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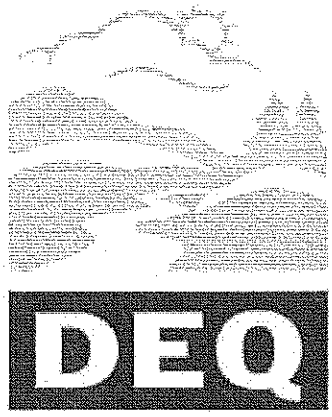
OREGON
ENVIRONMENTAL QUALITY
COMMISSION MEETING
MATERIALS



State of Oregon
Department of Environmental Quality

MINUTES OF SPECIAL MEETING

of the

Oregon Environmental Quality Commission

August 18, 1969

A special meeting of the Oregon Environmental Quality Commission was called to order by the Chairman at 5:10 p.m. August 18, 1969, in Room 72 of the State Office Building, 1400 S.W. 5th Avenue, Portland, Oregon. Members present were B.A. McPhillips, Chairman, Edward C. Harms, Jr., George A. McMath, H.P. Meierjurgen and Storrs S. Waterman.

Participating staff members were: Kenneth H. Spies, Director, Arnold B. Silver, Legal Counsel; Harold M. Patterson, Director of Air Quality Control Division; R. Bruce Snyder, Meteorologist; and F.G. Odell, Associate Engineer. Mr. Tom O'dell was present as special representative of the Attorney General.

Also present at this meeting were several persons from the grass seed and grain growers industry, the Eugene metropolitan area and the news media.

The proceedings of the meeting were recorded by a court reporter.

The Chairman announced that the purpose of the meeting was to consider proposed amendments to the field burning schedule which had initially been adopted by the State Sanitary Authority on June 28, 1969, filed with the Secretary of State on July 9, 1969, and later amended by the successor agency, the Environmental Quality Commission, on August 6, 1969. He said further it was the intention of the Commission to formally adopt the proposed amendments at another special meeting of the Commission to be held at 10:00 a.m. on Wednesday, August 20, 1969 in the Second Floor Auditorium of the Public Service Building, 920 S.W. 6th Avenue, Portland, Oregon, at which time all interested persons would be given an opportunity to present testimony regarding the proposed amendments. He pointed out that such action is considered necessary in view of the fact that the present ban on field burning adopted by the Commission on August 13, 1969 will expire Wednesday evening, August 20, 1969.

Mr. McPhillips then called on Mr. Patterson to present a report. After commenting briefly on the status of the program, Mr. Patterson asked Mr. Snyder to present the staff report. Mr. Snyder then reviewed for the Commission members and all the other persons present at the meeting the staff report on field burning dated August 18, 1969, a copy of which was introduced by Mr. Silver as Exhibit A and has been made a part of the Department's permanent files in this matter.

It was reported by Mr. Snyder that experience has shown that neither the original schedule adopted on June 28 nor the amended schedule adopted on August 6 was adequate to prevent gross air pollution in the upper Willamette Basin from being caused by agricultural field burning. He said that based on the results obtained thus far this season the only effective control method is to limit the acreage burned on any given day and that in Linn and Lane Counties the amount of burning in one day should not exceed 2,000 acres. The staff report presented by Mr. Snyder contained specific conclusions and recommendations. Among other things the staff recommended that (1) a revised field burning schedule be adopted for the remainder of 1969, (2) that the burning of annual ryegrass and cereal grain fields not be allowed in 1970 and thereafter, and (3) that the Department of Environmental Quality commit itself to an objective of ending all open burning in the Willamette Valley by not later than 1972.

In the discussion that followed Mr. Snyder's report he said, in response to a question by Mr. Meierjurgen, that the 1972 deadline for all open burning would probably include propane burning. In reply to a question by Mr. McMath he said the state fire marshal had not been consulted on how to allocate the acreage, but he did not expect any difficulty with the proposed program. In reply to Mr. Waterman he said in his opinion there has not been much change during the last 5 years in the amount of field burning.

Mr. McPhillips asked why this year has been more of a problem and Mr. Snyder said probably because the public has become more aware, more vocal and more sensitive and maybe because the burning this year has been more concentrated.

Mr. Patterson then reviewed the proposed changes or amendments to the field burning schedule that had been drafted by the staff as requested by the Commission members at their August 13 special meeting held in Eugene, Oregon.

The proposed schedule submitted by Mr. Patterson included only two classes of days, based on meteorological conditions, whereas the original schedule included six classes. The revised classes are (1) "marginal" if the forecast mixing depth is greater than 3,500 feet and (2) "prohibited" if the forecast mixing depth is 3,500 feet or less. The proposed schedule also included a quota for the number of acres of field burning that can be allowed in each fire district on a "marginal" day, the time the burning shall start, and the time it shall be completed.

In reply to a question by Mr. McMath, Mr. Patterson said that propane burning would be outside of the listed quotas.

Mr. Harms said that although he had previously suggested much higher mixing depths he believes the other controls included in the new proposed schedule will be adequate. He commented, however, that the Department staff should probably have broader authority to authorize burning in excess of the schedule if conditions warrant it. He also said he thought burning should be prohibited on Saturdays as well as Sundays.

Mr. John Horton, attorney for the Oregon Seed Council, was then invited by the Chairman to make a statement. He said that he represented seed growers, dealers and equipment suppliers, that the growers are not an organized group, that farmers are extremely independent, that the pollution this year was not caused by the growers arrogance or disregard for the regulations, that for the most part the burning has been done under lawful permits, that the seed industry is looking for equipment that will effect burning and field sanitation without excessive smoke emission, that more time is required to find an alternate solution to this complex problem, that based on a recent report by Dr. Hewson of Oregon State University five years would be required to make a detailed meteorological study of the Willamette Valley, that proper recognition

should be given to the economic impact of a complete ban on burning at this time, and that his clients ask that no precipitous action be taken that would result in hundreds of thousands of acres of fields not being able to be burned.

Mr. McPhillips said the Commission recognizes the economic impact of the grass seed industry but it realizes also that unless a deadline is set progress in solving this problem will be delayed too long. He said the problem must be solved as soon as possible.

Mr. Waterman asked Mr. Horton if 1972, as suggested in the staff report, would provide sufficient time. Mr. Horton in reply referred again to the report of Dr. Hewson that five years would be needed just to make a meteorological study.

Mr. Harms pointed out that the 1972 deadline is only a recommendation in the staff report and is not a part of the proposed amended schedule, that he personally had suggested some 8 or 10 years ago that the agricultural exemptions be removed from the state air pollution control laws, that he is convinced that under present technology perennial grass seed fields must be burned, and that as a consequence there must be a balancing of the interests.

In response to a question by Mr. Waterman, Mr. Horton agreed that alternate solutions must be found and that the detailed meteorological study proposed by Dr. Hewson would not be the full answer to the problem.

It was then MOVED by Mr. Harms, seconded by Mr. Meierjurgen and carried that the proposed revised field burning schedule be amended by changing the wording in the paragraph following the "Prohibited" Class under "Schedule of Meteorological Conditions" to read "ALL SATURDAYS AND SUNDAYS ARE PROHIBITED, and ***."

It was also MOVED by Mr. Harms, seconded by Mr. McMath and carried that the last paragraph on page 1 of the August 6 amended schedule be substituted for the last paragraph of page 1 of the amended August 18 schedule.

The Chairman then asked if anyone else present at the meeting had a statement they wished to make and if they could present any new testimony. No one offered to speak.

Mr. Silver then reminded everyone present that the revised new schedule with these two amendments would be considered for final adoption by the Commission members at a special meeting on Wednesday, August 20, 1969, beginning at 10:00 a.m. in the Second Floor Auditorium of the Public Service Building and that if anyone had any objections or suggested changes they should present them to the Commission either before or at that time.

The amended proposed revised schedule is attached to and made a part of these minutes. Mr. Patterson said copies would be sent on August 19 to all fire districts and other interested parties.

There being no further business, the meeting was adjourned at 6:30 p.m.

Respectfully submitted,

Kenneth H Spies

Kenneth H. Spies, Director

Proposed Revised AMENDED AUGUST 18, 1969

FIELD BURNING SCHEDULE

This schedule has been developed pursuant to 1969 Legislation for application in the Willamette Valley counties of Multnomah, Clackamas, Washington, Linn, Yamhill, Marion, Polk, Benton and Lane during the summer agriculture burning season, July through October. Other schedules will be developed for this and other areas as necessary.

As the Statute directs, certain types of atmospheric conditions have been classified "marginal" conditions. The specified type and extent of burning allowed has been established.

SCHEDULE OF METEOROLOGICAL CONDITIONS

Class	Meteorological Conditions
Marginal:	Forecast Maximum Mixing Depth greater than 3500 feet.
Prohibited:	Forecast Maximum Mixing Depth 3500 feet or less.
	Note: ALL SATURDAYS AND SUNDAYS ARE PROHIBITED, and under "prohibited" class all burning is prohibited except when a fuel such as propane is used so that combustion is nearly complete.

SCHEDULE OF EXTENT AND TYPES

Beginning Time for Burning:

Burning shall begin in Zone 1 and the beginning hour for burning, unless otherwise specified in the daily advisory, shall be 11:00 a.m. (the average time the mixing depth is forecast to reach 3000 feet). Zone 2 burning shall begin one hour after Zone 1, and Zone 3 shall begin burning 2 hours after Zone 1. Therefore, unless otherwise specified in the daily advisory, burning will begin as follows: Zone 1 - 11:00 a.m., PDT, Zone 2 - 12 noon PDT, Zone 3 - 1:00 p.m.,PDT.

The period for starting fires shall be limited to one hour after the stated beginning time.

Burning Duration:

The burning shall be completed within two hours after the fire is set.

Further Provisions:

Permits shall be issued on a day-to-day basis and each permittee shall have a current valid written permit for that day issued in accordance with the schedules of this order.

No permits shall be issued and no cereal grain field may be burned during 1969.

Whenever visibility at Salem or Eugene airport, as observed by the U. S. Weather Bureau in the NW quadrant is reduced to 6 miles or less by smoke or haze for two consecutive hours, or to 3 miles or less at any time under prevailing relative humidities of 70% or less on any day, the following 2 days shall be prohibited.

The staff of the Department of Environmental Quality may authorize burning in excess of that permitted by the schedule where conditions in their judgment warrant it, or, by express written permit, burning on an experimental basis, and may also, on a fire district by fire district basis, issue limitations more restrictive than those contained in the schedule, when in their judgment it is necessary to attain air quality.

The extent of acreage that may be burned in any one day in accordance with this schedule shall be limited as summarized below for each fire permit issuing agency. Fire permits shall be issued only for perennial grass until the maximum acreage allowed by the schedule is issued. Permits shall be issued for annual grass only when permits for perennial grass do not fill the acreage quota for each fire permit issuing agency in accordance with the schedule.

In no instance shall the total acreage of permits issued by each permit issuing agency exceed that of the schedule for the marginal day, except as provided for 50-acre quotas as follows. When the established daily acreage quota is 50 acres or less, a permit may be issued to include all the acreage in one field providing that field does not exceed 100 acres and provided further that no other permit is issued for that day. Permits for more than 50 acres shall not be issued on 2 consecutive days.

SCHEDULE OF ZONES AND ALLOWED DAILY BURNING QUOTAS

ZONE 1

Lane County	Fire District	Quota
	Junction City	125
	Creswell	75
	Irving	50
	Coburg	50
	Alvadore	75
Linn County	Harrisburg	325
	Brownsville	200
Benton County	Monroe	100

ZONE 2

Benton County	Fire District	Quota
	Benton County Jurisdictions	150
	Palestine	50
	N. Albany	50
	Corvallis	50
	Philomath	50

Linn County	Fire District	Quota
	Halsey-Shedd	350
	Lebanon	250
	Sweet Home	50
	Tangent	250
	Albany	150
	Scio	100

ZONE 3

Clackamas County	Fire District	Quota
	Canby	75
	Monitor	100
	Molalla	50
	Scotts Mills	50

Marion County	Fire District	Quota
	Jefferson	50
	Turner	75
	Aumsville	175
	Stayton	150
	Sublimity	350
	Silverton	350
	Four Corners	100
	Liberty	50
	S. Canyon Hills	
	Keizer	50
	Brooks	50
	Mt. Angel	50
	Woodburn	125
	St. Paul	125
	Aurora	50
	Hubbard	50
	Scotts Mills	100
	Clackamas-Marion FPA	125

Polk County	Fire District	Quota
	Southeast	100
	Southwest	75
	Wallace-Sheridan-Orchard Heights	50
	North Polk	50
	Sheridan	50
	Valley Junction	50

Washington County	Fire District	Quota
	Forest Grove	50
	Gaston	50
	Hillsboro	50
	Tri-City	50
	Beaverton	50

Yamhill County	Fire District	Quota
	McMinnville	50
	Dayton	50
	Sheridan	50
	Carlton	50
	Yamhill-Polk	50
	Yamhill	50

Other Fire Districts in the Willamette Valley

All fire districts not specifically named in the schedule shall follow the 50-acre daily limitation.

NOTICE OF INTENDED ACTION RE EXECUTIVE ORDER
OF THE
ENVIRONMENTAL QUALITY COMMISSION ADOPTING
SCHEDULE PERTAINING TO FIELD BURNING

This matter having come on regularly for consideration before the Environmental Quality Commission, hereinafter called the Commission, of the Department of Environmental Quality, on the _____ day of August, 1969, for the adoption of a field burning schedule, pursuant to Enrolled House Bill 1228, Chapter _____, Oregon Laws 1969, the Commission does make the following

FINDINGS OF FACT

1. That on the 13th day of August, 1969, in the City Council Chambers, Eugene, Oregon, an order was entered by the Commission prohibiting the issuance of permits for the burning of fields for a period of seven (7) days; and that said order was furnished to all public agencies responsible for providing information and the issuance of permits under ORS 476.380 and 478.960, and to all other interested persons; that said order also contained other reasonable limitations on the burning of fields.

2. That the aforesaid order will expire on the 20th day of August, 1969, and it is necessary to adopt a new schedule for field burning upon its expiration.

3. That the Environmental Quality Commission held a public meeting on the 18th day of August, 1969, in Room 72, State Office Building, Portland, Oregon, to circulate notice of its intended action in the adoption of a new schedule and afford interested persons opportunity to submit data or views orally or in writing, and to answer relative inquiries; that the Environmental Quality Commission having considered the data, reports and views presented to it, does make the following

CONCLUSIONS

1. Enrolled House Bill 1228, Chapter _____, Oregon Laws 1969, provides that the Sanitary Authority of the State of Oregon may prohibit the issuance of permits in any area of the state whenever smoke dispersion will be significantly restricted; and said Act also provides

that the Sanitary Authority shall classify different types of combinations of atmospheric conditions as marginal conditions and shall specify the extent and types of burning that may be allowed under different combinations of atmospheric conditions.

2. That the attached schedule and terms of this order were adopted pursuant to the aforesaid Enrolled House Bill 1228 and after notice of the intended action as far as practicable was given to interested persons to submit views and data orally or in writing.

Based upon the foregoing findings and conclusions, IT IS HEREBY ORDERED:

1. The effective date of the attached schedule and the following terms of this order shall take effect immediately on the date of August 20, 1969, because

   (a) An early date is required in view of the fact that the former order banning field burning will expire August 20, 1969.

   (b) The intolerable effects of smoke resulting from field burning has caused in the outdoor atmosphere air contaminants in quantities, of characteristics and of a duration that are injurious to human and animal life, or to property, and which unreasonably interfere with enjoyment of air and property.

   (c) That any postponement would result in serious prejudice to the public interest and a danger to public health and safety.

2. That the schedule marked Exhibit "A", attached hereto and by reference incorporated herein,is hereby adopted as additional field burning restrictions of the Environmental Quality Commission pursuant to Enrolled House Bill 1228.

3. That all straw, stubble and residue shall be removed from a field prior to its being burned by the use of propane or liquid petroleum gas methods and a permit shall be obtained from the responsible permit-issuing agency prior to the utilization thereof which shall insure nearly complete combustion.

4. That in all cases where a permit for propane or liquid petroleum gas burning is requested, the office of the State Fire Marshal, as a condition precedent to the issuance of such permit shall inspect and approve all burning equipment and fuel prior to its utilization and shall prohibit their use in the event combustion will not be nearly complete.

5. That all permits issued subsequent to this order shall be in writing and during the burning operations shall be maintained at the burning site by the person granted said permit for inspection by appropriate authorities.

6. No permit-issuing agency or other person authorized to grant permits shall give oral permission to burn fields and future permits shall only be issued in writing, upon a day-to-day basis and shall be issued only upon the schedule for burning adopted by the Department of Environmental Quality. At all times proper and accurate records of the transaction and copies of permits granted shall be maintained for inspection by the proper authority.

This order being necessary for the immediate preservation of the public peace, health and safety, an emergency is declared to exist and this order shall take effect immediately.

Dated this _____ day of August, 1969.

B. A. McPhillips, Chairman,
Environmental Quality Commission

AMENDED AUGUST 18, 1969

FIELD BURNING SCHEDULE

This schedule amended August 18, 1969 supercedes all prior schedules.

This schedule has been developed pursuant to 1969 Legislation for application in the Willamette Valley counties of Multnomah, Clackamas, Washington, Linn, Yamhill, Marion, Polk, Benton and Lane during the summer agriculture burning season, July through October. Other schedules will be developed for this and other areas as necessary.

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The period for starting fires shall be limited to one hour after the stated beginning time.

Burning Duration:

The burning shall be completed within two hours after the fire is set.

Further Provisions:

Permits shall be issued on a day-to-day basis and each permittee shall have a current valid written permit for that day issued in accordance with the schedules of this order.

No permits shall be issued and no cereal grain field may be burned during 1969.

Whenever visibility at Salem or Eugene airport, as observed by the U. S. Weather Bureau in the NW quadrant is reduced to 6 miles or less by smoke or haze for two consecutive hours, or to 3 miles or less at any time under prevailing relative humidities of 70% or less on any day, the following 2 days shall be prohibited.

The Department of Environmental Quality may authorize burning on an experimental basis when such experiments are related to reducing the effects of field burning and under the direction of Oregon State University.

The extent of acreage that may be burned in any one day in accordance with this schedule shall be limited as summarized below for each fire permit issuing agency. Fire permits shall be issued only for perennial grass until the maximum acreage allowed by the schedule is issued. Permits shall be issued for annual grass only when permits for perennial grass do not fill the acreage quota for each fire permit issuing agency in accordance with the schedule.

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	Jefferson	50
	Turner	75
	Aumsville	175
	Stayton	150
	Sublimity	350
	Silverton	350
	Four Corners	100
	Liberty	50
	S. Canyon Hills	
	Keizer	50
	Brooks	50
	Mt. Angel	50
	Woodburn	125
	St. Paul	125
	Aurora	50
	Hubbard	50
	Scotts Mills	100
	Clackamas-Marion FPA	125

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	Dayton	50
	Sheridan	50
	Carlton	50
	Yamhill-Polk	50
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Other Fire Districts in the Willamette Valley

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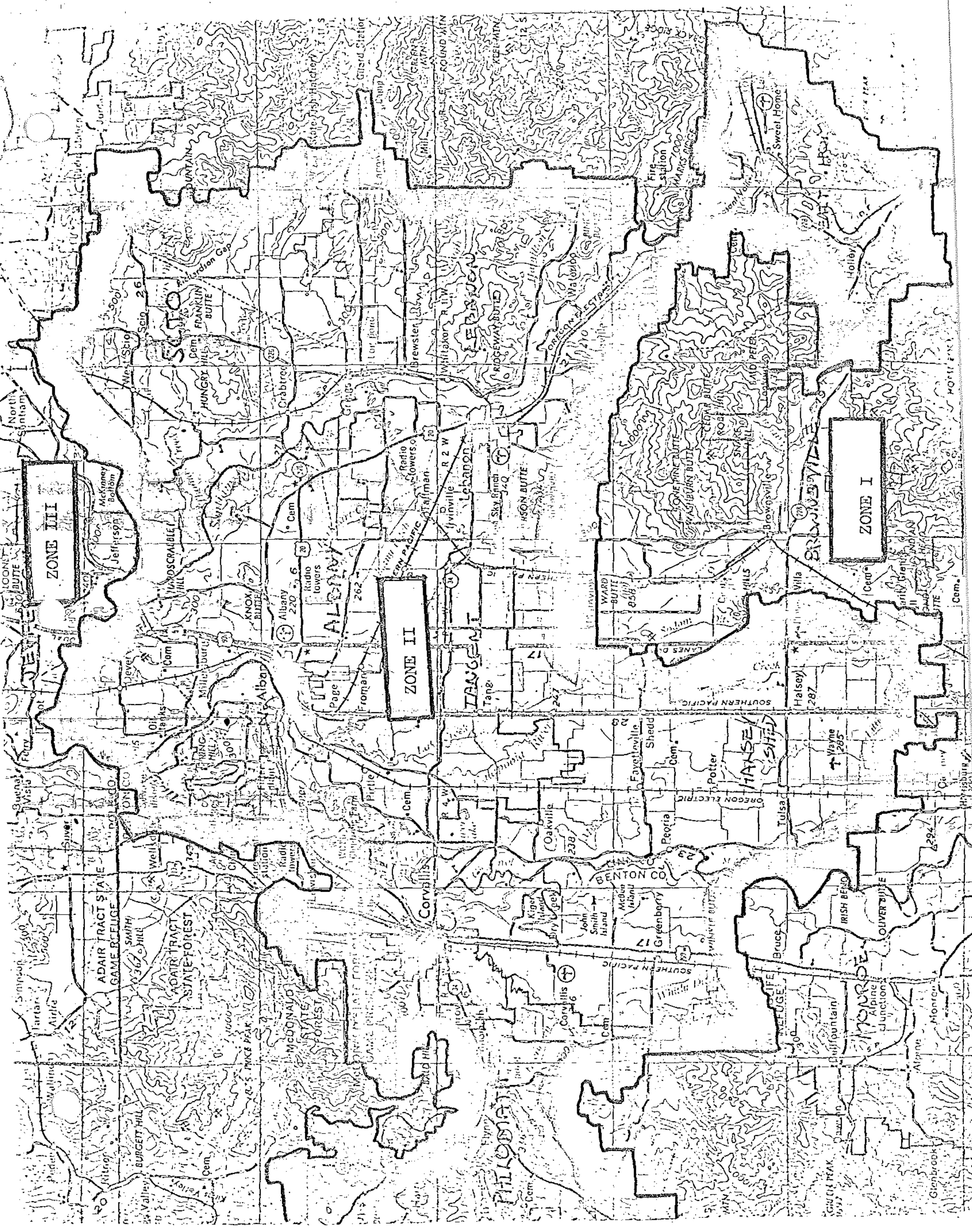
FIELD BURNING ZONES



DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR QUALITY CONTROL

REPORT ON FIELD BURNING

August 18, 1969

Department of Environmental Quality
1400 S. W. Fifth Avenue
Portland, Oregon 97201

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DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR QUALITY CONTROL

AN AUGUST 18, 1969 REPORT ON FIELD BURNING

1. BACKGROUND

The following brief report was prepared to provide a ready summary of some of the significant points and a review of some staff findings and conclusions in relation to the effects of field burning conducted in the Willamette Valley.

1.1 Acreages

The total acreages of perennial, annual and cereal grain crop land subject to burning is currently estimated as follows:

Crop Type	Acreage	% of Total Acreage
All	363,000 Acres	100%
Perennial	144,000 Acres	40%
Annual	111,000 Acres	30%
Cereal Grain	108,000 Acres	30%

For Benton, Lane and Linn Counties, which comprise 63% of all field burning acreage in the valley, the acreage breakdown is as follows:

All	229,000 Acres	
Perennial	97,000 Acres	42%
Annual	97,000 Acres	42%
Cereal Grain	35,000 Acres	15%

1.2 Types and Characteristics of Emissions

Because of the differences in crop growth and residue density, the average particulate emissions per acre burned are estimated to vary as follows: Fine Fescue - 48 lbs/acre, Annual Rye - 80 lbs/acre, Perennial Rye - 64 lbs/acre, Blue Grass - 40 lbs/acre, Bent Grass - 32 lbs/acre, Grain - 48 lbs/acre. Most of these particles are in the 0.1 to 1.0 micron size range.

Elsewhere in the literature it is reported that quantities of condensation nuclei are emitted by open fires. It has been reported that burning a one acre natural grass plot would provide about 33 billion particles per cubic inch from the surface to a height of 10,000 feet.

Analysis of emissions from straw and stubble residue samples which were burned in special equipment closely approximating field conditions have been reported by Dr. R. W. Boubel, et al. The analysis showed that the burning generates both gaseous and particulate air contaminants, as follows: Particulate emissions averaged 15.6 lbs/ton of fuel burned; carbon monoxide, 101 lbs/ton; and hydro-

carbons in lbs/ton were 1.74 for saturates plus acetylene, 2.8 for olefins, and 1.68 for ethylene. The oxides of nitrogen peak during the burn was 29.3 ppm.

1.3 Emission Inventory of Particulate in the Valley

The staff completed a broad summary of particulate emissions in the Willamette Valley (excluding Multnomah County) using a rapid survey technique. The survey summary was limited to particulate matter because at this time it is the judgment of the staff that the effects of field burning are primarily related to particulates. A more detailed summary of the survey is attached as Table I to this report. The emission inventory indicates that on an annual basis the percentages of particulate emissions in the Willamette Valley are as follows:

Public Sources (mobile, space heating and waste disposal)	29%
Agricultural & Forestry Practices (field burning and slash burning)	42%
Industrial Sources	29%

However, during August, the month of most field burning, emissions in the Valley from the broad classifications are estimated as follows:

Public	11%
Agricultural	78%
Industrial	11%

The emission inventory, while an extremely useful tool, is only one of several inputs that must be used to properly evaluate effects of a source or sources on an air pollution problem. Location, strength, duration, physical and chemical character of emissions, terrain and meteorology are some of the other factors that must be considered in an evaluation.

1.4 Visibility and Atmospheric Loading

It is generally accepted that there is a direct relationship between visibility and air pollution, i.e., the greater the pollutant loading in a given volume of air, the less the visibility through that volume. Unfortunately, visibility reduction cannot at present be used dependably as a direct indicator of specific pollutant loadings, since the relationship between the optical characteristics of the atmosphere (visibility is one such characteristic) and pollution loading is a series of very complex and interrelated functions of particle size, shape, phase (solid, liquid or gaseous), particle size distribution, humidity, particle refractive index, and incident light wavelength (in the case of visible light, a whole series of wavelengths). An illustration of the complexity of the problem is indicated by the fact that visibility through a volume of polluted air may vary depending upon whether the sun is in front of or behind the observer.

The relationships between atmospheric loading of field burning contaminants and visibility have not specifically been examined. However, Dr. R. W. Boubel, et al., of Oregon State University are currently conducting studies at the Eugene

airport to determine on a quantitative basis the relative magnitude of field burning's contribution to visibility reduction in that area.

Although the gas sulfur dioxide (SO_2) is not a contaminant of concern in field burning, the following graphs from the USDHEW publication "Criteria for Control of Sulfur Oxides" illustrate some of the effects of humidity. Figure 1-1 shows increasing particle size of hygroscopic particles with increasing humidity, while Figure 1-5 shows that visibility decreases with increasing humidity and increasing SO_2 concentrations.

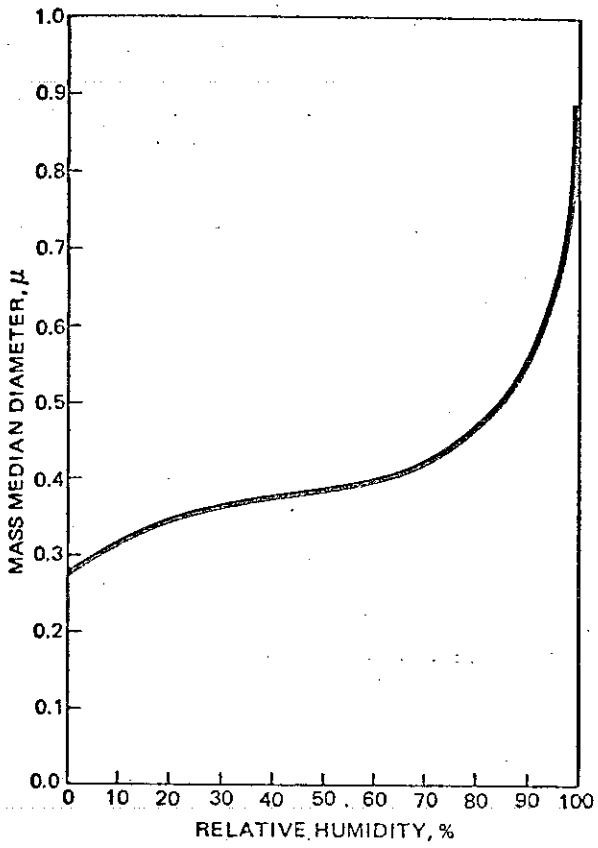


Figure 1-1. Calculated Mass Median Diameter of Suspended Sulfuric Acid Mist Droplets as a Function of Relative Humidity.

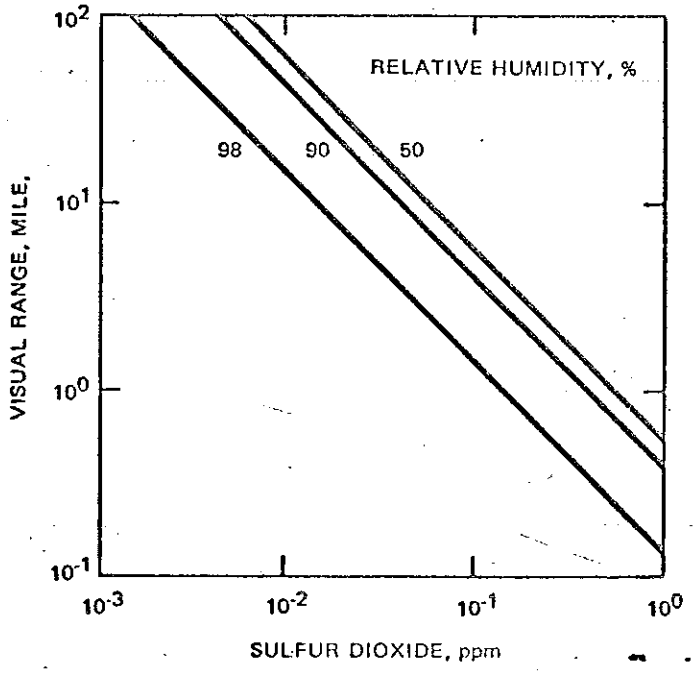


Figure 1-5. Calculated Visibility (Visual Range) in Miles at Various Sulfur Dioxide Concentrations and at Different Relative Humidities in New York City.

Despite the fact that visibility cannot at present be correlated directly with atmospheric loading, it is a criteria of air pollution control and the one used by the public in evaluating air quality.

2. 1969 SEASON HISTORY AND PROGRAM RESULTS

2.1 Program

On June 28, 1969, the Environmental Quality Commission adopted a much-discussed and much-amended "Schedule of Days", as required under House Bill 1228. The schedule was filed with the Secretary of State on July 9, and went into daily operation on July 21. The schedule itself used a combination of forecast mixing depth and crop type restrictions to limit burning of grass and grain crops. Guidelines to fire permit agents issued by the Department of Environmental Quality included acreage limitations for certain districts considered to be critical to the smoke problem in the upper Valley. The schedule appeared to be having the desired effect until the last days of July. The period July 28 - August 5 demonstrated the schedule was inadequate without acreage control. After an August 5 meeting with the Governor, suggestions offered at the meeting by the seed industry as a solution to the smoke problem were put into effect on August 6. These changes simply reduced the hours available for burning and instituted a "checkerboard" for burning in the upper Valley. The problem continued, and on August 13, the Environmental Quality Commission met in Eugene with a request from the Governor to take all necessary steps to end the problem. At that meeting, the Commission adopted an order banning agricultural burning in Benton, Lane, Linn, Marion and Polk Co.'s for 7 days putting stringent permit requirements on propane flaming, and voiding all outstanding permits. The restrictions resulting during the season are summarized in Table II.

2.2 Complaint Summary

An analysis of complaints directed against agricultural field burning received by the Department through August 14, 1969 shows that of the 3172 complaints tabulated, one or more of the following effects were specifically noted by the complainant:

Smoke	2809
Particle Fallout	988
Visibility Reduction	1603
Health Effects	1095
Odor	409
General	338

2.3 Visibility Effects

Suffice it to say that visibility in the Willamette Valley, and primarily in the area from Albany south through Eugene, was severely reduced during burning hours, and, depending on conditions, for some time after burning hours on many days. Although the upper Valley was as usual the most affected area, Salem and the mid-Valley were also affected on some days. Visibility effects tended to be more localized in the broader, lower end of the valley.

Severe reductions in visibility were neither restricted to days of unlimited burning, nor were they reduced or eliminated by the amendments offered by the industry.

2.4 Other Measurements

It was anticipated that the Lane Regional Air Pollution Authority would initiate high volume air sampling to measure suspended particulates during the burning season; however, neither the Region nor the Department staff had completed suspended particulate data to measure atmospheric loadings until sampling was initiated on August 14th.

The staff installed a continuous carbon monoxide analyzer on August 8, 1969, at the State Office Building, 165 E. 7th Street, Eugene. Data covering the period August 9 to 15 shows that the one-hour maximum was 4.0 ppm, the 8 hours maximum was 2.3 ppm and the daily 24 hour averages ranged from less than 1 ppm to 1.5 ppm. The Oregon-Washington Committee's recommended standard is not to exceed 20 ppm for 8 hours and the recommended objective is not to exceed an average concentration of 5 ppm for 24 hours.

It is concluded that carbon monoxide as measured at this station during this period is not a contaminant of concern as caused by field burning, motor vehicles, or other sources.

Since the severe atmospheric conditions that occurred in Eugene on August 12 were related to field burning and those on August 14, when field burning was prohibited, were caused by other sources (Note: From 12 M to 9 AM there were 7 hours of calm, with 3 AM - NNW 5 mph and 4 AM - SE 6 mph winds), a special comparison of carbon monoxide levels is shown below:

	1 hour Max.	8 hour Max.	24 hour Max.
August 12	3.5 ppm	1.6 ppm	1.1 ppm
August 14	3.5 ppm	2.3 ppm	1.5 ppm

3. ANALYSIS OF 1969 SEASON

3.1 Data

In the period following the August 13 meeting of the Environmental Quality Commission, a variety of data was collected and examined. Of the available information, the following was judged to be most useful in attempting to analyze the 1969 season to date:

a. A daily record of burning permits issued in 10 major fire districts in the southern end of the Valley, compiled by the Air Resources Center at Oregon State University.

   Since it offered a sample accounting for over 70% of the total acreage of crops burned in Linn and Lane Counties, the data was extrapolated to give an estimate of total acreage of each crop type burned on each day in these two counties.

b. Daily records of the actual mixing depth at Salem, obtained from the U. S. Weather Bureau.

c. Recorded minimum visibility and number of observations of restricted visibility (less than 6 miles) at Eugene airport.

This data is tabulated in Table II.

3.2 Burning Completed to Date

The data of Table II indicate that over 114,000 acres of annual and perennial grasses and grain fields were burned in Linn and Lane Counties in the first 23 days of the season through August 12. This amounts to 58% of the total acreage in the two counties, including 67% of the perennial grasses, 58% of the annual ryegrass, and 15% of the grain fields that are normally burned.

3.3 The Effect of Acreage and Mixing Depth on Visibility at Eugene

Figure 1 is a graph of minimum visibility at Eugene plotted as a function of the total acres burned in Linn and Lane Counties. Each point represents one day, and the different symbols indicate 3 ranges of mixing depths. The following tentative conclusions were drawn from the graph:

a. Under conditions prevailing during the field burning season, mixing depth is not a valid predictor of visibility reduction at Eugene. Of a total of 9 smoky days in Eugene (visibility 6 miles or less), an even distribution of mixing depths among the 3 ranges was observed. It appears that the amount of smoke being generated in the immediate vicinity is simply too great for dispersal under any but extraordinary atmospheric conditions.

b. 90% (8 out of 9) of Eugene's smoky days occurred when more than 2000 acres were burned in Linn and Lane Counties. The single smoky day with less than 2000 acres burned (July 25) was the least severe of the 9 days.

c. Of the 11 days on which 2000 or more acres were burned, 8 were smoky. Thus Eugene has a 70% chance of being smoky when 2000 or more acres are burned in the two counties. Eliminating the anomalous day of August 4 increases the percentage to 8 out of 10 or 80%.

d. Of 7 days on which 200 to 2000 acres were burned, only one or 15% was smoky.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Acreage Limitation

Based on the statements in the previous section, it appears that the single most important conclusion to be drawn from the 1969 burning season to date is that smoky conditions in Eugene may be expected any time the amount of burning is equivalent to 2000 acres or more in Linn and Lane Counties. Thus it appears that the only effective control method to be followed is to apportion the allowable acreage burned on any given day to such that this figure is not exceeded.

To determine how the acreage should be allotted, the 2000 acre figure was compared with the total acreage to be burned. The table below gives the 2 county totals of various combinations of field types, and the number of burning days required to complete burning of 100% of each combination, assuming a 2000 acre/day limitation is imposed:

Type of Burning	Acreage, Linn & Lane	% Equalling 2000 acres	Days to Burn 100%
Perennial, Annual, Grain	188,700	1.05%	94
Perennial & Annual Grasses	158,700	1.26%	79
Perennial Grass only	79,300	2.52%	40

An investigation of the average number and types of forecast mixing depths over the past 2½ seasons indicates the maximum number of days on which burning can be done during a normal season of 73 days extending from July 20 through September 30:

Mixing Depth	Average Number of Days			
	July	August	September	Total
Greater than 3000	12	30	22	64
Greater than 3500	12	29	20	61
Greater than 4000	9	24	12	45
Greater than 6000	-	-	-	4 (in 2½ season period)

From the two tables above, it is obvious that if an acreage limitation equivalent to 2000 acres in Linn and Lane Counties is to be imposed, only the burning of perennial grass fields can be completed in the allotted season, regardless of any mixing depth criteria.

Two thousand acres in Linn and Lane is equivalent to 2.5% of the acreage of perennial grass fields in these counties; the same proportional quota should be applied to Benton County as well. North of these three counties surrounding Eugene a different, higher percentage quota may be justified. Preliminary results from a study at Oregon State University indicate that the acreage burned north of these three counties is probably less significant in determining air quality at Eugene. An arbitrary selection of 5% of the perennial acreage would seem to be reasonable, and can be reduced if smoky conditions persist in the lower valley.

4.2 Mixing Depth

In determining the meteorological criteria for burning, it appears that the choice is somewhat arbitrary since it has been shown that acreage burned is a much more significant factor. It is important, however, that some control be established and that burning be prohibited on those days when it is likely to cause aggravation of existing poor air quality in populated areas due to

normal pollution emissions and very stable atmospheric conditions. These conditions existed on August 14, when it is certain that any amount of field burning in the area would have caused a very severe problem. The mixing depth on this day was 4700 feet.

It would seem desirable to have the minimum allowable mixing depth as high as possible. However, a selection of 4000 feet would allow only 5 days in excess of the theoretical 40 days needed to burn the perennial grass fields. This is not a sufficient allowance for deviations from average conditions, rain, etc., and would probably result in the burning not being completed. Decreasing the cut-off point to 3500 feet gives an additional 16 days in the average year, with only a small additional risk to air quality. Lowering it to 3000 feet offers only a small increase in the available number of days. It is therefore concluded that a prohibition of burning when the forecast mixing depth is 3500 feet or less will provide ample time for completing the burning of perennial grass fields, with some protection of air quality as long as an acreage allotment is adhered to.

4.3 Daily Burning Schedule

In order to further protect the air quality at Eugene, it is considered important that field burning be spaced in time from south to north throughout the valley, with the earlier burning beginning in the south. This will minimize the effect of smoke accumulations due to the generally southward flow of the Valley air masses.

Accordingly, it is recommended that the Valley be divided into 3 zones, with burning to be initiated at one-hour intervals beginning at 11 a.m. in Zone 1, the most southerly. Zone 1 and Zone 2 are composed primarily of Benton, Linn and Lane Counties; Zone 3 comprises the remainder of the Valley. The starting time of 11 a.m. allows for breakup of the usual morning inversion. It is recommended that all fires be initiated within one hour of the starting time in each zone, and that they be completely burned out no later than two hours after initiation. For enforcement purposes this would mean that any fire beginning later than one hour after starting time, or continuing to burn three hours after the scheduled or forecast starting time, is an illegal fire.

4.4 Summary of Staff Recommendations

1. A revised Field Burning Schedule should be adopted for the remainder of 1969, including the following provisions:

   a) Daily quotas of maximum acreage for which permits are to be issued should be assigned to each fire permit district. The quota is to be 2.5% of the total acreage of perennial grass fields in each district in Benton, Linn, and Lane Counties, and 5% elsewhere.

   b) In granting permits to fill daily quotas perennial grass fields shall always be given priority over annual ryegrass. No permits should be issued for cereal grain fields.

c) All days are to be considered either marginal or prohibited. On marginal days the full quota of acreage may be permitted and burned. All burning shall be prohibited on days when the forecast mixing depth is 3500 feet or less.

d) Benton, Linn and Lane Counties should be divided into 2 zones with the balance of the Valley constituting Zone 3. On each marginal day, burning should begin in Zone 1 (closest to Eugene), with burning beginning in Zones 2 and 3 at one hour intervals following. A starting time in Zone 1 of 11 a.m. should normally be satisfactory.

2. Burning of annual ryegrass and cereal grain fields should not be allowed in 1970 and thereafter.

3. Department of Environmental Quality should carefully study air quality and daily burning permit records for the remainder of 1969 in order to determine the effects of limited burning allowed under the established program.

4. The following research should be encouraged and supported:

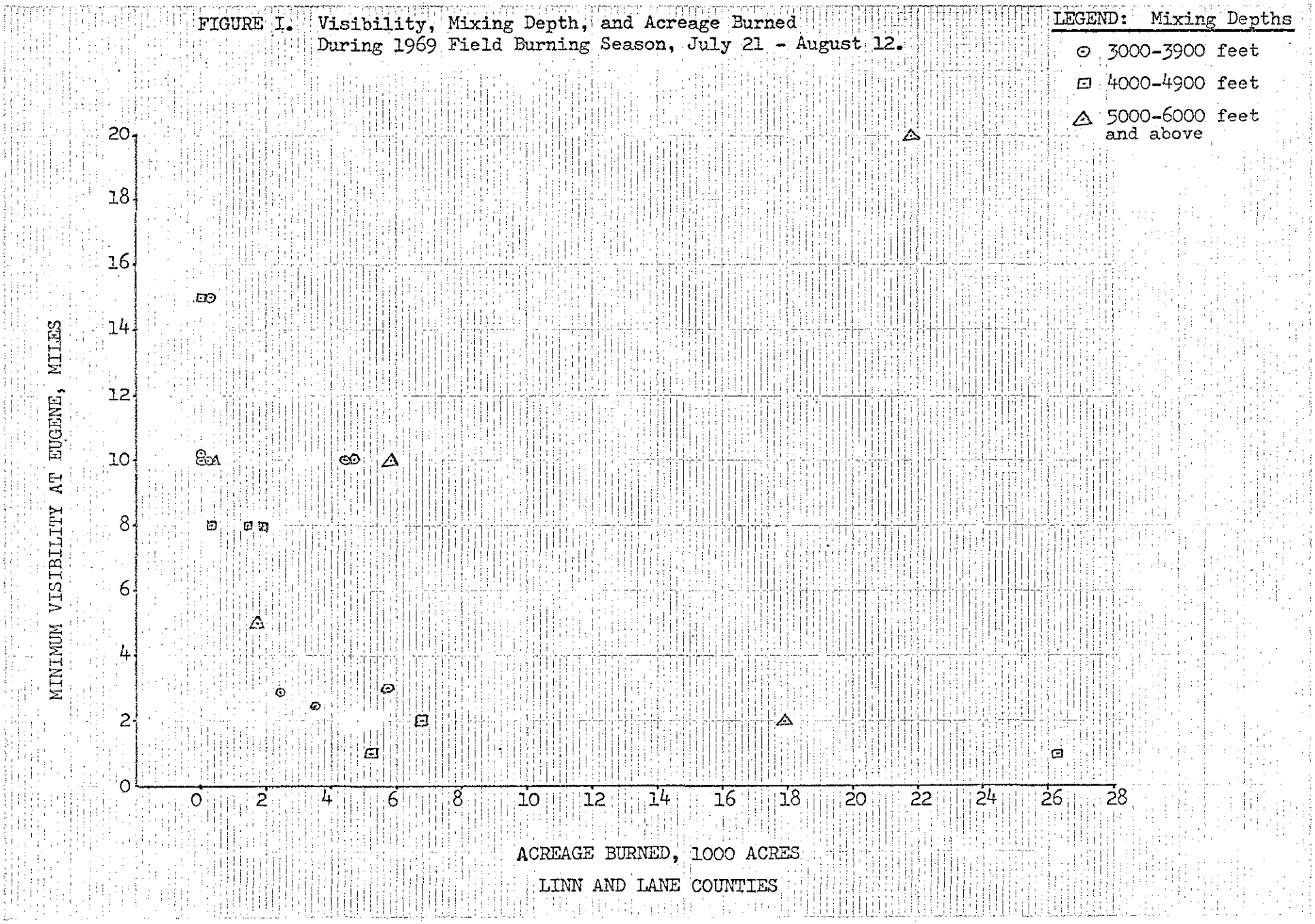
a) A study of the effects of field burning within 20 miles of Eugene, and of the economic and social consequences of prohibiting this burning beginning in 1970.

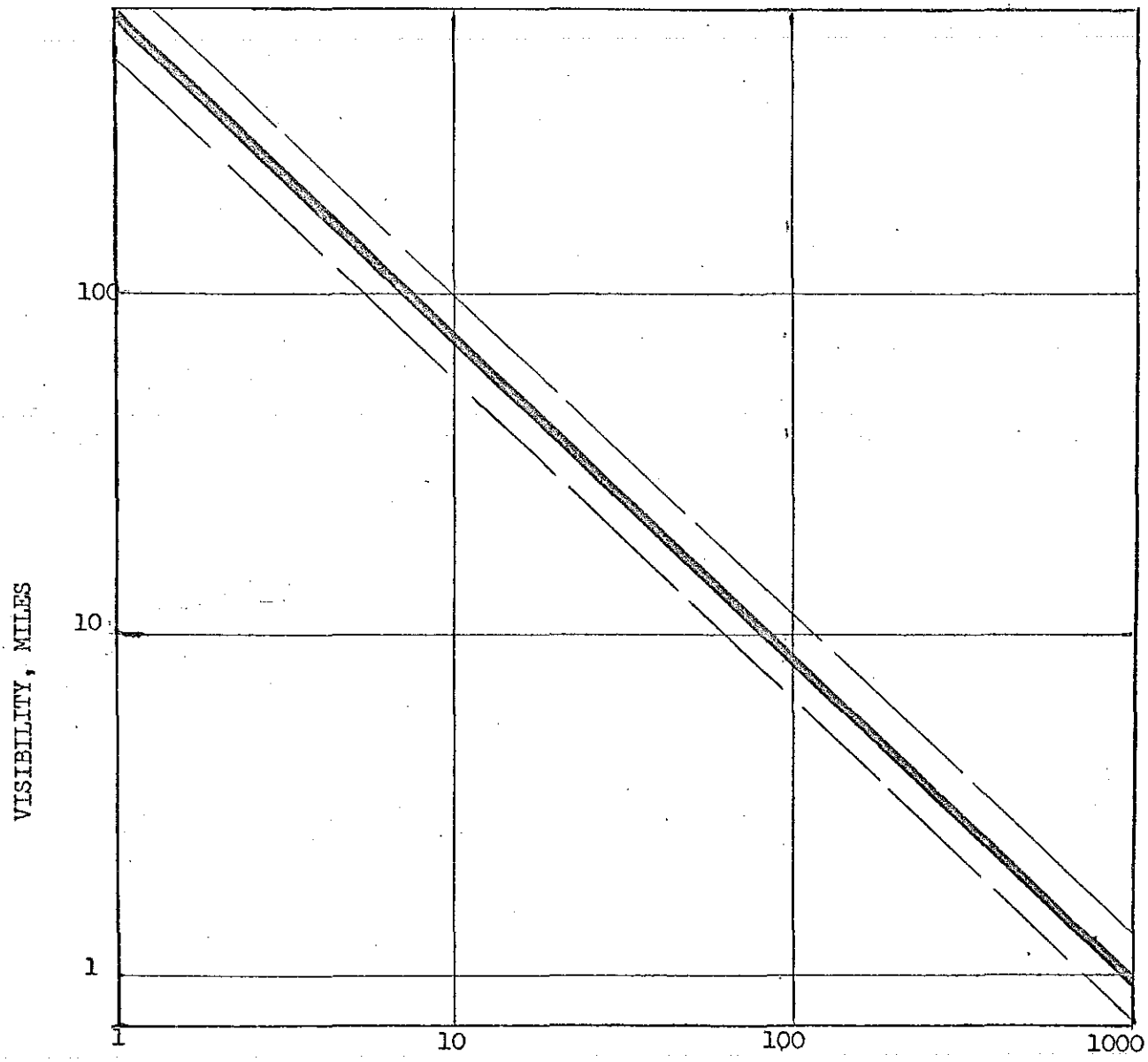
b) Ongoing research into alternate methods of sanitizing perennial grass fields, including the widespread use of efficient propane flaming and its effects on air quality.

c) A study of the economic effects of alternate-year burning of blue grass and other species of perennial grass.

5. Department of Environmental Quality should publicly commit itself to the objective of ending all open burning in the Willamette Valley by not later than 1972.

FIGURE I. Visibility, Mixing Depth, and Acreage Burned During 1969 Field Burning Season, July 21 - August 12.





Theoretical effect of suspended particulate matter concentrations on visibility.

FIGURE II

TABLE I

PARTICULATE INVENTORY - WILLAMETTE VALLEY[1]

Source Type	ANNUAL Millions of pounds	% of total	Assumed % of annual	AUGUST Millions of pounds	%
PUBLIC					
Mobile sources	6.1	8.5	8.3%	.51	3.5
Space Heating	4.5	6.3	5	.23	1.6
Waste disposal	10.0	14.0	8.3	.83	5.6
AGRIC. & FORESTRY					
Field burning[2]	23.1	32.3	50	11.5	78.2
Slash[3]	6.6	9.2	0	0	0
INDUSTRIAL					
Wigwam burner[4]	3.8	5.3	10	.01	1.5
Other	17.0	23.8	8.3	1.41	9.6
TOTAL	71.1	100	-	14.5	100

NOTES

1. Including Clackamas, Washington, Yamhill, Polk, Marion, Benton, Linn and Lane counties.

2. Emission factor 16 lb/ton: Boubel, et, al, "Atmospheric Emissions from Open Burning".

3. Emission factor 5 lb/ton: University of Washington, College of Forestry Interim Report on "The Study of Forest Fire Atmospheric Pollution".

4. Emission Factor 7 lb/ton: Boubel, R. W. "Particulate Emissions from Sawmill Waste Burners" (Revised 8-69).

8-11-69

TABLE II

DATE	PERMITTED BURNING TYPE	DURATION, HRS.	ACTUAL MIXING DEPTH	ACRES BURNED, LINN & LANE	EUGENE AIR QUALITY MINIMUM VISIBILITY	NO. OBS. VIS	6 Mi.	NUMBER OF COMPLAINTS
7-21 M	P	9	3000	200	10	0		0
7-22 T	P	5	4000	250	8	0		0
7-23 W	All	8	4000	1,950	8	0		1
7-24 T	P	5	4800	1,550	8	0		2
7-25 F	P	9	5800	1,750	5	1		0
7-26 S	PA	7	3800	4,650	10	0		1
7-27 S	All	8	7000	250	10	0		0
7-28 M	PAG	7	3000	2,400	3	3		19
7-29 T	P	7	3400	3,550	2.5	3		10
7-30-W	None in Benton, Linn, Lane							
	P other	7	4400	0	15	0		11
7-31 T	None	0	2000	0	10	0		31
8- 1 F	P	7	4000	6,750	2	4		173
8- 2 S	P	5	3300	5,700	3	1		33
8- 3 S	P	5	3900	250	15	0		3
8- 4 M	PAG	9	8000	21,800	20	0		33
8- 5 T	All	8	6200	17,950	2	5		413
8- 6 W	P	3	9000	5,450	5	3		549
8- 7 T	P	3	4400	5,800	10	0		223
8- 8 F	P	2	4400	3,200	1	7		477
8- 9 S	None	0	3600	0	10	0		6
8-10 S	None	0	?	0	10	0		2
8-11 M	P	2	3200	4,600	10	0		22
8-12 T	PA	4	4000	26,350	1	6		577
8-13 W	None	0	4500	0	6	2		38

P= Perennial grass seed fields used for grass seed production
A= Annual grass seed fields
G= Cereal grain fields