs during the summer months when most of us are outdoors a great deal. In addition, that field burning benefits only a relatively few people in our state, many of whom are hardly among Oregon's needy.

Please consider this before taking action against wood-burning stoves.

Thank you.

Sincerely,

Harold K. Lonsdale
President

HKL:skm

BEND, OR 97701
PM
7 MAY
1984

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(4)

PORTLAND, OREGON
MAY 4, 1984

DEPT. OF ENVIRONMENTAL QUALITY:

I'M WRITING THIS LETTER IN PROTEST TO THE NEW PROPOSED WOOD STOVE EMISSION LIMITS. AS PER THE ARTICLE IN WED., MAY 2, OREGONIAN WOOD STOVES OF EXISTING TYPES WOULD BE ELIMINATED COMPLETELY. THE ARTICLE ALSO STATES THAT NEW DESIGN TYPES WOULD BE REQUIRED TESTED TO NEW STANDARDS WHICH WOULD COST ABOUT $6000 PER TYPE. THIS WOULD DRIVE THE COST OF A NEW STOVE UP PROBALLY $200 WHICH IS NOT DESIRABLE IN THE STATE OF THE ECONOMY TODAY. I DON'T THINK THIS HAS BEEN CONSIDERED OR IF IT HAS IT HAS BEEN IGNORED IN ORDER TO ACHEIVE A GOAL THAT IS NOT AS ESSENTIAL AS SOMEONE LOSING THEIR HOME OR CAR OR GOING

HUNGRY. IT JUST DOESN'T MAKE SENSE TO THOSE OF US WHO HAVE TO PAY THE BILL, ESPECIALLY THOSE WHO ARE ON FIXED INCOME & THE ELDERLY.

THE ARTICLE IN THE OREGONIAN ALSO NOTES A SPOKESMAN FOR OREGON ASSOCIATED INDUSTRIES, MR. R.B. SNYDER, TELLS D.E.Q. TO SET UP STOVE REGULATIONS TO ALMOST FORBID ANY EMISSION TO THE AIR SHED TO ENABLE MORE INDUSTRIES TO START BUSINESSES. HE IS SAYING WE, THE HOME OCCUPANTS, CAN'T INTRODUCE ANY EMISSIONS INTO THE AIR SHED SO THAT NEW BUSINESSES CAN. WE ALL KNOW THAT BUSINESS MAKES JOBS, BUT IS EVERYONE WHO LIVES IN THE STATE REQ. TO PAY SO BIG BUSINESS CAN MAKE PROFITS EVEN IF THEY DO MAKE JOBS,

ALSO BIG BUSINESSES IN THE PAST HAVE NOT COMPLIED AND WHEN CAUGHT HAVE COMPLAINED THEY COULD NOT AFFORD TO COMPLY AND HAVE BEEN GRANTED ANOTHER 10 YRS. EXTENSION OF COMPLYING. IN THE MEAN TIME THIS SAME BUSINESS IS POLLUTING THE AIR SHED & WHEN TESTS ARE TAKE & POLLUTION IS HIGH D.E.Q. COMES TO THE HOME OCCUPANT & SAYS HEY! YOUR WOOD STOVE IS MAKING TOO MUCH POLLUTION. IS THIS RIGHT OR EQUITABLE? MUST ALL THE LITTLE PEOPLE SERVE BIG BUSINESS FOREVER? I'M PERSONALLY TIRED OF THE INEQUITY AND FEEL A DIFFERENT APPROACH MUST BE TAKEN.

THIS LETTER MAY BE LATE BUT I DIDN'T FIND OUT ABOUT THE DEADLINE UNTIL LATE MAY 16th. PLEASE ENTER THIS LETTER IN THE RECORDS

Leo F. Effle

(5)

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BELLEVUE, WASHINGTON 98004
TELEPHONE: (206) 453-6980

ALLAN R. ABRAVANEL, P.C.

May 4, 1984

Honorable Frederic J. Hansen
Director
Department of Environmental Quality
522 S.W. Fifth Avenue
P. O. Box 1760
Portland, Oregon 97207

Re: Proposed Woodstove Certification Rules

Dear Fred:

Enclosed for your convenience is a copy of comments upon the Department of Environmental Quality's proposed woodstove certification rules, which we have filed on behalf of Klickitat Enterprises, Inc.

As you will note, we have requested an opportunity to file additional comments after the May 4, 1984 cutoff date for comments, if necessary. The reason for this request is that, as you know, this is an extremely complex subject matter and scientific and technological data regarding the woodstove emissions testing program and proposed standards are still being developed and analyzed. For this reason, we have requested the right to file additional comments, if new and important information becomes available.

If you have any question regarding either this letter or the comments we have filed, or if I may be of any assistance, please do not hesitate to call me.

Very truly yours,

Al R. Abravanel

Allan R. Abravanel

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Enclosu

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
MAY 08 1984
OFFICE OF THE DIRECTOR

May 3, 1984

Mary Bishop
Commissioner
Environmental Quality Commission
P.O. Box 1760
Portland, OR 97202

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
MAY 14 1984
OFFICE OF THE DIRECTOR

Re: Woodstoves Emissions Standards

Dear Ms. Bishop:

Although I am a lifelong environmentalist who believes in regulation, I am forced to conclude that the D.E.Q.'s proposed woodstove emissions standards are arbitrary and punitive. This is not an environmental policy, but a vendetta against stoves, and against the public who must rely on stoves to fight rising energy costs.

Behind D.E.Q.'s proposals, I believe, is the regulators' prejudice against simple energy sources that are not connected to the power grid. This prejudice is fanned by local industries who want to reduce competition for the airshed in order to minimize their own pollution control costs. D.E.Q. has become the tout of protected industries.

1. Why, for example, has D.E.Q. ignored the thoughtful recommendations of its own Wood Stove Advisory Committee for a 9/4 final standard, and instead proposed a tighter 7/3 standard that most experts view as technically impractical and restrictive of innovation?

2. Why has D.E.Q. exempted fireplaces, woodburning furnaces and furnace add-ons, which equity, common sense and good environmental policy would treat equally with woodstoves?

3. Why will D.E.Q. require stove manufacturers to re-test every five years, at a heavy cost that must be passed on to consumers, when factory inspection has long satisfied UL and all other safety testing authorities as a less costly means to the same end?

4. Why does D.E.Q. propose a pollution limit <u>per stove</u> instead of <u>per unit of heat output</u>, thus requiring homeowners with large heating requirements to buy two or more stoves and chimneys instead of one, at great extra cost, but at no extra protection to the airshed?

As a woodstove importer, I believe stoves that meet the 9/4 standard will be a boon to the public, to the environment and to our industry. Oregon D.E.Q. evidently does not share this optimistic view. Behind a smokescreen of rhetoric about the environment, their real goal must be to end woodstove use in Oregon.

Yours truly,

RC

Ronald Cohen
President

Letter sent
~~[illegible]~~ J. Petersen's sign
(Drafted by P.R. 5/17 AM)

14 Arrow Street
Cambridge, MA 02138
Telephone: (617) 354-1459
Telex: 921499
Cable: COHPECK

Cohen & Peck Inc.