OREGON
ENVIRONMENTAL QUALITY
COMMISSION MEETING
MATERIALS 11/18/1999

DEQ

State of Oregon
**Department of
Environmental
Quality**

State of Oregon
Department of Environmental Quality **Memorandum**

Date: November 1, 1999

To: Environmental Quality Commission

From: Langdon Marsh, Director

Subject: Agenda Item G, EQC Meeting, November 18-19, 1999
Carbon Filter System Pollution Abatement System (PFS) at the Umatilla Chemical Agent Disposal Facility (UMCDF)

Statement of Purpose

The purpose of this staff report is to present to the Environmental Quality Commission (Commission) the results of the Department of Environmental Quality (Department) review of information and public comments, and the Department's recommendation, related to the inclusion of the Pollution Abatement System (PAS) Carbon Filter System (collectively referred to as the "PFS") at the Umatilla Chemical Agent Disposal Facility (UMCDF).

Background

The UMCDF permitted design is for five incinerators of four different types (housed in a single building) to treat the various components of the chemical weapons stockpile at the Umatilla Depot. Each of the furnace systems has its own standard Pollution Abatement System (PAS), although four of the five furnaces ultimately feed into a single common stack. The gases exiting the standard PAS from each furnace are further conditioned (to remove moisture) and then channeled through the PFS before being released from the main stack. The PFS consists of fixed beds of granular carbon to further clean the gases before they are released through the main stack.

In August 1997 a legal challenge to the UMCDF permits was filed in Multnomah County Circuit Court (Case No. 9708-06159) by G.A.S.P. (a local Hermiston organization), the Sierra Club of Oregon, Oregon Wildlife Federation, and 22 individuals (collectively referred to as the "Petitioners"). The Petitioners challenged the validity of the hazardous waste and air permits issued by the Environmental Quality Commission (EQC) and the Department of Environmental Quality (DEQ) ("Agencies") in February, 1997.

The Commission has stated that the PFS was required for "an additional measure of safety" (Reference 1), but the Petitioners believe that the PFS poses additional risks that were not thoroughly evaluated by the Commission. During the Court proceedings the Agencies agreed through Counsel that there would be further proceedings to address the issues related to the carbon filter system that had been brought forth by the Petitioners. A public comment period on carbon filter technology was opened and the Commission held a special worksession to collect additional information on the carbon filter system.

Authority of the Commission with Respect to the Issue

The criteria for unilateral modification of the UMCDF permit are set forth at 40 CFR 270.41 which is incorporated in pertinent part by reference at OAR 340-100-0002, 340-105-0041 and Division 106 (See Attachment A). Causes for unilateral modification of a hazardous waste treatment facility permit (as opposed to modifications requested by the Permittee) include:

1. Material and substantial alterations or additions to the permitted facility or activity occurring after permit issuance. *See* 40 CFR 270.41(a)(1);
2. New information which was not available at the time of permit issuance and would have justified different permit conditions. *See* 40 CFR 270.41(a)(2);
3. New statutory, regulatory, or judicially mandated standards. *See* 40 CFR 270.41(a)(3);
4. "Acts of God" or uncontrollable circumstances warranting revised compliance schedules. *See* 40 CFR 270.41(a)(4).

Alternatives and Evaluation

The Commission may decide that the information submitted by the Petitioners does not meet the criteria for unilateral modification of the UMCDF HW Permit. Alternatively, the Commission may instruct the Department to open the UMCDF Hazardous Waste Storage and Treatment Permit (HW Permit) for modification with respect to the inclusion (not configuration) of the PFS in the UMCDF pollution abatement system design. When a permit is modified under 40 CFR 270.41, only the conditions subject to modification are reopened. Changes to the design configuration of the PFS would be processed in accordance with the requirements of 40 CFR 270.42 (permit modification at the request of the permittee), as adopted by Oregon rule.

Summary of Public Input Opportunities

At the Commission's direction, a public comment period was opened on July 19, 1999, to solicit comments about carbon filter technology at UMCDF. The comment period was held open until September 20, 1999. A total of six written comments (from five Commenters) were received during this comment period. (A copy of all written comments received by the Department was transmitted to the members of the Commission on September 24, 1999.) See Attachment B for a summary of public comments received.

On August 18, 1999, the Commission held a special worksession, which included a three-hour worksession on the UMCDF carbon filter system, and carbon filter technology in general. The Commission heard presentations from the National Research Council, the U.S. Army, Raytheon Demilitarization Company, and the Petitioners. A copy of the transcript of the EQC worksession on August 18, 1999 is included as Attachment C. (The August 18 worksession also included discussion of issues unrelated to the PFS. The carbon filter technology portion of the worksession begins on page 32 of the transcript in Attachment C.)

The Petitioners submitted information during the Court proceedings related to G.A.S.P., et al. *v.* Environmental Quality Commission, et al. (Case No. 9708-06159, Circuit Court of the State of Oregon). One of the exhibits from the Court proceedings was incorporated by reference by two of the Commenters (Condit, et al., and Brenner). The Department provided the Commission with a full copy of the exhibit [Attachment D] and a review of the exhibit prepared by Ecology and Environment, Inc., at the request of the Department [Attachment E].

The Petitioners also submitted a comment to the Commission related to the PFS during the public comment period that was opened from March 3-15, 1999 for the Commission's "Order Clarifying Permit Decision" [Reference 1]. In addition to providing comments on the draft Order, the Petitioners submitted an excerpt of a risk assessment of the UMCDF PFS that had been prepared by an Army contractor [Reference 2]. The Department provided the comment and a full copy of the excerpted risk assessment document to the Commission prior to their March 19, 1999 meeting.

Commenters also had opportunities to comment on the UMCDF PFS during two different public comment periods that were opened as part of a Class 2 Permit Modification Request (PMR) related to the configuration of the PFS. The Class 2 PMR was submitted to the Department on November 17, 1997 [PMR No. UMCDF-97-005-PAS(2TA)]. One comment (from G.A.S.P.) was received during the 60-day public comment period. After the close of the first public comment period the Permittees submitted "supplemental information packages" that the Department considered significant enough to require a new public comment period. One comment (again from G.A.S.P.) was received during this second 60-day public comment period. See Attachment F for documents related to the 1997 PFS Permit Modification Request.

[The Permittee submitted a new Class 2 Permit Modification Request (PMR) related to the PFS on October 19, 1999 (UMCDF-99-043-PAS(2), "Upgrade of the Exhaust Induced Draft Fans and Rectifying Permit Inconsistencies." The public comment period will be open from October 19 through December 20, with a public meeting scheduled for November 16, 1999 in Hermiston.]

Attachment B contains a summary of public comments received during the most recent comment period, to include comments presented during oral testimony on August 18, 1999. Attachment B also includes the "Chance to Comment" form, the agenda for the Commission worksession held in August, and the invitation to the Petitioners to address the Commission at the August worksession (sent through Counsels).

Discussion

A total of six written comments (from five Commenters) were received during the most recent comment period. Three of the comments did not pertain directly to carbon filter technology, except in the sense that if an alternative treatment technology (in lieu of incineration) had been selected there would not be a need for carbon filtration of flue gases. One anonymous Commenter supported keeping the PFS in the UMCDF design because they "are needed for safety."

The Chair of the National Research Council's (NRC) "Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program" ("Stockpile Committee") gave a presentation to the Commission on an NRC report that had been released just a few days before the meeting titled "*Carbon Filtration for Reducing Emissions from Chemical Agent Incineration*" [Reference 3]. The Executive Summary of the NRC report, which includes the NRC's Findings and Recommendations) is included as Attachment G. (The NRC is the "working arm" of the National Academy of Sciences, providing scientific and technological services to governmental agencies and Congress. Attachment G includes the "Frequently Asked Questions" section from the NRC website.)

Many of the comments presented, both at the August worksession and in the written comments submitted to the Department, pertained to the NRC's *"Carbon Filtration"* report. The Department retained Ecology and Environment, Inc., (E&E) to review the NRC report in the context of its applicability specifically to the UMCDF design, potential ramifications to the UMCDF "Pre-Trial Burn Human Health and Ecological Risk Assessment" conducted in 1996, and the health and ecological risk assessments that will be conducted after the completion of UMCDF trial burns.

E&E concluded that the NRC carbon filter report "is generally well written and accurate," but noted that some of the "statements and conclusions about health risks" were based on "documents that were not evaluated by DEQ or the EQC." The E&E reviewer cautioned DEQ and EQC against using the NRC carbon filter report as the sole basis for making conclusions about the emissions reduction performance and/or the human health risks of the PFS at UMCDF. A copy of the E&E "Technical Memorandum: Review of *Carbon Filtration for Reducing Emissions from Chemical Agent Incineration*" is included as Attachment H.

The discussion presented below is limited to the two written comments that related directly to carbon filters, oral testimony from the August 18 worksession, and discussion of the exhibit that was submitted during the Court proceedings [Attachment D] that the Commenters incorporated by reference. The discussion below does not include Commenters' criticisms of the NRC *Carbon Filtration* report, except as they relate specifically to UMCDF carbon filters. The principal authors of the NRC *Carbon Filtration* report were present at the August worksession, and responded directly to the Commenters immediately after their oral testimony to the Commission. (See pages 52-70 of the transcript in Attachment C.)

The Department evaluated the public comments (and other information submitted by the Petitioners during the course of legal proceedings) on the basis of whether the information was new information which was not available at the time of permit issuance that would have justified different permit conditions. *See* 40 CFR 270.41(a)(2).

Completeness of the PFS Design

The Commenters believe that it is clear that the design of the PFS at UMCDF has not yet been finalized, and that DEQ and EQC could not have set permit conditions that are protective of public health and the environment without review of the final design. One Commenter argues that the permits issued for UMCDF should be revoked because if the PFS design was not finalized, then the Permittee's Application was incomplete, and the EQC had no authority to issue permits in the first place.

The Department is aware that the PFS design is still incomplete. The Permittee's Class 2 Permit Modification Request (PMR) submitted in November, 1997 was conditionally approved in November, 1998 (See discussion of the PMR in "Summary of Public Input Opportunities" above and related documents in Attachments F and I). The conditional approval letter (See DEQ Item No. 98-0938 in Attachment F) required the Permittee to submit additional information related to the PFS, which resulted in further Department inquiries. The Department and the Permittee exchanged correspondence during 1999 related to various documents concerning the PFS and on August 24, 1999 the Department sent the Permittee a letter requiring the submittal of another Permit Modification Request to reflect the final design of the PFS (See DEQ Item No. 99-1398 in Attachment F).

The Permittee submitted a new Class 2 Permit Modification Request (PMR) related to the PFS on October 19, 1999 (UMCDF-99-043-PAS(2), "Upgrade of the Exhaust Induced Draft Fans and Rectifying Permit Inconsistencies"). The public comment period will be open from October 19 through December 20, with a public meeting scheduled for November 16, 1999 in Hermiston. The Commenters, and the Department, will have additional opportunity to review the PFS design configuration contained in this most recent PMR in light of the issues brought forth by the National Research Council and through the recent EQC-initiated public comment process on carbon filtration technology.

Use of a "Fixed Bed" Design

Commenters have expressed concern that the fixed-bed design of the carbon filtration technology being employed at UMCDF poses several process operation and safety risks, and that the design is "unproven." The National Research Council [Appendix C of Reference 3] was able to identify 22 commercial combustion facilities (most of which were located in Germany) that were utilizing fixed-bed carbon filters to "remove residual sulfur dioxide and hydrogen chloride, mercury, organic solvents, and semivolatile organics like dioxins and furans."

The Commenters point out the possibility of "channeling" that can occur in a fixed-bed filter, potentially allowing flue gases to pass almost directly through the carbon material. The UMCDF PFS carbon filters will be comprised of a set of carbon beds in series. The granular carbon media at UMCDF will be packed into the filter beds and subjected to physical vibration to ensure a tight enough pack to significantly reduce the possibility of loose-fill areas that could allow channeling. The Department believes that the packing method, combined with the multiple carbon beds and chemical agent monitoring between the beds, will be sufficient to minimize the possibility of channeling, or to detect chemical agent if channeling or "breakthrough" of the carbon beds occur.

The Ability of Carbon to Adsorb Chemical Agent

The Commenters have questioned the ability of the activated coconut shell carbon (the type of carbon proposed for use in the UMCDF PFS) to adsorb chemical warfare agents. The Department has reviewed numerous documents (see Attachment I) that provide data supporting the conclusion that carbon is effective in removing agent from the flue stream. The National Research Council also provides supporting data referring to the ability of activated carbon to adsorb chemical agent (see Reference 3). The Department believes the design of the UMCDF PFS allows sufficient carbon capacity not only to adsorb residual pollutants from the gas stream, but also provides sufficient capacity to capture and retain excess emissions (not only of agent, but also of constituents such as dioxins and furans) caused by transient upsets occurring in the UMCDF furnaces upstream of the PFS.

Commenters also expressed concern over the possibility of "off gassing" occurring if the carbon in the PFS is subjected to high temperatures. The Department agrees that excessive temperatures in the PFS could result in off-gassing of accumulated material. The Department has reviewed several reports by the Edgewood Research Development and Engineering Center (ERDEC) that discuss the results of tests conducted to study the effects of temperature (see Attachment I). The Department believes that the risk of off-gassing due to high inlet temperatures to the PFS is mitigated by the automatic waste feed cut-off settings for the furnaces that will be activated at a temperature below the temperature that will produce off-gassing from the carbon. In addition, the PFS design incorporates an emergency bypass feature to reduce the risk of carbon bed ignition in the case of extremely high inlet temperatures.

PFS Safety Risks

The Commenters expressed concern that the safety and health risks posed by the operation of the PFS have not been adequately characterized for either the on-site workers or the off-site population. The National Research Council agreed, and included in their report the statement (see Findings 4 and 5 and associated recommendations in Attachment G) that "the risk of acute hazards to workers...has not been adequately characterized" and that "if increased worker risks and hazards are identified, it is not clear what steps the army would take to mitigate them." The NRC goes on to recommend that the "Phase 2" Quantitative Risk Assessments should "include a complete evaluation of worker risk associated with the addition of the pollution abatement system filter system" and that the Army should clarify what mitigation measures will be taken to protect both the workers and the public. Nevertheless, the NRC concluded that the risks posed by the PFS to off-site populations was "negligible" and that the PFS as a whole was "risk-neutral."

The Department shares the concerns of the Commenters regarding the risks both to the workers and to the off-site population, and concurs with a statement made by one of the Commenters during the August 18 worksession that "the workers are members of the public." Although worker risk can often be mitigated through risk management actions (careful implementation of procedures, limited access, etc.), the Department believes that further study of both worker risk and potential health risks to off-site populations due to the operation of the PFS is warranted.

Operation of the PFS During "Upset" conditions

The Commenters expressed grave concern that there are plans to bypass the carbon filter bed in case of accidents or upsets, and that "if you have to bypass them when you are in a critical event" then you are defeating the purpose of "giv[ing] us some additional security in the event of a...serious malfunction." The Department believes that there is a misunderstanding on the part of the Commenters concerning the conditions under which the PFS will be "bypassed." The PFS will not be bypassed during <u>furnace</u> upset conditions, unless the furnace upset conditions are having effects downstream that are resulting in <u>PFS</u> upset conditions. The bypass feature on the

PFS is provided for safe operation in the case of, for example, unacceptably high inlet temperatures to the PFS that could pose a risk of fire in the carbon beds. The PFS will not be bypassed solely because of upset conditions in furnace.

The Use of a "Five-Stage" Pollutant Abatement System

The Commenters recommend that the Commission require UMCDF to use a "five-stage pollution abatement system." The Commenters cite an article in the "Journal of Hazardous Materials" that recommends the use of a four- or five-stage pollution abatement system for dioxin and furan control, including 1) a quench tower; 2) acid gas wet scrubber (for hydrogen chloride and hydrogen fluoride); 3) a scrubber for sulfur dioxide; 4) an activated carbon filter; and/or 5) an "SCR" system for NOx (Nitrogen oxides) control. [The Department assumes that "SCR" system refers to a "Selective Catalytic Reduction" system.]

The Department notes that the design of the UMCDF incorporates just such a pollution abatement system, including the use of quench tower (for rapid cooling to prevent dioxin formation and wet scrubbing with caustic solution to neutralize acid gases), a venturi scrubber (for particulate and acid gas removal), a packed bed scrubber tower (for final treatment of acid gases), a demister tower (for removal of sub-micron particles and metal oxides), and the activated carbon filtration provided by the PFS.

The Department believes that the pollution abatement system employed at UMCDF will be more than adequate to insure that UMCDF can meet all of Oregon's emission standards, even without the addition of the PFS. Permit Conditions VI.A.1.vi and VII.A.8 of the UMCDF HW Permit require that "Each incinerator shall meet the applicable performance standards...**before** [*emphasis added*] entering each incinerator's carbon filter system." The PFS provides the "additional measure of safety" that the Commission desired when it granted the permits in 1997.

"Exhibit 74"

This document is an exhibit that was submitted related to Case No. 9708-06159 (Circuit Court of the State of Oregon), and was incorporated by reference in the comments of both Lisa Brenner and Richard Condit, et al.. "Exhibit 74" is titled "*An Analysis of Kriistina Iisa's Report Concerning the Emission of Dioxin and the Use of PAS Carbon Filters for the Oregon Environmental Quality Commission*" (Attachment D).

Exhibit 74 is a "critique" by Drs. Brenner and Stibolt of a report written in 1996 by Dr. Iisa of Oregon State University in response to questions posed by the EQC related to dioxin control from incinerators. The critique contains extensive and serious allegations about "whether the report authored by Kristiina Iisa…is a deliberate attempt to mislead the reader." The Commenters allege that the Commission should not have relied on Dr. Iisa's information concerning the ability of carbon filtration to capture and retain emissions from UMCDF. The exhibit included numerous attachments and appendices to support the allegations, which have been provided to the Commission separately. (Attachment D contains only the main body of Exhibit 74.)

The Department retained E&E to review Exhibit 74 and provide a report on whether the allegations had a basis in fact. The E&E authors of the "Technical Memorandum" (Attachment E) concluded that " statements made by Professor Iisa in her report were correct given the information available at the time. Overall, Professor Iisa's report accurately summarizes the information presented in her references. The statements and claims made in the affidavit are largely without validity. Some statements accurately highlight the uncertainty related to dioxin emissions, but these uncertainties were acknowledged by Professor Iisa and would not change the conclusions of her report."

Conclusions

The Department has concluded that there is no basis at this time for unilateral modification by the Commission of the UMCDF Hazardous Waste Treatment and Storage Permit as related to the PFS.

The Department believes that the fixed-bed design of the UMCDF carbon filtration system is not unique, and has been demonstrated as effective when applied to large combustion facilities, including hazardous and medical waste incineration facilities. Agent monitoring will be conducted between the carbon beds, and if agent is detected because of carbon channeling, carbon saturation, and/or off-gassing, there will be an automatic waste feed cut off of agent feed to the affected furnace. The UMCDF PFS has the capacity to capture and retain transient flue gas emissions caused by upset operating conditions upstream in a furnace.

Intended Future Actions

The Department will review the Class 2 Permit Modification Request related to the PFS submitted by the Permittees in October, 1999, and will revise PFS-related permit conditions as necessary. The Department will review the Permit Modification Request in light of the issues identified by the National Research Council and the Commenters concerning operational risks and design completeness of the PFS.

Department Recommendation

The Department recommends that the PFS be retained as part of the UMCDF design, and that the Commission find that there is insufficient basis for unilateral modification of the UMCDF Hazardous Waste Storage and Treatment Permit related to the inclusion of the PFS.

The Department also recommends that the Commission send a letter to the Office of the Governor requesting that Oregon Occupational Safety and Health Administration (OR-OSHA) review the issues related to worker risk at UMCDF.

Attachments

Attachment A: *"Authority to Modify Hazardous Waste Facility Permits,"* Memorandum from Larry H. Edelman, Oregon Department of Justice, to Environmental Quality Commission, August 4, 1999. [DEQ Item No. 99-1344]

Attachment B: Documents related to the Public Comment Period July 19-September 20, 1999 (Summary of Public Comments received, "Chance to Comment" Form, Agenda for the August 18, 1999 EQC Worksession, and invitation to present oral testimony). [DEQ Item Nos. 99-1816, 99-1200, 99-1245, and 99-1320]

Attachment C: Worksession on the Umatilla Chemical Agent Disposal Facility, Partial Transcript of the August 18, 1999 Worksession, prepared by the Department of Environmental Quality. [DEQ Item No. 99-1509]

Attachment D: *"An Analysis of Kriistina Iisa's Report Concerning the Emission of Dioxin and the Use of PAS Carbon Filters for the Oregon Environmental Quality Commission,"* an attachment to the Affidavit of Lisa P. Brenner, Ph.D. and Thomas B. Stibolt, M.D., Exhibit 74 to "*Petitioners' Opposition to Respondents' Supplemental Motion for Summary Judgment*," Case No. 9708-06159 (Circuit Court of the State of Oregon), April 12, 1999. [DEQ Item No. 99-0704]

Attachment E: *"Review of Affidavit by Lisa P. Brenner, Ph.D. and Thomas B. Stibolt, M.D.,"* Technical Memorandum prepared by Ecology and Environment, Inc., September 15, 1999. [DEQ Item No. 99-1528]

Attachment F: Documents related to the Pollution Abatement System Carbon Filter System Class 2 Permit Modification Request [UMCDF-97-005-PAS(2TA)] {Conditional Approval Letter (November 1998), Request for Further Information (August 1999), Notice of Decision (November 1998), and Response to Comments (November 1998). [DEQ Item Nos. 98-0938, 99-1398, 98-0991, and 98-0989, respectively]

Attachment G: Executive Summary of *"Carbon Filtration for Reducing Emissions from Chemical Agent Incineration,"* National Research Council, August 1999. [DEQ Item No. 99-1410]

Attachment H: *"Review of the NRC report, Carbon Filtration for Reducing Emissions from Chemical Agent Incineration"* Technical Memorandum, Ecology and Environment, Inc., October 7, 1999. [DEQ Item No. 99-1678]

Attachment I: Reference Documents Related to the Class 2 Permit Modification Request UMCDF-97-005-PAS(2TA) and other technical documents reviewed by the Department concerning the use of carbon filtration technology.

Reference Documents (available upon request)

1. *"Order Clarifying Permit Decision,"* Environmental Quality Commission, March 19, 1999. [DEQ Item No. 99-0490]
2. *"Risk Assessment of the Pollution Abatement Filter System for the Umatilla Chemical Agent Disposal Facility,"* Mitretek Technical Report MTR 1997-60, September 1998. [DEQ Item No. 99-0066]
3. *"Carbon Filtration for Reducing Emissions from Chemical Agent Incineration,"* National Research Council, August 1999. [DEQ Item No. 99-1410]

Other Reference Documents

The Department has reviewed a significant number of technical documents, and exchanged correspondence with the Permittee, related to carbon filter technology. Some of the documents and correspondence has been listed separately in Attachment I.

Approved:

Section: Sue Oliver (ACTING MGR.)

Division: ______________________

Report Prepared By: Sue Oliver

Phone: (541) 567-8297, Ext. 26

Date Prepared: October 26, 1999

ATTACHMENT A

"Authority to Modify Hazardous Waste Facility Permits"

Memorandum from Larry H. Edelman
Oregon Department of Justice
to
Carol Whipple, Chair
Environmental Quality Commission
(DEQ Item No. 99-1344)

August 4, 1999

HARDY MYERS
Attorney General

DAVID SCHUMAN
Deputy Attorney General

DEPARTMENT OF JUSTICE
GENERAL COUNSEL DIVISION

99-1344

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MEMORANDUM

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
AUG 09 1999
HERMISTON OFFICE

DATE:	August 4, 1999
TO:	Carol A. Whipple, Chair Environmental Quality Commission
FROM:	Larry H. Edelman, Assistant Attorney General Natural Resources Section
SUBJECT:	**Authority to Modify Hazardous Waste Facility Permits**

This memorandum is to provide guidance regarding the legal bases for modification, revocation, and/or termination of a hazardous waste treatment facility permit issued pursuant to applicable federal and state regulations. The issue is addressed in the context of the Umatilla Chemical Agent Disposal Facility permit and the Environmental Quality Commission's authority to modify that permit if it were to find new evidence or changed circumstances.

This memorandum addresses only bases for unilateral permit modification, not modifications at the request of the permittee.[1]

Criteria for Permit Modifications

The criteria for unilateral modification of a hazardous waste facility permit are set forth at 40 CFR 270.41 which is incorporated in pertinent part by reference at OAR 340-100-0002, 340-105-0041 and Division 106. Causes for unilateral **modification** of a hazardous waste treatment facility permit include:

1. Material and substantial alterations or additions to the permitted facility or activity occurring after permit issuance. *See* 40 CFR 270.41(a)(1);
2. New information which was not available at the time of permit issuance and would have justified different permit conditions. *See* 40 CFR 270.41(a)(2);
3. New statutory, regulatory, or judicially mandated standards. *See* 40 CFR 270.41(a)(3);

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[1] Modifications at the request of the permittee are governed by 40 CFR 270.42.

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4. "Acts of God" or uncontrollable circumstances warranting revised compliance schedules. *See* 40 CFR 270.4(a)(4).

Causes for unilateral modification, revocation **and** reissuance include:

1. Cause exists for permit termination under 40 CFR 270.43 (grounds for termination in turn include noncompliance with any permit condition, failure by the permittee to disclose all relevant facts in the application or misrepresentation of relevant facts at any time, or a determination that the permitted activity endangers human health or the environment);

2. The permit issuing authority has received notification of a proposed permit transfer.

The hazardous waste facility permit issued to the Army and Raytheon references in paragraph I.C.1 the regulatory bases for modification, revocation or termination described above. Paragraph I.C.2 of the Umatilla permit additionally references applicable state law at ORS 466.170 regarding Commission authority to revoke the permit on a finding of violation of the statute, rules, or a material condition of the permit.

Paragraph I.C.3 references ORS 466.200 which provides authority to the Department to halt operations under the permit if there is reasonable cause to believe there is a **clear and immediate danger to the public health, welfare or safety or to the environment** from continued facility operation.

Finally, paragraph I.C.4 of the permit provides for **reopening** of the permit if Congress or the President makes substantial changes in the Chemical Weapons Demilitarization Program or in CSSEP.

Initiation of Permit Modification, Revocation, Termination

Hazardous waste facility permits may be modified, revoked, reissued, or terminated either at the request of any interested person (including the permittee) or upon the initiative of the permitting body. 40 CFR 124.5. All requests must be in writing and must contain facts or reasons supporting the request. In the case of the Umatilla permit, the Commission is the permit issuing body and would, therefore, be the entity authorized to make unilateral permit modifications. Revocation or termination proceedings would most likely be conducted as contested cases governed by the Administrative Procedures Act.

If the Commission denies a request for modification, revocation, or termination it must send the requester a brief, written response giving a reason for the decision. Denials are not subject to public notice, hearing, or comment. OAR 340-106-0005. Denials by the Commission are subject to judicial review under ORS 183.480 as orders in other than a contested case. OAR 340-106-0005(1)(c).

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Procedure for Modification

The procedure for unilateral permit modifications by the Commission is not precisely specified in the statutes or rules. Preparation of a modified draft permit is required. 40 CFR 270.41. The procedures for public notice, comment and public hearing then become applicable. 40 CFR 124.10; 124.11; 124.12. The most logical procedure would appear to be for the Commission to direct the Department to prepare a modified draft permit which would be processed similarly to a new or reissued permit, i.e. noticed for public comment and hearing. 40 CFR 124.12(a)(3) incorporated by reference in OAR 340-100-002 as modified by Division 106. As with permit issuance, the Commission would then have the option of providing for contested case review of the modified permit by the permittee and/or interested persons.

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ATTACHMENT B

Documents related to the Public Comment Period
July 19-September 20, 1999

Summary of Public Comments Received
Related to Carbon Filter Technology
(DEQ Item No. 99-1816)

Invitation to Comment On Carbon Filtration Technology
at the Umatilla Chemical Agent Disposal Facility
(DEQ Item No. 99-1200)

Environmental Quality Commission Agenda
for the August 18, 1999 EQC Worksession
(DEQ Item No. 99-1245)

Invitation to the Petitioners to provide comment
at the August 18, 1999 EQC Worksession
(DEQ Item No. 99-1320)

Attachment B, Table 1. Summary of Public Comments Received.

Commenter	DEQ Item No.	Date Received	Summary
Dr. David Kosson, Chair, NRC Stockpile Committee	99-1509 (Transcript) (See Attachment C)	8/18/99	From oral testimony at the EQC Worksession held August 18, 1999. Dr. Kosson is the Chair of the National Research Council's (NRC) "Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program" ("Stockpile Committee"). He presented the Findings and Recommendations from a recent NRC report titled *"Carbon Filtration for Reducing Emissions from Chemical Agent Incineration."* Dr. Kosson's oral presentation is not included in the August 18 Transcript, but a copy of the Executive Summary (including the Findings and Recommendations) was included as an attachment to the transcript and is also included as Attachment G of this Staff Report.
Rick Holmes, Operations Team, U.S. Army Project Manager for Chemical Stockpile Disposal	99-1509 (Transcript) (See Attachment C)	8/18/99	From oral testimony at the EQC Worksession held August 18, 1999. Mr. Holmes gave a brief presentation to the Commission on the design of the carbon filter system that will be used at UMCDF. His presentation was not transcribed. Mr. Holmes answered a question from the Commission during the follow-up discussion after the presentation of Mr. Condit and Mr. Harrison (See Page 67 of the August 18 transcript in Attachment C).
Thomas Stibolt, M.D. (on behalf of G.A.S.P., et al.)	99-1509 (Transcript) (See Attachment C)	8/18/99	From oral testimony at the EQC Worksession held August 18, 1999 (See Page 32 of the EQC Worksession transcript included as Attachment C of this Staff Report). Dr. Stibolt expressed his dissatisfaction with the public involvement process and his concerns that his comments to the DEQ on this and other permit processes "sort of disappears into a black hole…"

Attachment B, Table 1. Summary of Public Comments Received. (Continued)

Commenter	DEQ Item No.	Date Received	Summary
Richard Condit, Esq., (representing G.A.S.P., et al.)	99-1509 (Transcript) (See Attachment C)	8/18/99	From oral testimony at the EQC Worksession held August 18, 1999 (See Pages 34-46, 50-51, and 68-69 of the August 18 transcript in Attachment C). Mr. Condit, acting as Counsel for G.A.S.P., et al. expressed his client's concerns about a variety of issues concerning the carbon filter system that will be used at UMCDF. He prefaced his comments by stating that "The folks I represent and work with do not intend to suggest that the DEQ or EQC should reject carbon filter technology as a potentially meaningful method to reduce some of the risks of operating the incineration system." Mr. Condit criticized the Army for submitting a "seriously defective" application to the EQC when they were seeking to obtain a permit. Mr. Condit expressed his concern that the design of the PFS is still not finalized, and provided extensive criticisms of the NRC report. Mr. Condit's oral testimony was re-iterated in his written comments (See below for additional summary of Mr. Condit's written comments).
Mick Harrison, Esq., (representing G.A.S.P., et al.)	99-1509 (Transcript) (See Attachment C)	8/18/99	From oral testimony at the EQC Worksession held August 18, 1999 (See Pages 46-49 of the August 18 transcript in Attachment C). Mr. Harrison re-iterated some of Mr. Condit's testimony, to include the need for a "mass balance," the concerns about carbon filters and channeling, volatilization of the agent from the filters at high temperatures, and the ability of the carbon filters to retain agent. Mr. Harrison also provided additional testimony concerning an incident that occurred at the Tooele, Utah facility when an undrained bomb was processed through the Metal Parts Furnace.

Attachment B, Table 1. Summary of Public Comments Received. (Continued)

Commenter	DEQ Item No.	Date Received	Summary
Dr. David Kosson, Chair, NRC Stockpile Committee	99-1509 (Transcript) (See Attachment C)	8/18/99	Dr. Kosson responded to the oral testimony of the Richard Condit and Mick Harrison (see Pages 53-68 of the EQC Worksession transcript included as Attachment C of this Staff Report). Dr. Kosson discussed the independence of the NRC and how the Committee and report review process works. He also clarified the apparent misunderstandings related to the storage versus processing risks; the issue of installing, but not operating, the PFS; carbon injection versus fixed carbon beds; the bypass of the PFS during upset conditions; carbon types; waste characterization; "puffs"; the ability of the carbon to collect agent; and the differences between the Pollution Abatement System carbon filters and the building carbon filters.
Dr. Walter May, Member, NRC Stockpile Committee	99-1509 (Transcript)	8/18/99	From oral testimony at the EQC Worksession held August 18, 1999 (See Pages 58-69 of the August 18 transcript in Attachment C). Dr. May responded to the concerns expressed by Mr. Condit and Mr. Harrison, and the questions of the Commission, regarding the ability of carbon to adsorb chemical agents, the possibility of "off-gassing" of agent from carbon filters, and the independence of the NRC.
Dr. Kathryn Kelly Member, NRC Stockpile Committee	99-1509 (Transcript) (See Attachment C)	8/18/99	From oral testimony at the EQC Worksession held August 18, 1999 (See Pages 60-67 of the August 18 transcript in Attachment C). Dr. Kelly responded to the concerns of Mr. Condit and Mr. Harrison, and the questions of the Commission, concerning the issues surrounding worker and population risks posed by the carbon filters. Dr. Kelly stated that "…to sum it up from a risk perspective, that the carbon filter themselves don't increase or decrease the risk to the off-site population or environment in any appreciable way. No big gains, no big drawbacks, it's risk neutral, as has been sated in the report."

Attachment B, Table 1. Summary of Public Comments Received.
(Continued)

Commenter	DEQ Item No.	Date Received	Summary
Don Siebenaler, Study Director, NRC Stockpile Committee	99-1509 (Transcript) (See Attachment C)	8/18/99	From oral testimony at the EQC Worksession held August 18, 1999 (See Pages 68-70 of the August 18 transcript in Attachment C). Mr. Siebenaler discussed the National Academy of Sciences review process for reports produced by NRC Committees.
Jeff Hockett	99-1365 and 99-1483	8/13/99 and 9/3/99	The Commenter proposed that carbon filter systems would not be necessary if another treatment technology was used in lieu of incineration (Plasma Arc Furnace).
Anonymous	99-1296	7/29/99	The Commenter sent in a post card with the statement "Carbon filter is needed for safety. Please put it on the stack."
Bob Palzer, Sierra Club	99-1555	9/20/99	The Commenter sent in a copy of an email titled "ACWA Program Update" (dated September 16, 1999) related to the activities of Assembled Chemical Weapons Assessment, and a comment concerning alternatives to incineration as a treatment technology. No specific comment was provided regarding the UMCDF carbon filter system.
Richard E. Condit, Stuart Sugarman, Mick Harrison, Counsels for the Petitioners (G.A.S.P., Sierra Club, Oregon Wildlife Federation, et al.)	99-1539	9/20/99	The Commenters preface their comments with the statement that "it is not the intent of these comments to suggest that the DEQ/EQC should reject the addition of pollution control systems as a potentially meaningful method to reduce some of the risks of operating the incinerators currently planned for the Umatilla Chemical Demilitarization Facility."

Attachment B, Table 1. Summary of Public Comments Received.
(Continued)

Commenter	**DEQ Item No.**	**Date Received**	**Summary**
Richard E. Condit, et al. (Continued)			The Commenters believe that it is clear that the design of the PFS at UMCDF has not yet been finalized. Because the final design was not complete the Commenters believe that "the EQC had no authority to issue the permit for UMCDF [and] the Commentors [sic] request that the EQC immediately revoke the permit." The Commenters believe that the DEQ and EQC could not have "set permit conditions necessary to protect public health and the environment" without the final design. The Commenters contend that the DEQ and EQC "have failed to assess what negative impacts may result from the addition of a PAS-CF unit." The Commenters cite the risks of "…carbon fire, accumulation and release of chemical warfare agents and other dangerous chemicals…" that are discussed in the National Research Council (NRC) report "*Carbon Filtration for Reducing Emissions from Chemical Agent Incineration.*" The Commenters provide a critique of the NRC report that includes, but is not limited to, the following issues: • The final design of the PFS was not available to the NRC Committee for their review. • The NRC limited their references and discussions of incinerators to those using carbon injection systems. • The NRC recommends "that the carbon bed filter be bypassed in case of upsets or accidents." • The NRC report "does not contain professional references supporting carbon bed filter technology" and those references that are included are outdated.

Attachment B, Table 1. Summary of Public Comments Received.
(Continued)

Commenter	DEQ Item No.	Date Received	Summary
Richard E. Condit, et al. (Continued)			The Commenters cite an article in the "Journal of Hazardous Materials" that describes "state of the art air pollution control equipment and trends" (a copy of the article was not included). The referenced article apparently recommends the use of a four- or five-stage pollution abatement system for dioxin and furan control, including 1) a quench tower; 2) acid gas wet scrubber (for hydrogen chloride and hydrogen fluoride); 3) a scrubber for sulfur dioxide; 4) an activated carbon filter; and/or 5) an "SCR" system for NOx (Nitrogen oxides) control. [The Department assumes that "SCR" system refers to a "Selective Catalytic Reduction" system.] The Commenters believe that the UMCDF carbon filter system should be required to undergo "operational verification testing" at the Army's prototype incinerator at Johnston Atoll in the Pacific (JACADS). The Commenters also reference a review of a report done by Dr. Kristina Iisa in 1996 at the request of the EQC (see "Exhibit 74" below). The review of the Iisa report was submitted during the legal proceedings in 1999 (Case No. 9708-06159, Circuit Court of the State of Oregon). The Commenters request that the DEQ and EQC: • "…revoke or suspend the current permit…" • "Make a factual finding regarding the ability of [the PFS] to collect and retain chemical warfare agents." • "Reassess the risks posed by the UMCDF incineration system (including the PAS-CF unit)…" "Request that the Army perform a mass balance analysis of the currently employed carbon filter technology used for cleaning the air inside facility buildings."

Attachment B, Table 1. Summary of Public Comments Received.
(Continued)

Commenter	DEQ Item No.	Date Received	Summary
Lisa Brenner, Oregon Clearinghouse for Pollution Reduction	99-1541 (w/attachments)	9/20/99	The Commenter believes that NRC report "*Carbon Filtration for Reducing Emissions from Chemical Agent Incineration*" demonstrates "that the carbon bed filters are NOT [emphasis in original] the best available control technology." The Commenter does not agree with the NRC or the Army that the risks of delaying processing outweigh the risks of continued storage, and asserts that "there is time to reconsider the disposal plan" and that a "change to advanced technology can avert potential disasters." The Commenter also refers to "previously submitted testimony such as our critique of the Iisa carbon filter report" (see "Exhibit 74" below). This Comment included attachments consisting of various documents that the Commenter believes supports the opinion that carbon filtration does not reduce the risks posed by incineration; that the processing risks have been underestimated and the storage risks overestimated; therefore, there is sufficient time to reconsider the use of incineration as a treatment technology for chemical agents. Each of the Attachments to this Comment are listed and summarized in the table below.
Lisa Brenner and Thomas Stibolt	"Exhibit 74" of DEQ Item No. 99-0704 (See Attachment D)	4/14/99	This document is an Exhibit that was submitted related to Case No. 9708-06159 (Circuit Court of the State of Oregon), and was incorporated by reference in the comments of both Lisa Brenner and Richard Condit, et al.. The Exhibit is attached to an "Affidavit of Lisa P. Brenner, Ph.D [sic] and Thomas B. Stibolt, M.D." and is titled "An Analysis of Kriistina Iisa's Report Concerning the Emission of Dioxin and the Use of PAS Carbon Filters for the Oregon Environmental Quality Commission."

Attachment B, Table 1. Summary of Public Comments Received.
(Continued)

Commenter	DEQ Item No.	Date Received	Summary
Lisa Brenner and Thomas Stibolt (Continued)			Exhibit 74 is a "critique" by Drs. Brenner and Stibolt of a report written in 1996 by Dr. Iisa in response to questions posed by the EQC related to dioxin control from incinerators. The critique contains extensive allegations about "whether the report authored by Kristiina Iisa, PhD [sic]…is a deliberate attempt to mislead the reader, or instead simply poor writing on the part of an individual who is unskilled in or inexperienced with scientific inquiry and reporting techniques." Allegations contained in Exhibit 74 include, but are not limited to: • That Dr. Iisa "…selectively chooses from [her] references only that material which seems to support a predetermined agenda…" or that the references Dr. Iisa cited do not support, or in fact contradict, the statements made by Dr. Iisa in her report and in her statements to the EQC. • That Dr. Iisa did not adequately reference or support her calculations and statements to the EQC. This Exhibit includes numerous attachments and appendices to support the allegations. The main body of Exhibit 74 is included in this staff report as Attachment D. [This Exhibit has been reviewed by a contractor (Ecology and Environment) on behalf of the Department. A copy of the Technical Memorandum is included in this Staff Report as Attachment E.]

Table 2. Summary of the Documents Included as Attachments to the Comments of Lisa Brenner, Ph.D.

Comment Attach. No.	Document Title (if applicable)	Author	Summary of document/comment
1-A	"SAIC QRC [sic] Internal Inconsistencies"	Halstead Harrison	Dr. Harrison reviewed the "Quantitative Risk Assessment" (QRA) prepared by Science Applications International Corporation, an Army Contractor. Dr. Harrison has identified what he believes are "internal consistencies" in the report that result in underestimated processing risks.
1-B	"Sabotage and other accidents are the greatest real danger"	Halstead Harrison	Dr. Harrison believes that the "formal, mostly-dioxin-driven risk estimates…are likely low…and that the uncertainty associated with them is very large…". Dr. Harrison concludes that "the expected risks from accidents and sabotage likely exceed those from dioxin modulated cancers, by an order of magnitude." Dr. Harrison refers to a letter he wrote to Carol Browner, Administrator of the U.S. Environmental Protection Agency. The letter to Ms. Browner is included as Comment Attachment 4-B (see below).
2	"Pollution Abatement Systems and Chemical Agent Destruction"	Lisa Brenner	Dr. Brenner believes that the extreme toxicity of chemical agent, as compared to materials processed in commercial medical or hazardous waste incinerators, warrants the best available control technology. Dr. Brenner states that "If DEQ really had no alternative for disposal but incineration and they selected a pollution control system that was the best available, they would have looked at a five stage system typical of commercial hazardous waste incinerators (ref) for controlling emissions." [The Department assumes that the "reference" referred to in the above quotation is the description of the article related to pollution control systems that was cited in the comments of Richard Condit, et al..]

Table 2. Attachments to the Comments of Lisa Brenner, Ph.D.
(Continued)

Comment Attach. No.	Document Title (if applicable)	Author	Summary of document/comment
3	"The most recent, August 1999 NRC report and its comments about risk"	Halstead Harrison	Dr. Harrison "disagree[s] emphatically with the [NRC's] report's assurance" that the [quoting from the NRC report] "carbon filter would virtually eliminate the possibility of an accidental release of a chemical agent through the stack." Dr. Harrison believes that "off-design operations" cannot be detected quickly enough to allow "prompt remediation" and recommends alternative sampling and analytical technology for stack emissions that would provide faster response times than those currently in use.
4-A	"Current Standards are not Protective"	Lisa Brenner	Dr. Brenner cites a July 1998 research report from the U.S. EPA that concluded "that the current sampling and analytical schemes for characterizing HWC [Hazardous Waste Combustion] emissions are inadequate and provide an incomplete picture of the emission profile." A copy of the research report was attached. (See below.)
With 4-A	"Development of a Hazardous Waste Incinerator Target Analyte List of Products of Incomplete Combustion" EPA Research and Development Report, EPA Document No. EPA-600/R-98-076, July 1998	National Risk Management Research Laboratory	From the Abstract of this report: "Pilot-scale incineration experiments were performed to develop a comprehensive list of products of incomplete combustion (PICs) from hazardous waste combustion (HWC) systems. The goals of this project were: 1) to develop an expanded list of HWC target analytes for EPA's Office of Solid Waste (OSW) to use as a basis for a PIC-based regulatory approach; 2) to identify the total mass of organic compounds sufficiently to estimate the toxicity of the complex mixture; and 3) to enable OSW to assess the relative importance of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs) to other PICs."

Table 2. Attachments to the Comments of Lisa Brenner, Ph.D.
(Continued)

Comment Attach. No.	**Document Title (if applicable)**	**Author**	**Summary of document/comment**
4-B	"Reflections on Risk Assessment," from *"Waste Not"* Newsletter, No. 452, July 1999	Halstead Harrison	The "Waste Not" newsletter article is a re-print of the letter that Dr. Harrison wrote to Ms. Carol Browner, EPA Administrator concerning the inadequacies of the current risk assessment process.
5	"Experiences From The Utah Incinerator"	Lisa Brenner	Dr. Brenner cites the problems that have occurred during operations of the Tooele Chemical Agent Disposal Facility (TOCDF) in Utah as indicative of what will happen at UMCDF. Dr. Brenner also states that the transcripts from recent TOCDF legal proceedings in Utah are not yet available, but she believes that the "EQC [must] read in order to understand the full folly of the antiquated furnaces being used at TOCDF and built at Umatilla."
5-A	"When Good Rockets Go Bad"	Peter Hille, Common Ground	Mr. Hille summarizes the procedures being used at TOCDF to process M-55 rockets containing gelled agent.
5-B	"Update to Review of 30 March 1998 Incident: New Information," prepared for Chemical Weapons Working Group, August 20, 1999	Anthony Flippo. TM Management, Inc.	Mr. Flippo's report summarizes information concerning an incident at TOCDF that involved a possible release of chemical agent through the stack when an un-drained bomb was processed through the Metal Parts Furnace. Mr. Flippo (a former Supervisory Engineering Technician at Dugway Proving Ground) also includes his concerns about the ability of carbon filtration to clean chemical agent from an air stream: "The filter mediums are prone to settling, resulting in cracks, due to vibration from transportation and air handling systems. The cracking allows for channels for contaminates to pass through to atmosphere. The filter mediums will release the agent trapped to atmosphere when exposed to high temperatures."

Table 2. Attachments to the Comments of Lisa Brenner, Ph.D.
(Continued)

Comment Attach. No.	Document Title (if applicable)	Author	Summary of document/comment
5-C	"Information Paper for 15 July 1999 Citizens' Advisory Commission Meeting"	Timothy Thomas, TOCDF Site Project Manager, Dep't. of the Army	This attachment includes a cover letter from Mr. Thomas to Dr. Jane Bowman (Utah Citizens Advisory Commission) transmitting an "Information Paper concerning feeding munitions into the Deactivation Furnace system and Metal Parts Furnace at TOCDF." [It is not clear if the attached document is the complete "Information Paper" or if it is an excerpt.] The paper discusses the permitting process, the background, and the procedures being used to process incompletely drained munitions through the furnaces.
5-D	"Testimony ends, decision not expected for three months," June 18, 1999.	Associated Press, Salt Lake City	The article discusses the legal proceedings in Utah that were before the U.S. District Court regarding the "suit by environmental groups seeking to shut down the Army's chemical weapons incinerator in Tooele County."
5-D	"The chemical weapons dilemma," July 28, 1999	Editorial, Desert News, Salt Lake City, Utah	The editorial discusses the federal court case and states that although "it is understandable that groups…[are]…calling for an accurate accounting…destruction of the chemical weapons needs to continue."
With 5-D	Incident summaries at TOCDF	Unknown	Several pages are included that summarize three separate "incidents" at TOCDF (March 30, 1998; May 21, year not identified; May 24, year not identified; May 26, year not identified; and June 4, year not identified).

Table 2. Attachments to the Comments of Lisa Brenner, Ph.D.
(Continued)

Comment Attach. No.	Document Title (if applicable)	Author	Summary of document/comment
6	"Risk estimates did not include all risks and uncertainties, and statistics create a falsely inverted comparison between the dangers of storage and processing"	Lisa Brenner	Dr. Brenner uses quotations from the NRC (August, 1999) that the Army has still not conducted a thorough risk assessment that will account for risks posed by the carbon filter system.
6-B	Compendium of various news articles, press releases, fact sheets from the Chemical Weapons Working Group, and Congressional letters related to the chemical demilitarization program.	Various	Topics covered include funding issues, requests to the Government Accounting Office for investigation of the Army's chemical demilitarization program, the Assembled Chemical Weapons Assessment program, M-55 rocket stability, and the Dunnage incinerator.
7	"Safe STORAGE [emphasis in original]: If it were reconfigured to protect from accidents and sabotage, the stockpile would be stable long enough to modernize the disposal plan, even with leaking rockets."	Lisa Brenner	Dr. Brenner asserts that the risk of storage has been exaggerated, and that there is sufficient time to reconsider the design and dispose of the stockpile with alternative technologies.
With 7	Tooele Chemical Agent Disposal Facility Quantitative Risk Assessment, September, 1996, Science Applications International Corporation (SAIC) SAIC-96/2600 (Summary Report, Final Draft)	SAIC	Includes a two-page excerpt from this report, discussing storage risks, and M-55 rocket risks.

Table 2. Attachments to the Comments of Lisa Brenner, Ph.D.
(Continued)

Comment Attach. No.	Document Title (if applicable)	Author	Summary of document/comment
With 7	"Stockpile Condition (M55 Rocket) Reassessment," Memorandum to Robert Brauer, July 29, 1994.	Craig Williams, Chemical Weapons Working Group	Mr. Williams summarizes information that he received from an unidentified member of the NRC Stockpile Committee concerning the risks of M-55 Rockets.
With 7	"Annual Status Report on the Disposal of Chemical Weapons and Materiel for Fiscal Year 1998," September 30, 1998.	Dep't. of Defense	Excerpt from the report discussing the stability of the chemical weapons stockpile.
With 7	"Department of Defense's Status Assessment for the Chemical Demilitarization Program," January, 1997.	Dep't. of Defense	Excerpt from the report discussing the stability of the chemical weapons stockpile.
With 7	"Department of Defense's Interim Status Assessment for the Chemical Demilitarization Program," April 15, 1996.	Dep't. of Defense	Excerpt from the report discussing the stability of the chemical weapons stockpile, along with a Chemical Weapons Working Group summary of the report.
8	"Advanced technology works for every component of the stockpile and is in use"	Lisa Brenner	Dr. Brenner cites the report expected in September, 1999, from the Assembled Chemical Weapons Assessment program in stating that "there can be no question that advanced approaches to destroying the chemical agent stockpiles, including the rockets are tested, available and **being implemented at the site where Army managers of this program live**." [emphasis in original]

Oregon Department of Environmental Quality

A CHANCE TO COMMENT ON...

COPY

INVITATION TO COMMENT ON CARBON FILTRATION TECHNOLOGY AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY (UMCDF)	**Public Notice Date: July 19, 1999** **Written Comments Due: Sept. 20, 1999**

UMATILLA CHEMICAL AGENT DISPOSAL FACILITY (UMCDF)
UMATILLA CHEMICAL DEPOT
HERMISTON, OREGON
ORQ 000 009 431

For what facility?

This Invitation to Comment is related to the **Umatilla Chemical Agent Disposal Facility** (UMCDF) under construction at the U.S. Army Umatilla Chemical Depot near Hermiston, Oregon. The UMCDF is an incineration facility that will be used to destroy the stockpile of chemical warfare agents that are stored at the Depot.

In February 1997, the Environmental Quality Commission (EQC) and the Department of Environmental Quality (DEQ) approved an Air Contaminant Discharge Permit (Air Permit) and a Hazardous Waste Storage and Treatment Permit (HW Permit) for UMCDF.

What do the carbon filters do?

The design of UMCDF includes a carbon filtering system for final treatment of exhaust gases before they are released to the atmosphere through a stack. Each of the furnace systems at UMCDF has a standard Pollution Abatement System (PAS) to ensure that air emissions meet Oregon's environmental standards. (UMCDF uses five incinerators of four different types (housed in a single building) to treat the various components of the chemical weapons stockpile at the Umatilla Depot.) The gases exiting the standard PAS are conditioned to remove moisture and then channeled through carbon filter beds before being released from a stack.

The air emissions from the UMCDF furnaces must meet all of the emission standards required by the state Air and HW Permits **before** the gases pass through the carbon filter system. The Environmental Quality Commission required inclusion of the carbon filter systems at UMCDF to provide an additional measure of safety.

Why does the EQC want comments on carbon filters?

The Army has re-designed the carbon filter system since the time of the original permit decision in February 1997 (the Department approved the design modifications in November 1998). Although the permit modification process incorporated two public comment periods, there have been concerns raised by some members of the public that the carbon filtration system proposed for use at UMCDF is "unproven." The EQC wishes to collect additional information regarding the use of carbon filters to clean exhaust gases from hazardous waste incinerators.

What additional information does the EQC want to collect?

The EQC is interested in any information that the public could provide regarding the application of carbon filtration technology to a combustion facility. For example:

- Effectiveness of carbon filters in emission reduction, including emissions of dioxins, furans, and metals;
- Operational complexity of a carbon filter system;

- Safety of carbon filter systems, including the risk and consequences of catastrophic failures, and safety features available to preclude such failures;
- Waste generation from carbon filter systems, including the treatment and disposal of spent carbon; and
- Other issues of concern to the public about the use of carbon filters at UMCDF.

Where can I find more information?

The Air and HW Permits, and other information related to UMCDF, can be found at the following information repositories:

DEQ--Hermiston Office
256 E. Hurlburt, Suite 105
Hermiston, OR 97838
(541) 567-8297
or 1-800-452-4011

Pendleton Public Library
502 S.W. Dorion Avenue,
Pendleton, OR 97801
(541) 966-0210

Portland State University Library
951 SW Hall, Fifth Floor
Portland, OR 97204
(503) 725-4617

Hermiston Public Library
235 E. Gladys Avenue
Hermiston, OR 97838
(541) 567-2882

Mid Columbia Library
(Kennewick Branch)
1620 S. Union St.
Kennewick, WA 99336
(509) 586-3156
or 1-800-572-6251

Umatilla Community Outreach Office
245-B East Main Street
Hermiston, OR 97838
(541) 564-9339

Will there be public meetings or public hearings?

The Environmental Quality Commission will be having a special meeting about UMCDF on August 18, 1999. The meeting will be held at 811 S.W. Sixth Avenue, Portland, Oregon, Room 3A, and will begin at 10:00 a.m. with a presentation by the U.S. Army concerning the Army's plans for the Dunnage incinerator (one of the five furnaces permitted for UMCDF). The work session on UMCDF carbon filtration technology will be held from 12:30-3:00 p.m..

Persons on the DEQ's Umatilla mailing list received the August EQC meeting agenda with this Chance to Comment Form. If you did not receive an EQC Agenda for the August 18 meeting please contact the Hermiston office of the DEQ at the number given above.

Where do I send my comments?

Written comments should be presented to the DEQ by 5:00 p.m., September 20, 1999. The mailing address is Wayne Thomas, Umatilla Program Manager, DEQ – Hermiston Office, 256 E. Hurlburt, Suite 105, Hermiston, OR 97838.

Accommodation of disabilities:

Please notify DEQ about any special physical or language accommodations you may need as far in advance of the meeting or hearing as possible. To make these arrangements, contact Sylvia Herrley at 1-800-452-4011 (toll free in Oregon), or at (503) 229-5317. People with hearing impairments may call DEQ's TDD number at (503) 229-6993.

Accessibility information:

This publication is available in alternate format (e.g. large print, Braille, Spanish) upon request. Please contact DEQ Public Affairs at (503) 229-5317 to request an alternate format.

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99-1245

EQC Agenda

Environmental Quality Commission
Special Meeting

Umatilla Chemical Agent Disposal Facility

August 18, 1999
10:00 a.m. to 3:00 PM
MEETING ROOM 3A
DEQ Headquarters
811 S.W. Sixth
Portland, OR 97206

Time	Agenda topics	Presenter
10:00 a.m.	Introduction	DEQ
10:10 a.m.	Dunnage Incinerator	U.S. Army Program Manager for Chemical Demilitarization
11:00 a.m.	Question and Answer Session	EQC
11:30 a.m.	**Lunch break**	
12:30 p.m.	Introduction	DEQ
12:35 p.m.	Application of Carbon Filter Technology to Stack Emissions	National Research Council
12:55 p.m.	Current Design of Carbon Filter System at UMCDF	U.S. Army and Raytheon Demilitarization Company
1:15 p.m.	Carbon Filter Technology	G.A.S.P., et al.
2:15 p.m.	Question and Answer Session	EQC and all Presenters
2:45 p.m.	Summary Discussion	EQC/DEQ
3:00 p.m.	Adjourn	

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
JUL 23 1999
HERMISTON OFFICE

DEQ Item No. 99-1245 (92.01)

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Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Eastern Region
Hermiston Office
256 E Hurlburt
Hermiston, OR 97838
Phone: (541) 567-8297
FAX: (541) 567-4741
TTY: (503) 229-6993

August 3, 1999

Mr. Stuart Sugarman
Attorney at Law
3430 SE Belmont, Suite 101
Portland, OR 97214

RE: Environmental Quality Commission
Work Session, August 18, 1999
DEQ Item No. 99-1320 (92)

Dear Mr. Stuart Sugarman:

On Wednesday, August 18, 1999 the Environmental Quality Commission (EQC) will be having a special Work Session in Portland, Oregon to discuss the Umatilla Chemical Agent Disposal Facility (UMCDF) under construction at the Umatilla Chemical Depot. Enclosed is a copy of the meeting agenda with the times for your presentation. As you can see, in the afternoon the EQC will be hearing about the carbon filter technology to be used at UMCDF. The purpose of the meeting is to update the members of the EQC on carbon filter technology in general, and on the specific design of the fixed-bed carbon filters to be used at the UMCDF.

On behalf of the Commission, the Department of Environmental Quality is inviting you or your designated representatives to speak to the Commission about carbon filter technology related to one or more of the following topics.

- Current industrial applications of carbon filter technology.
- The effectiveness of carbon filters for reducing stack emissions from combustion sources.
    - Gaseous emissions (such as CO, CO2, SO_2, NO_X, etc.)
    - Other emissions (metals, dioxins, furans)
- Operational complexity of a carbon filter system.
    - Effects on combustion process operation (such as operational shutdowns due to malfunction of the carbon filter system)
    - Conditioning of gas stream upstream of carbon filter system
    - Maintenance issues (such as frequency of filter changeouts due to pollutant and/or moisture loading)
- Safety of carbon filter systems.
    - Risks and consequences of catastrophic failures
    - Safety features to preclude failures

- Waste generation from carbon filter systems.
  - Analysis of spent carbon
  - Disposal of spent carbon

If you require further information concerning the Work Session please contact me at (541) 567-8297, ext. 22.

Sincerely,

Wayne C. Thomas

Wayne C. Thomas
Program Manager
Umatilla Chemical Agent Disposal Program

Enclosure [DEQ Item No. 99-1245 (92.01)]

Cf: Stephen Bushong, DOJ
Larry Edelman, DOJ
Stephanie Hallock, DEQ
Sue Oliver, DEQ

DISTRIBUTION

Richard Condit, ESQ
Mark Niczynski, US DOJ
Lieutenant Colonel Thomas F. Woloszyn, UMCD
Raj Malhotra, PMCD
Jay Bluestein, RDC

ATTACHMENT C

Environmental Quality Commission

Transcript of the
August 18, 1999
Worksession on the
Umatilla Chemical Agent Disposal Facility

(DEQ Item No. 99-1509)

Prepared by

Oregon Department of Environmental Quality
Umatilla Program Office
Hermiston, Oregon

Environmental Quality Commission

August 18, 1999

Worksession on the Umatilla Chemical Agent Disposal Facility

Prepared by

Oregon Department of Environmental Quality
Umatilla Program Office
Hermiston, Oregon

DEQ Item No. 99-1509(92.01)

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Environmental Quality Commission
August 18, 1998
Worksession on the Umatilla Chemical Agent Disposal Facility

(DEQ Item No. 99-1509(92.01))

INTRODUCTION

This document is a partial transcript (prepared by the Oregon Department of Environmental Quality) of the meeting of the Environmental Quality Commission on August 18, 1999 held in Portland, Oregon. The meeting was held as a special worksession to discuss the Umatilla Chemical Agent Disposal Facility (Permit No. ORQ 000 009 431). Agendas for the worksession are included as Attachment A.

After introduction by staff, there was a presentation by the U.S. Army concerning "Secondary Waste Processing at the Umatilla Chemical Agent Disposal Facility." This portion of the meeting is not included in the transcription, although the question and answer session immediately following the Army's presentation is included. A copy of the Army's presentation materials are included as Attachment B.

The National Research Council (NRC) gave a presentation concerning the findings and recommendations contained in an NRC report released August 11, 1999 ("Carbon Filtration for Reducing Emissions from Chemical Agent Incineration") The NRC presentation is not included in this transcription, but a copy of the Executive Summary from the report is included as Attachment C. Immediately after the NRC presentation, a representative from the Army gave a brief presentation concerning the design of the carbon filter system at the Umatilla facility. This portion of the meeting was not transcribed.

[Copies of the audio cassette tapes are available upon request from the Department of Environmental Quality.]

SPEAKERS

The following persons spoke at this meeting:

NAME	TITLE	ORGANIZATION
Carol Whipple	Chair	Environmental Quality Commission
Tony Van Vliet	Member	Environmental Quality Commission
Linda McMahon	Member	Environmental Quality Commission
Melinda Eden	Member	Environmental Quality Commission
Mark Reeve	Member	Environmental Quality Commission
Stephanie Hallock	Eastern Region Administrator (Acting Director for this meeting)	Department of Environmental Quality
Larry Knudsen	Counsel to the EQC	Department of Justice

NAME	TITLE	ORGANIZATION
Wayne Thomas	Umatilla Program Manager	Department of Environmental Quality
James Bacon	Program Manager for Chemical Demilitarization	U.S. Army
Mark Evans	Chief, Operations Team	U.S. Army Project Manager for Chemical Stockpile Disposal
Rick Holmes	Member, Operations Team	U.S. Army Project Manager for Chemical Stockpile Disposal
Loren Sharp	Deputy Project Manager, Umatilla Chemical Agent Disposal Facility	Raytheon Demilitarization Company
Karyn Jones	President	G.A.S.P.
Thomas Stibolt, M.D.	Consultant	Representing G.A.S.P., Oregon Wildlife Federation, Oregon Sierra Club, and other petitioners
Richard Condit	Counsel	Representing G.A.S.P., Oregon Wildlife Federation, Oregon Sierra Club, and other petitioners
Mick Harrison	Counsel	Representing G.A.S.P., Oregon Wildlife Federation, Oregon Sierra Club, and other petitioners
Dr. David Kosson	Chair	National Research Council Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program (National Academy of Sciences)
Dr. Walter May	Member	National Research Council Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program (National Academy of Sciences)
Dr. Kathryn Kelly	Member	National Research Council Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program (National Academy of Sciences)
Don Siebenaler	Study Director	National Research Council Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program (National Academy of Sciences)

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Commissioner Whipple: —Chemical Agent Disposal Facility. I believe there is an agenda in the back of the room, as well as some materials. I expect you all know, but I would remind you that we are here today to take in information, basically to be listeners today, there is no scheduled, nor will there be any action taken by the Commission today on these issues. I'd like to introduce the members of the Commission. To my right, Linda McMahon and Tony Van Vliet, to my left Mark Reeve, and we are expecting Commissioner Eden.

Also with us today from our staff, Larry Knudsen, Legal Counsel for the Commission, Stephanie Hallock, the Acting Director for today, and Kitty Purser, the official recordkeeper for these events. We're going to move right into the agenda, I'd like to again welcome all of you today. I know there is certainly a great deal of interest in this topic, and I recognize a few of you folks in the audience. Particularly I would like to welcome Commissioner Dennis Doherty from Umatilla County and Commissioner Dan Brosnan from Morrow County, as well as the rest of you folks. We will have a question and answer session at 11:00 following the dunnage incinerator presentation. That is largely for the Commission to be asking questions. We will, if, depending kind of on our time schedule, we intend to break at 11:30 and then re-open at 12:30. So, all that being said, I would like staff to present the topic for the morning.

Wayne Thomas: Good Morning Madam Chair, Members of the Commission. I'd like to thank the Commission for taking the time to hold this special worksession for the Umatilla Project specifically on the issues of the Dunnage Incinerator and Carbon Filter Technology. For the record, my name is Wayne Thomas. I am the Manager of the Umatilla Program, located in Hermiston, Oregon. With me is Sue Oliver, Senior Hazardous Waste Specialist, and the lead staff person for the Dunnage Incinerator question.

This morning we will be hearing from the Army and its contractor on the Dunnage Incinerator issue. On August 18 of 1998, exactly one year ago, the Department was notified that the Army was considering removal of the Dunnage Incinerator from the permitted design for Umatilla. The Department and the Army have had several meetings on this question and in May of 1999 we were advised by the Army that they would reach a decision on this question by the end of July of this year.

Based on our discussions with the Army, it appears that, it is our belief that, the Army has limited its mission to destruction of chemical warfare agents, and incorrectly assumes that wastes produced from demilitarization processes is something that can be taken care of later. This kind of thinking has resulted in the innumerable sites around the nation that now require costly clean-up and restoration, usually after significant environmental damage had occurred. The Hanford experience for the local community is always at the forefront of our thinking and we do not want to re-create that situation at the Umatilla project.

Oregon has consistently informed the Army that treatment of the chemical weapons stockpile must include treatment of all agent-contaminated wastes generated during stockpile, maintenance, processing, and closure operations. The Department's stated position has been that the Army must have an acceptable on-site treatment methodology for all secondary wastes prior to the start of thermal operations at the Umatilla project. However, given the current schedule, and the Army's lack of progress in resolving the secondary waste issues, the Department recognizes that this position may cause a delay in the start of disposal operations, which may result in increased risk to the community from continued storage.

At the June 25th EQC meeting I advised the Commission of the Department's concerns regarding the dunnage incinerator and secondary waste and at that time the Commission requested that the Army come to you today and present a briefing on the status of this question. Representatives from the Army and the Raytheon Demilitarization Company are here today to provide that briefing and I believe propose a strategy for management of secondary waste.

Commissioner Whipple: Thank you.

> [Transcription note: The meeting then progressed with a presentation by the U.S. Army concerning "Secondary Waste Processing at the Umatilla Chemical Agent Disposal Facility." Mr. James Bacon (U.S. Army Program Manager for Chemical Demilitarization) introduced Dr. Theodore Prociv, Deputy Assistant Secretary of the Army for Chemical Demilitarization, who was in attendance at this meeting, although he did not address the Commission. Mr. Bacon's introduction was followed by presentations by Mark Evans of the Chemical Stockpile Disposal Program and Loren Sharp of the Raytheon Demilitarization Company. This portion of the meeting is not included in this transcription. A copy of the Army's presentation materials are included as Attachment B.]

Commissioner Whipple: [After completion of the Army's presentation.] Thank you very much, all of you. I would like you folks to stay where you are and have the Department, Sue Oliver and Wayne Thomas, to come up a little closer. I would also like to note that Commissioner Eden has joined us, courtesy of probably Horizon, which may explain a thing or two. I guess, I think we are ready to enter our question and answer phase. I think I'll ask the first one of staff and then open it to the Commission. Is this, the presentation that we've had this morning, are you familiar with this, have you folks had an opportunity to discuss some of these things particularly or is this your first cut at this?

Wayne Thomas: This is Wayne Thomas. We have seen the presentation earlier this week; we have not had a real opportunity to review it in the detail that I would like at this time. We have had the opportunity to do a preliminary review and we were aware of what was going to be [unintelligible word] today.

Commissioner Whipple: O.K. Well, I think, let's hear from the Commission.

Commission Van Vliet: Madame Chair, I have a question [unintelligible]. Is this considered a Permit Modification or a complete change in the permit itself?

Larry Knudsen: At present, we do not have either in front of us, but we are talking about the potential for a Permit Modification.

Stephanie Hallock: Madame Chair? I think that one thing that I would like to get clarified if able to do it at this time, it's a little unclear to me from the presentation what particular technology you are considering? Is it one that, if I am understanding you correctly, you will be experimenting at JACADS and you are inviting us out to see it, are you able to tell us any more about it, or is it when the Permit Mod request comes in that we actually see what it is? Because, I think, for those of you who have been through this process with us, there will have to be review by our folks in terms of what kind of analysis of that technology our law requires that we do, so obviously the sooner that we know what it is the earlier we can get on with it.

Mark Evans: Sure. What the Army is proposing is a parallel path while we maintain the DUN on hold, because we know the DUN will work and we know the DUN is permitted and will meet its permit requirements. While we go ahead to develop, and these are all thermal systems, these are not alternatives of that type, where alternatives seem to carry magic meaning to some folks. For instance, if you look at charcoal its really using the deactivation furnace system, which is already permitted to handle certain waste, putting in a different kind of feed gun into that system to allow us to introduce the charcoal into that system as well. That's how we achieve a capital cost reduction, the furnace is already paid for, the Pollution Abatement System is paid for, the Filtration System at the back end is already paid, for a relatively minor capital investment we can expand the use of that incinerator system.

For the DPE suits, the system that seems to have the most promise, is relatively low technology, it's an actual extrapolation off the autoclave technology which elevates the temperature to drive off organic compounds from contaminated surfaces, and that's basically what the unit will be comprised of. At this stage, to do things the way that the State of Oregon has a clear preference to do, I would like to be able to lay processing data on the table and someone has to make that evaluation as opposed to an engineering extrapolation. We certainly have an engineering extrapolation, and we would certainly be willing to share all of that information, but prior to the Army even making the decision that it does or does not wish to request a permit modification we really need to get that kind of data into hand.

In addition, I think our program experience clearly teaches us the risks of making economic projections at this early stage of the development of a new approach. I think we need to field this and see does it or does it not truly deliver the return on investment prior to making that decision.

Commissioner Whipple: Thank you.

Mark Evans: You're welcome.

Commissioner Van Vliet: How much of the current Dunnage Incinerator would you be starting now anyway if you developed a new system?

Mark Evans: Would that be [unintelligible] sure I understand the question. Would we go ahead and install the DUN? We would have to go ahead at this stage to make the decision to install the large unit and the Pollution Abatement System. If we went forth with the DUN at this stage, as opposed to leaving it on hold, we would in fact have to put the whole unit in. We would have to make the capital investment to do that, given the procurement lead times and the time to takes to install and test the unit, which is why this is a very important time for us. Once we cross that particular threshold and make the capital investment to do it, since there is no compelling risk driver in either direction, our intention will be to move forward and use that unit even though we may be pursuing different approach elsewhere, so we're kind of at a very important point in our evolution. Is that the answer?

Commissioner Van Vliet: Yes, that's a fair answer. Is Raytheon right now on target and on budget? Is there any cost over runs right now running on the project?

Mark Evans: I believe the best answer to that is, yes, there are some cost issues we are working to resolve and most of those deal with our method for incorporating lessons learned from our Johnston and our Tooele Facility. We budgeted anticipating lessons learned, and where we have a lot of lessons that we learned, we incorporate. The question became our ability to timely incorporate those lessons and how far along in construction we got before those lessons came to bear.

That's really the cost challenge that we have. The budget we have for incorporating the lessons is adequate, potential breakage to the construction program, i.e., re-working of work that we may have done is leading to some of the cost issues that you have probably read about, and that's our challenge today is working the best business answer for incorporating those changes. Which changes do we want to do now, which changes do we wish to defer to systemization, which in some cases makes sense—we're going to be testing the unit with multiple end effectors, why spend the money to do the end effector test today, when I know we will be changing it in a year from now, and which changes might even make more sense to implement during operations, and there are some which fall into that kind of category.

Commissioner Van Vliet: Well, not considering the Dunnage problem at all, right now at this point in time, are they on target and on budget?

Mark Evans: We are within our programmatic life cycle, which is different than their contract cost. I am not trying to dodge the question, I'm trying to be very direct. There's two dollar figures—what we have on the contract with them, and how much Mr. Bacon budgets to actually execute the job. So while there may be a change in contract value, right now they are within how much money we had anticipated we would spend for change incorporation.

Commissioner Eden: I believe it was Mr. Sharp who said something about what happens if the alternatives to the DUN don't pan out, then we are in the year 2002 or 2003, what happens to our project here in Umatilla if the alternatives don't pan out?

Mark Evans: Let me first address the schedule. I don't believe we will actually be out in 2002 or 2003—

Commissioner Eden: I was just going on what you had on your slide.

Mark Evans: Well, that's the timeline when we would submit certain things. That's why I said, that's to submit a permit modification if a permit modification is necessary. If for instance the initial JACADS processing data on carbon indicates that the system is certainly not delivering what it had been designed to do, we can move forward to implement the DUN. We would be able to do that in advance of that schedule, that's when we would be able to go through our change management process, which adds some time, before we make a decision to submit a permit modification.

Commissioner Eden: And what effect would that have on the schedule to begin burning here?

Mark Evans: If there was a requirement to have the Dunnage incinerator installed and tested, prior to commencement to agent operations it would delay that agent operations.

Commissioner Whipple: Excuse me, but isn't that sort of—kind of where we are now anyway?

Mark Evans: Yes it is. We are at the stage now, do we move forward to install the Dunnage incinerator or not, that's why this is a very important time for us. But I would like to emphasize that the decision not to install the Dunnage incinerator today is not a decision as to whether or not the Dunnage incinerator is going to be used. That is not the issue I believe we face today. The issue is do we install it today or do we allow it to remain on hold for the alternatives will mature so we can make a decision based on demonstrated data as opposed to engineering projection, that's what we are after.

Commissioner Van Vliet: You mentioned that one of the downsides was the doubling of the tonnage of carbon that needs to be destroyed, up to 782 tons, what's the increased risk factor by storing that amount?

Mark Evans: We have looked at that. It's not doubling how much is going to be destroyed, it's when it gets destroyed—it gets destroyed during closure. Given the contamination experience in the half-life of agent on charcoal that we experience historically this is a minimal to no risk impact issue for us. Because they are going to have to download it and handle it anyway. If you look at the actual restriction on multi-agent processing it's going to have to go to storage at some stage anyway and come back out of storage, minimally six months to a year or later.

We have looked at that, we have looked at how agent and carbon behave with one another, there should be no public, or worker risk increase based upon that extension. Now of course, we need to finish developing the method and nailing that down to a greater level of definity so we can submit an updated quantitative risk assessment and we are not yet at that stage.

Commissioner Eden: Here is a simplistic question: Why can't we just burn it as we go along?

Mark Evans: Burn the charcoal as we go along? It's a very interesting issue that comes up and that is that the charcoal that we are primarily taking about comes from the building ventilation system, it's not done its useful life, we're actually going to be changing it here to comply with the literal provisions of the permit before it's even done its useful life and we will take it out at the end of each agent campaign. Here is the issue, I am at the end of a GB agent campaign, I have charcoal with GB on it I have to take it out, I can't multi-agent process it so I can't process it during the next campaign which is VX, I have to wait until the next GB campaign comes along. If you go through the leapfrog of the order of campaigns, that's what ends up to us not, quote, processing as we go along. PPE, we would hope that we could process as we go along, I think you saw that from what we talked about only the PPE for the first campaign would still not be that way, all the rest we would process as we go along.

Commissioner Reeve: Madame Chair? What's happening at Utah right now?

Mark Evans: [break in recording] —they're actual agent-used protective ensembles from TOCDF. So some of those suits from our Tooele facility actually go to this unit that we're testing in Tooele to verify that it works. So far, the test data looks very promising and those suits can be processed into a landfill at that stage. Wood, the gross majority, ninety-eight some odd percent of our wood is not contaminated wood. We have a landfill on the Tooele Army Depot we're size reducing it, chipping it and landfilling that wood on Depot, so that's what's happening with current waste-handling practices at Tooele.

Commissioner Reeve: So the DUN is installed but it's not being used?

Mark Evans: Correct.

Commissioner Reeve: What is the intent in terms of using the DUN there?

Mark Evans: We do not intend to use the DUN.

Commissioner Eden: Why don't you just take that one and bring it over here?

Mark Evans: We have talked about that and actually, we would probably bring you the DUN that's sitting outside and inside Anniston, Alabama if the issue became to expedite the delivery of the Dunnage Incinerator, and that has been taken under consideration [unintelligible] Ideally—we've even talked about bringing in the one out at Johnston Island, taking it out. Because that's a different type of constructed facility, it's a steel panel building as opposed to a hardened concrete facility, so maybe extrication would actually be easier at JACADS. We think that if the decision was made that we must move forward with the DUN, we will bring the DUN from Anniston.

Commissioner Reeve: Would that have a significant impact on the cost savings?

Mark Evans: We've taken the cost—that into consideration in our economic projections. We look across the entire program and right now, we have one DUN, if every site, and we are going to do this at every site, and each site may have some different preferences on how they wish to move forward. Right now, we have the DUN in Alabama; we are prepared to use it in Alabama if the preference there is to use one in Alabama. We have one on order for Pine Bluff, we can move forward to do that as well, so we have several options, but we do have the DUN in Tooele.

I would hope not to extricate that from the facility. I would find it difficult to believe that that would be the best cost decision from a program perspective, given the [unintelligible]. But then again that Dunnage Incinerator has never seen agent operations either. It does have about 30-40% of the modifications we want to put into the DUN already installed, so we have thought about that.

Commissioner McMahon: We have been talking a lot about risk and money, and I understand those are important considerations, and the idea of flexibility is the one that the Commission has often embraced as important. I think what's troubling me right now and I know we aren't making any decisions today, is that this isn't a usual issue that we deal with, this is an issue of extremely high public visibility and volatility and uncertainty makes our job really really hard, so—that's—how do we address that problem of uncertainty and even with a great deal of public involvement, how does that keep the waters quiet while we go around looking for alternatives, whether there is a risk or not is almost—is much lessened in that kind of environment.

Mark Evans: That's a great question. That's why to us—the first thing—the standard that has to be met is a compliance schedule with rigor. If there is not a compliance schedule with rigor, with teeth, then we shouldn't embark on this path. Because that is the answer, to some degree, of risk control, risk management that we share with the State, not just the Army and that's why it was very important when we came up with milestones to tie to. I can quote a million milestones out of our systemization program that really don't have a lot of meaning to us. We can not possibly execute the program without those critical milestones, tier one, two, three, or four. Those are absolute critical path activities towards the destruction of the first campaign's worth of munitions.

The easy answer that the Army could have made is to install the DUN. That would have been the easy answer, and I think the fact that that you know that we're here tells you 13 million to 20 million dollars is real money, and it's not money that we want to spend unless it is really the best answer and at this stage its absolutely a workable answer and a compliant answer, but there are things that appear to be equally compliant and a heck of a lot less expensive. And it's on the horns of that dilemma that we find ourselves. We think there's a way to satisfy both and that is what we are really trying to achieve.

Commissioner Van Vliet: What was Congress' response to the expense of this program?

Mark Evans: Mr. Bacon would probably be the best one to address that.

Mr. Bacon: Obviously Congress in each year as the appropriations passed, expressed concern for the high cost of the program, it is a 15 billion dollar program, about 12.3 of which is for our chemical weapons stockpiles at the eight states, at the eight sites in the United States and the one on Johnston Island. The other parts are what we call non-stockpile in which we remove the binaries, the binary weapons, out of Umatilla and other former production facilities, etc., and the other component is the CSEPP Program, the emergency preparedness managed jointly by the Army and Federal Emergency Administration.

The short answer is, Congress is concerned about the high cost of the program, and in fact the language for this year, the '00 bill, asks, directs us to evaluate alternatives, methods, shouldn't use the word alternatives that's not in their language, but evaluate ways to reduce the cost of the program and be more cost effective. So we are continually undergoing that rationale in doing that and now we have a report that will be due to Congress next March, March 2000, addressing the very point you asked.

Stephanie Hallock: Madame Chair, may I ask a question? I would be curious to know the kinds of conversations that you had in Utah when you decided not to use the DUN at Tooele and also the kinds of conversations that are going on at Anniston and Pine Bluff and sort of where those conversations are?

Mark Evans: Sure. The decision not to use the DUN in Utah, it really didn't even require a permit modification at this stage of given the interpretations of our disposal options under the existing permit language, we did talk repeatedly with the State about what we were or weren't doing with wood, PPE, things of this type. Utah is a unique location as well because of the location of CAMDS, which is our pilot facility where we can test things so when we put the thermal destruction system, the autoclave next generation, for protective clothing in there, they permitted that, they recognized that this will have potential long-term benefits with them for coming up with a method.

It really is always an issue of what is the best economic decision given the disposal restrictions and requirements in each particular state. In Alabama and Arkansas we are going to be doing something very similar to what we are doing here, which is saying, here's what the choices are that we really are faced with. We are absolutely committed, if the sentiment is to move forward with the DUN, we'll install the DUN. We do think there are ways to save money and achieve the same end state that we think are legitimate and it's a legitimate point of discourse, but it's very early in that discussion process.

Commissioner Whipple: Mine's going to be simple. I guess one of the things that's kind of sticking in my mind, is, we're talking about the Dunnage Incinerator, which I think is one of five furnaces that would be at Umatilla, and now we are looking at doing something so we don't have to install the fifth one. But in your discussion of what those technologies may be it sounds like really they're not truly the alternative as we have come to understand alternative technologies in this arena. So now we are thinking, well, essentially let's just burn what we have in one of our existing incinerators. That does not strike me as a particularly creative solution at this stage in the game. Why are we so slow to come around to say, gosh why don't we just burn it up in something we already have?

Mark Evans: The process, actually, the burning part of it isn't the complexity that we are going to deal with, it's putting the carbon into a form that combusts the way we'd like it to. There's a micronizer, it's a mill, for lack of a better term, that grinds it, to deliver the particle size that we are talking about using in this system. At this stage of our maturity of our lifecycle, we keep abreast of what is going on in our, I'll put it in quotes, more "creative" world of alternatives. But to truly achieve—when we have a system that we know is totally environmentally compliant now, designed now, I am not necessarily in the market for creativity per se, I mean, I can implement what I have, unless there is another advantage to the process. Is it safer, is it more compliant, is it substantially less money while being as safe as well as environmentally compliant and that is what you are watching us go through is that kind of thought process.

The advantage of using one of the existing incinerator systems, is that it may not be creative technologically, but if you look at where the program was eight years ago when we proposed the DUN and where we are today, it is from a waste management perspective, different than that which we originally thought. Trying to capitalize on the fact these systems may have capabilities that we had not originally intended before. I tend to think that this demonstrates a degree of management creativity as opposed to technological creativity. We do keep abreast though, we do, we pay attention and I'm sure if something was suddenly to emerge that was, that met, the same degree of standards and could demonstrate a return on capital of this way, I'm sure we would want to talk about it, but given the key word in the State of Oregon is demonstration.

The unit at JACADS has not been demonstrated with surrogate waste, it's a [unintelligible] waste, the same contamination levels we have here in the same kind of plant we have here. It's going to create an unparalleled opportunity for direct extrapolation here. It really gives us a good opportunity to shake it down so that what gets put here, whatever it might be, the DUN, be it something else, is a truly demonstrated unit on the actual waste that we process.

Stephanie Hallock: Madam Chair, may I ask another question? Is there any relationship between the discussion that we are going to have this afternoon on carbon filters and the decision that you might make with regard to the DUN and disposal of waste?

Mark Evans: Let me answer that very directly. No, and here's why. The Pollution Abatement System Filtration System is an additional environmental or safety safeguard added into the system. We talk much differently when we talk about maximum protection when we are talking about systems which were installed primarily from that perspective as opposed to something like this. This discussion is really a business discussion as to what's the best business answer to meet the same set of standards. That discussion's going to have a much different flavor.

Commissioner Eden: But wouldn't the carbon filters left over from a Carbon Filter Pollution Abatement added onto the end of the abatement system be disposed of in a Dunnage incinerator?

Mark Evans: Or an alternative, absolutely.

Commissioner Eden: I'd like to follow up on the cost issue. I am having trouble understanding why it would cost $30 million if you already have a Dunnage Incinerator or two sitting around some place, I understand there are costs associated with installation and operation, but we're not talking about $30 million if you've got one you are not using some place else.

Mark Evans: For instance the Pollution Abatement Filtration System, the PAS filters which we're talking about, are not procured, that's not a sunk cost we've made yet. The pollution abatement system itself, the quench tower, the baghouse has not been procured yet. So we still have all those capital investments, we have the modifications to the Dunnage incinerator, which we will make to allow it to be optimally reconfigured between the multiple modes that it has. Before we are finished we are going to spend some serious money on that particular unit.

Also given the way that the DUN is integrated into the facility we have a relatively big testing program we do to test all of those integration points before we are finished we are probably looking $30 million. We are pretty confident on that number. At one site the number might $26 million because of the capital cost of DUN itself is about 4 million, so one site may be at 26 million dollar number, that would be Anniston, Umatilla or Pine—

Commissioner Eden: That was the answer to my question. What was the capital cost of the—

Mark Evans: —of the unit just in and of itself.

Commissioner Whipple: If I can step in here for just a minute and ask—we're not ready to stop this conversation, but I think about a seven minute break is in order, so we'll re-convene here about 11:05.

[Break]

Commissioner Whipple: Good morning, I'll think we'll reconvene here. We'd like to spend a bit more time with questions for the folks on the panel, including our department staff. Unless someone else has a burning question, I'd like to ask a couple of questions of Wayne. Where do we go from here? I mean, I think there's a clearly, I sense there are a lot more technical questions that the Commission would like to ask these folks while they're in front of us, and we certainly will. I wonder if you could give us a flavor, procedurally, for where we are. I mean, we don't have any specific request in front of us at the moment, so—

Wayne Thomas: That's correct Madame Chair. As I interpret what the Army is proposing today, this is a concept that they would like the Department and the Commission to consider. Prior to them developing a permit modification. A permit modification is the instrument that the Department and Commission will act upon to make a decision. At this point, I think the proposal needs considerable review by staff. There are many questions that are unanswered from our perspective. One thing that I noticed in the tiered approach that was laid out is all based on the submittal of items, not approval of items, by the Department, that has significant impact on schedule and the Commission's involvement with those Class 3 Permit Modifications that would be necessary.

My recommendation, if I can make one at this time, I think that we need to meet with the Army and their representatives and explore what they have presented here in more detail and try to fill in some of the blanks. There are a lot of questions that I think need to be asked yet. At this point it is very preliminary for us to make a recommendation either way on whether this is an [unintelligible] approach that we would [unintelligible].

Commissioner Whipple: Thanks. How about any more comments from Commission members?

Commissioner Van Vliet: Yes. I was interested just from the standpoint of having worked in wood, huge piles of materials we are worrying about spontaneous combustion. You get 782 tons of carbon filters piled up, is there any indication, or any study at all, of spontaneous combustion in those kind of piles?

Loren Sharp: What we have experienced on JACADS, and I believe we would see the same thing here, when you take these charcoal trays out of the filter units they're about double their weight in humidity that's been absorbed on them. I would expect the same type of thing, so we end up with essentially two trays and a 110-gallon drum with both trays being double-wrapped in plastic and the barrel is also double-wrapped. We have stored about 127,000 pound on the island, with no problems at all that have developed. That's the best answer from the JACADS experience

Commissioner Van Vliet: The reason I ask, my experience with wood chip piles is with high moisture content is you get spontaneous combustion on it and why wouldn't that also be true in some of your carbon?

Mark Evans: I can tell you sir that we have looked at that as part of risk bounding, to see how this material would behave over a long period of time, we are talking about several years of storage. So far there is no data to indicate that this particular waste, given its characteristics, would actually demonstrate that. You're right, we looked at mulching, things of that type, absolutely, particularly underneath where there is an oxygen-deprived environment and then you suddenly get oxygen introduced, there is some history with that, but this particular waste stream, given what we understand of its characteristics our assessment would not indicate that that has a likelihood of occurrence.

Commissioner Eden: Madame Chair? Now, are we just talking about the 782 tons that would be stored? That's the carbon filters from the ventilation system, right?

Mark Evans: That is all part of the filtration, to include the PFS units themselves as well, the carbon from that, so it's not just the building ventilation system.

Commissioner Eden: And what are you going to do with it on JACADS after you figure our exactly what you are going to do, you are going to do something with it?

Mark Evans: Sure, right now we have something called the micronizing burner, that's what you see is the "CMS," it's a Carbon Micronization System. Micronization is the process that is up front of the burner, it's what actually takes the charcoal—we use a coconut charcoal mix—to pulverize it to the size that we want, introduce it with JP5, which is the fuel of choice on Johnston Atoll, given what we have available on the Island, and burn it in the rotary kiln, the DFS. That's what we are proposing to go forward with as part of our closure initiatives on JI, Johnston Island.

I Just want to note that that is one of the best, the primary concept that is under exploration for carbon disposal. We would pursue that while maintaining the DUN on hold. That's why, if you'll notice, the tiered structure, at any one moment of those tiers, the DUN can emerge as the answer, in which case we do not have to proceed any further. Once we're going to make that capital investment, we're going to make that capital investment, and that's why if you notice, the topic of most folk's interest is the DUN, and we've come here to talk about secondary waste and the tier is actually laid out to go down each secondary waste type and at any one of those tiers the DUN could emerge as the answer. I don't consider it necessarily to be highly likely but its certainly is possible that it could. But that's what we're talking about doing at J.I.

Commissioner Eden: Now, is the only reason you don't like the DUN is because of the expense?

Mark Evans: Yes, $30 million, when we have alternatives that are sitting at half that dollar figure, that's real money.

Commissioner Eden: Thank you.

Mark Evans: You're welcome.

Commissioner Van Vliet: Coming back, you are still talking about incineration no matter what whether you use a new technique, why was not the rotary kiln approach looked at originally if it was a much better approach today, because that's not exactly new technology—

Mark Evans: —No it is not

Commissioner Van Vliet: —so when you are looking at this, is any of the DUN incinerators worked at all, have they been in operation, do you have any running data on any of the DUNs?

Mark Evans: Yes, we operated the Dunnage Incinerator at Johnston Atoll, disposing of wood. We never put it into its exclusive charcoal mode, we put it into a co-processing configuration, that's relatively different. That's given us some good insights to what we would do differently as we would go forward to implement it here. We also did some preliminary testing to show out some of the modifications had worked at Tooele prior to us looking at the dollars are not supporting us doing this, there are cheaper alternatives for us to do here. But, I want to come back to your primary point. This is still incineration, this is not something other than that. It is using the deactivation furnace system.

Now the reason we did not jump on it earlier was the dollars were against it in terms of where we could house the unit, the micronizing unit. In fact the cost estimate used to be about twice that which it is today and then the JACADS team came up with an innovative location. If you do it during closure you can put the unit in a place where we can't put it if we do it co-processing or processing as we generate it, quote unquote. That reduced the cost by half and suddenly there emerged this a very attractive option, and that's what's changed over time. The original concept of where we would house would be very expensive. Housing it elsewhere in the facility drops the cost substantially.

Stephanie Hallock: Madame Chair, may I ask a question? If you haven't taken operation of the Dunnage Incinerator through all of its paces that it designed to do, then how come you are able to conclude at this point, given sort of the unproven nature of some of the other things that you are trying, that a) one is going to work as well as the other and b) that you are really going to save all that amount of money?

Mark Evans: Well, the dollar savings—the alternatives are going to be relatively well tested on the specific waste streams that they have to do. So that part of the projection we are relatively comfortable with. The wild card in the DUN cost is how much money from the equipment enhancement and modification there is, if you look at that $30 million there is a placeholder in there for that kind of work. We need to recognize though—the DUN—while we did not put the JACADS DUN in its final ultimate charcoal configuration, that configuration was actually the configuration tested at out CAMDS facility which exclusively had a charcoal configuration. So we had that test data to draw on, we had the JACADS test data to draw on, so we are fairly comfortable we can extrapolate relatively accurately for that.

Commissioner Whipple: But the DUN at Tooele is also not doing anything?

Mark Evans: The DUN at Tooele is—no, it is not.

Commissioner Reeve: At the risk of asking the same, question again, why wouldn't the economics at Tooele work in favor of just using what's in place. I mean, I understand the need to analyze other types of processes to some extent, sort of with CAMDS here, you are looking at alternatives for secondary waste treatment, but at Tooele you've got the system in place but it's not being used and it makes me ask again why isn't not being used, why couldn't it be used?

Mark Evans: Sure, when we look at the process we would want to move forward with the modifications with DUN—let's look at the waste streams in pieces. The DUN's multiple waste streams. We don't have the need to process hardly any wood, which is the primary design function, remember I talked about multiple waste streams and what paces the design of the DUN? Wood in many cases is the extreme design case, so it's what paces the design of the DUN; we have virtually no wood that we would need to process there.

Commissioner Eden: Wait a sec. Can I interrupt you there? Isn't there a discussion between you and the DEQ about how much wood there actually would be here?

Mark Evans: It's a permit issue. There will be discussion and dialogue here as to making sure we have common understanding as to the permit requirements as it relates to wood. I am sure that process will continue and it will probably be—as you saw in Tier 1 there is a discussion of a waste analysis and characterization. That's part of what we'll talk about which is why you'll notice we drove all of the—that's a bad word, the issues of potential controversy we put into phased tier one. As you move to the right, you start to move into more technical issues on the tiered schedule. The issue's making sure we have a common understanding of what will and won't be the wood requirement is something we will have to resolve.

The way the laws and regulations are interpreted in Utah we have very little wood that we have to process in a hazardous waste incinerator. Most of it's not hazardous waste so we can do other things with it, and we do. So we take one waste stream, we take it out, now we go get the PPE suits we made a program decision, notice we do not specify in the permit application here that we were going to put those in the DUN, it was listed as an option we could consider as we move forward. So by definition now I have the thermal-destruct system that we are going to try to move forward there.

So now, I get down to what is the best answer exclusively for charcoal. And now that is the issue we talk about at Tooele, we believe that the micronizing burner is a good answer for Utah. We believe the burner itself is not that capital expensive. We're also considering a concept, following up on a question I think you asked, about equipment sharing. I happen to be a big believer in equipment sharing particularly certain types of items. That maybe these micronizers can go from site to site when they are done. If we look at the time lines, Tooele's micronizer could very easily end up somewhere else, assuming that we can show that it is agent-free for shipment. So when you look at that whole package there is some benefits to us moving forward with this kind of integrated approach and that's what is driving the value decision.

Commissioner Reeve: Speaking of time lines, is there a risk or a likelihood that operations at the Umatilla Facility would be extended as a result of going through this process?

Mark Evans: Let's break that into two pieces if I could sir. The destruction of the stockpile itself, no.

Commissioner Reeve: Right.

Mark Evans: Unless a decision is made that requires the unit to be installed and tested prior to commencement of that destruction operation. Assuming that that is not the case the issue would be the duration of closure. That falls under my area of responsibility. We are really looking at the lessons from JACADS as to what becomes the pacing issue during closure, what really drives the duration of closure at JACADS. Is it charcoal disposal? Right now the answer to that is no.

The pacing item's actually our ability to how many toxic entries we can make into the facility in a certain unit of time. That's actually now the pacing item for the closure of the facility itself, so we do track that and we absolutely do track the economics of that as well and what emerges that make sense. If somehow we have magic breakthrough, which I do not anticipate, in terms of toxic area efficiency of entry, perhaps we would come back to it. But if we did we have the option in place today, it's the DUN. And then we would say now at this stage, the life cycle costs now tells us to go to the DUN. Today the life cycle cost don't tell me to go with the DUN.

Commissioner Reeve: Can I re-ask the question though, just in terms of your current estimate. I know that a decision hasn't been made in terms of a possible change to dealing with secondary waste, but if a decision were made in the future, a different system for dealing with secondary waste, not the DUN, is there the possibility or likelihood that closure activities would go on longer then they're contemplated now?

Mark Evans: I don't think that that's likely, again I don't think that this will become the pacing item for closure. But something—it's a point that we all have to keep in our heads that we have a lifecycle program, Mr. Bacon's very clear in communicating to us, it's just not cost savings in '00 and '01, it's across that entire lifecycle in managing that entire equation. So believe me, the questions you're asking are the right questions, and the question that Mr. Bacon asks us all the time, make sure we don't make a good capital decision in '00 that costs us in '02 and '03. Today, when we look at the DUN, the answer is no. JACADS is also going to give us a magnificent opportunity to know what it really takes to close one of these facilities and it's going to be a very educational process as we figure out exactly what—when you go from closure, from a concept, to a tangible fielded operation we're going to learn some interesting things.

Commissioner Reeve: At Umatilla, could the—I understand the DUN has not been procured, could the DUN be procured and in place in time to meet the start of operations?

Mark Evans: We would probably use the DUN from another location, that would be our short-term answer. Whether or not we would—if we want to install the modifications that I believe would be prudent to do, not from a safety perspective, but in terms of process throughput and efficacy, it's going to be very challenging to do. And when someone like me says very challenging, I hope you understand what that means. I can't tell you it's outside the realm of possibility, I consider it unlikely.

Commissioner Reeve: These would be modifications to the DUN itself?

Mark Evans: Yes, to help increase its throughput rate or it becomes even a worst investment. You know, all I have talked about so far is investment cost, the alternatives also look like they will save us over the lifecycle, $4 million in operating cost. And that assumes the modifications I am talking about making, if I don't make those modifications it's going to be more expensive for us to operate.

Commissioner Reeve: So the throughput, in terms of the DUN as it's currently designed, is not what you would like to see?

Mark Evans: No, it is not.

Commissioner Reeve: And you are talking about modifications that would basically increase the throughput of it?

Mark Evans: Yes it would, even though the issue that we are really dealing with is the throughout rate, not its instantaneous rate of production. The permit mod—let me give you an example. Charcoal here is permitted, I believe it's 368 pounds an hour. The DUN will do 368 pounds an hour. The question is going to be, over the lifecycle, the way the DUN operates at JACADS we had periods when we shut it down to extricate the ash manually. That's time that the DUN is not available to be processing, because we have to cool it down, go in, do that, bring it back up to temperature. Therefore, [unintelligible] I'm really not talking about its ability to do in any one hour, I am talking about its ability to do something over a relatively longer period of time. There are things I would want do so that I would want to be able to capture those windows of time, because this facility is going to cost $350,000 a day to operate, and those days add up.

Commissioner McMahon: A question on that, if you've got modifications in mind, assuming that the DUN goes in, do those require permit modifications as well?

Mark Evans: We've looked at those and I believe the answer is yes.

Commissioner McMahon: Would they be minor, major, what?

Wayne Thomas: Those changes would probably not come to the Commission for review, the Department would look at those.

Commissioner Van Vliet: The DUN incinerator, use of words, is attached to Dunnage, but if you process that wood or whatever stream of material you have to go through, really any kind of incineration project could be determined and be called the Dunnage Incinerator, right? And take care of the carbon too?

Mark Evans: Yes.

Commissioner Van Vliet: So why the big change on why the worry about what you put in as long as it works. If you put in a rotary kiln type thing and call it a Dunnage Incinerator, all right. Now I come to my next question. Having been in the legislative process, I am not internally confident that Congress is going to somewhere along the line squeeze down some more on this particular project. If we don't have something in place, do we end up with 782 tons of material out there that become the responsibility of Oregon to get rid of, and in a sense create another hazardous waste situation? If they don't fund you in the year '01, '02 or '03?

James Bacon: That's a good question sir, but the mandate Congress also give us is the closure of facility, the disposal of all chemical agents and related material, i.e., secondary waste, closure of the facility in accordance with permit requirements. And in this case, complete elimination of the equipment and even of the main de-mil building here in Umatilla, in other words, no waste left. We will have to certainly make sure that we meet that mandate [unintelligible] and it's our challenge to make sure that Congress understands that each year as we justify the budget.

Commissioner Van Vliet: Your key word is "understands."

James Bacon: Yes sir.

Commissioner Van Vliet: And the second thing is, as an old budgeter I know that you can leave a lot of things on the book as mandates, but you just don't fund them.

James Bacon: I hear what you're saying. I've heard that term, unfunded mandates, but I'm not sure I know what that means.

Commissioner Van Vliet: I've become aware of those over 20 years of legislative work, but that's what worries me is basically, it should be on track and we hope that Congress understands the gravity of it, but I am not confident that Congress always does. If you don't have some kind of Dunnage facility that will take care of the carbon on-site as part this contractual agreement right now, and there is a withdrawal of funds and you don't get to move around one of those Dunnage Incinerators that you want to move around.

Mark Evans: Let me offer a thought for your consideration.

Commissioner Van Vliet: O.K.

Mark Evans: Part of what we try to do is to give ourselves flexibility. The thermal destruction system that is designed for JACADS is mobile. It's mobile with intent. I am not saying that is the best answer for Oregon, maybe the best answer would be to fit it into the facility itself in a fixed structure, but to give ourselves flexibility it is mobile. We have also looked at the ability of taking the micronizing mill—the only issue that would be totally unique to Umatilla would be the burner, because remember I said JACADS uses JP5, and here we use natural gas. So the burner itself, which is a little less than a million-dollar unit, just the burner, is the issue of capital that really shifts.

If somehow—I don't envision that that would occur, but the right answer may not necessarily still be spending the $30 million for the DUN, but it may be tying into making sure that we have equipment that we can relocate if that does turn out to be the most cost effective answer. I believe, like Mr. Bacon says that we will have the funding necessary to implement this. However, I just offer that for your consideration, that we have things of that type that we try to give ourselves flexibility, in case something that we don't foresee should emerge.

Commissioner Van Vliet: After you are done using such a mobile unit, is there any contamination in that unit left residual?

Mark Evans: We will prove the answer to that is no. I can tell you as an engineer who has looked at the system and its test data to date, I am confident that the answer will be no. But the

Oregon way is to "show me," and I have to run the unit to show you and that's what we are planning on doing. And if we look at the test program we're going to lay out at JI that's part of what they need to demonstrate. The unit is going to have reach that stage because we have to RCRA close it, so its going to have to achieve an agent-free status anyway. The question is, can I do so in a non-destructive way, right, so we can use it again. That's part of what we have to demonstrate.

Commissioner Van Vliet: Well, as you well know, as you start to transport those type of units through States, it becomes quite a degree of gastric juices arising in people's stomachs.

Mark Evans: Absolutely sir.

Commissioner Van Vliet: O.K.

Wayne Thomas: If I could add a comment? The Department was really concerned about this issue and we sent a letter to the Army back in early part of this year. With the pending closure of JACADS we did not want to have equipment magically appear at Umatilla, as a way to close JACADS, that has not gone through a rigorous decontamination process. It would be certified prior to shipment that it had done so. So the Army is very well aware of the requirements that we have in terms of equipment coming from other sites.

Commissioner Whipple: I have a question about—you know, trying to go back and thinking how we got started in all this anyway, in thinking about—of course, the driver being the greatest risk was storage and so one of things I am struggling with and even based on your testimony here today, I haven't heard anything here to alleviate that is that you are talking about things that maybe you are on the closure end, my concern and I think one of the drivers here is in fact on the beginning side of this equation. And I would have to say that it's going to be a very hard sell to me for anything that slows that down. And, frankly I don't think its unreasonable, I still don't think it's an unreasonable request from the State to say "We want the entire process operational before it starts."

So the work, certainly at least part of the work that needs to go on between the Department staff now and you folks, at least for me, is to answer that question. Balancing out what you see as the mature life—you used a phase, obviously I'm not an engineer, but it made sense—mature lifecycle. You're looking at the overall cost, and I understand that, and believe me, I don't want this to cost any more than it should either. But I think you need to understand that in a perfect world, I want to know that that lifecycle is operational from the get-go, and I don't know that I'm willing to tinker with it a lot.

Mark Evans: Let me just offer one thing for a thought as we move forward to work with the DEQ. and that's this. The only waste we can process as we go, that we are talking about changing, that is probably PPE, and that is only for the first campaign. Charcoal is never processed as you go anyway. And that's part of what we need to work out. What really is the tangible change that we are talking about doing, and it really ties to that 390 tons, that's the tangible difference between the two approaches.

Commissioner Whipple: Yes, but to me, the difference is—I mean understanding that maybe necessarily it wasn't going to be processed as we go along, but it was going to be clearly in place how it was going to be processed when we got to the right place to process it. And what I hear us doing now is tinkering with that and it makes me very nervous.

Commissioner Eden: Another way to put that, if I may Madame Chair, is why should the people of Umatilla and Hermiston accept this proposal? What's in it for them? And what's in it for us as so-called representatives of human health and environment in this State? It saves you money and everybody gets a federal tax bite out of their pay, but how do you sell this to Hermiston and Umatilla?

Mark Evans: Let me go through what I believe are the advantages of what we are articulating. Number one, it is as environmentally sound as what we originally proposed so there is no degradation in environmental protection or in worker or public safety, that's a major issue. So those issues are not the determinative issues you are talking about. Two, it is substantially less expensive and that is not just an issue to the Federal Government that tax dollar comes from those folk as well as the people in this room, too. If you look at this upon multiple sites, you are talking, what eleven, fifteen, million dollars, three sites, forty-five to sixty million dollars.

Next, you also have that it is going to be, it will ensure that the best incineration technology that we know is being applied, if the data from JACADS indicates that it has advantages, then we'll implement it. If it doesn't, we will implement the Dunnage Incinerator, but whatever we emerge will be the most demonstrated acceptable method.

One of the issues that you often get asked is, what if something better comes up tomorrow? I don't want to get into pie in the sky of what other people [unintelligible] alternatives, but we know that were going to be testing something in one of our other facilities. It seems to me legitimate to say to the people of Hermiston, if that does turn out to be the best answer we want to be in a position to put that answer here. And that is all we are truly saying today, we want to be in the position to do. If it does not turn out to be the best answer then we're in the position to put the DUN in and use it as the best answer.

That is the answer we have, we understand that many folks, when if comes to a maximum protection program, cost is not the determinative factor. We're not saying it should be, but given all else being equal, it should have a place at the table to be discussed, and that's the position we find ourselves in.

Commissioner McMahon: Madame Chair? I think you just said, sort of, what's on my mind in some ways, but maybe not quite as you meant it. For me, if cost is the only thing we are talking about here, I am not inclined to have the Department tinker too much. If there are other factors that have to do with safety and efficiency in the process way, then I am a little more open, but if it's just cost we're talking about, with an issue of this volatility, I am just not inclined to be real convinced. So I think that that's sort of my advice to you as you work with the Department. You are going to have to do more than cost on this issue from my point of view.

Commissioner Reeve: Madame Chair? Just a few observations. Obviously we're making a decision here and I think it's been very helpful and informative to listen to the proposal and I'm sure the Department and the Army will be talking and working this through. But just a few observations to help guide you, you probably want to know where we're coming from, too.

Where I'm coming from, at least in terms of what I've heard so far, is that I have sort of three main things that I'd like you to take with you as you talk to the DEQ.

The first is an issue that staff has raised, and I think its shared by us on the Commission and that is a sensitivity to the issue of legacy waste or the fact of allowing the secondary waste to be treated and processed "to be determined in the future," we are particularly prickly about "to be determined in the future" of legacy waste issue. So, recognize that that sensitivity is one that is fairly widely shared, and shared by myself as well.

The second point I'd like you to consider and think about is the risk of any of these activities or the risk of talking about or moving down the road to, what would be a Class 3 modification or a significant modification to the Permit as itself posing a risk. Now, usually when we talk about risk we are talking about human health and safety and the Environment. Well, I see a sort of a secondary risk in terms of Department decisions, Environmental Quality Commission decisions, being subject to other actors; and I am specifically talking about judicial review.

Judicial review is itself a risk. That is, our decisions, the Department's decisions, even if they go through public involvement processes; even if they are made in good faith based on the best science available, they are subject to challenge. Any process that sort of re-opens decisions and allows additional challenges, is something that carries risk, and if there is any possibility that that would, that those challenges would delay the start date for processing materials, that comes back to affect the risk to human health, obviously because storage itself is a risk. We are trying to get these materials treated as quickly as we can.

I know you have that in mind already, but its something again that I am sensitive too. Perhaps, my day job as a lawyer gets me more sensitive to that and the fact that judicial process is not a speedy one either. Finally I hope that you will review and take to heart some of the comments that are contained and what we will talk about this afternoon and that is the NRC Report on carbon filtration concerning the change management process, the CMP. The report is – relatively critical of the Army, at least at some other sites, in terms of how that CMP was implemented, the commitment of the Army to really following it, and I think that if you will take that to heart, recognize those criticisms are out there and that it's a respected body that's making them, I think that will serve you well in terms of going through the process with DEQ, and with the citizens surrounding the Umatilla facility.

Mark Evans: Part of my job is to serve as the liaison between the Army and the National Research Council, it's one of the highest pleasures and honors that I have in my job. And we do take very close to heart their comments on the Change Management Process. Part of what drives the tiered schedule to be longer than some may like, is the need to put the time in to correctly and adequately engage the public stakeholders in the decision process. The engineers among us will get frustrated because that adds time to the process, but that is kind of what drives some of the schedule durations that you've seen, and [unintelligible] we've discussed them before, so I think it is a very good note to make and I can tell you we have every intention of following through on the commitments we have made relative to change management.

Stephanie Hallock: Madame Chair, can I add one thing?

Commissioner Whipple: Sure.

Stephanie Hallock: I just wanted to gently take issue or bring to your attention with one thing you said about—in response to the cost questions, that all else is equal. I don't think that, just based on the discussion today, that I certainly feel that I understand the alternative that you would be proposing and that it is in fact equal in terms of protection of human health and the environment, and if you do decide to have a Class 3 Permit Modification proposal or some further discussion with the Commission about it, I think that we're going to need a lot more information rather than you just assuring us that it is equal.

Mark Evans: Oh, absolutely, and we've talked about having a bounding estimate on the risk issue which is why I can say today these things appear to be equal, and the need to get demonstrated data to back up whether the bounding things we put in—bounding estimates by definition have a degree of engineering assumption. I would prefer less engineering assumption, more demonstrated data, to support the position that it takes, but I totally agree with you. Watch our change management process, the first tier it has to clear is the risk tier before we even talk about it from any other perspectives. I agree with you that that burden has yet to be satisfied, it's early in that process, we would have to satisfy that burden prior to us even moving forward.

Commissioner Whipple: Thank you. We're actually, by the clock on the wall, we're along toward quarter to twelve. We probably haven't asked all the questions we'd like to yet, but I think, my question to Department staff would be—you certainly have some sense, I think, of some specific questions relative to the Commission, and what staff responsibilities are, you know well. Do you have enough information to review this and then prepare to reply to us, I guess, or to address a reply to the Commission?

Wayne Thomas: Madame Chair, I think we have enough comments from the Commissioners to enter into a dialogue with the Army on this issue and to report back to you at a future meeting where the Department stands on this question. We will begin that immediately

Commissioner Whipple: Thank you all very much for being here.

[Commissioner Whipple offers a opportunity to County Commissioners Doherty and Brosnan to make comments to the Commission. They both decline to comment at this time. After a lunch break the Commission re-convened. The National Research Council (NRC) gave a presentation concerning the findings and recommendations contained in an NRC report released August 11, 1999 ("Carbon Filtration for Reducing Emissions from Chemical Agent Incineration") The NRC presentation is not included in this transcription (See Attachment C). Immediately after the NRC presentation, a representative from the Army gave a brief presentation concerning the design of the carbon filter system at the Umatilla facility. This portion of the meeting was not transcribed.]

Commissioner Whipple: Now we're going to re-convene. We'd like to hear now from the group representing G.A.S.P., so if you would introduce yourselves, we'll continue on.

Karyn Jones: My name is Karyn Jones and I am here representing G.A.S.P. With me here is Professor Tom Stibolt, and Richard Condit, our legal counsel, and Mick Harrison, another attorney of ours, will be joining us by speaker phone. I want to re-iterate that we are here today because of our concerns over human health, worker safety, and the environment. With that, I would like to turn this over to Tom, and he'll be followed by Richard and Mick.

Thomas Stibolt: Thank you Karyn. I am Doctor Tom Stibolt, I'm a pulmonary and critical care physician here in Portland. I actually have an interest in incineration that goes back about 12 years at this point. I was part of the original Metro task force that was looking at municipal incineration when Metro was considering putting in a municipal solid waste incinerator in St.

Helens. I ended up trying to follow the area, as you know, a highly technical area and [unintelligible] there are a lot of things that we can use all the help we can get on.

My comments mostly have to do with the public involvement process, which I've found somewhat difficult with this particular issue. The original agenda is—we received in the mail said there was going to be no opportunity for comment at all, and then toward the end of last week in the Oregonian I discovered the opposition, whatever group that is, was going to be given an opportunity to speak. I don't feel I'm part of the opposition, I think I am in agreement with what this group is here for, which is to try to destroy these munitions as safely and effectively and as rapidly as we possibly can. Because I don't feel like there is any opposition to that, just questions of making sure the t's are crossed and the i's are dotted.

There have been a large number of groups that have provided comments to this process in the past, both people and groups. Dr. Trygve Steen from Portland State has been involved in that, because of the short notice wasn't able to be here, also a large number of groups including Citizens for Environmental Quality, the Oregon Chapter of the Physicians for Social Responsibility, Oregon Peace Works and other groups have actually been involved, and should be kept involved in this process, because this is a difficult decision you are making. It seems that we need all the help we can get, is not a problem, but is actually helpful.

I also just want to share with you, for twelve years in other venues I have made comments to DEQ on various permit processes and I'm always impressed that what I do sort of disappears into a black hole so I don't ever get any [unintelligible] read my comments, or paid any attention to them, certainly there's been no changes ever in any decisions that have been made based upon them, that I can see, where I notice that industry, the group that is supposed to be being regulated, if they have objections, those end up in large changes that are made in permit requirements [unintelligible] and I think it's something that DEQ and EQC really need to think hard about. And then just finally just point out that the issues brought out by the public over the years really do need to be addressed. There are a lot of comments that have been provided that I think were thoughtful comments about some very important issues that need to be really dealt with. [unintelligible] doesn't mean you stop anything, they really need to be looked at and incorporated if possible.

The two areas that I can think of off the top of my head are the whole risk of incineration that we've learned a lot about, air toxics, and various effects, other than cancer that they have, so those need to be considered. How this device will operate during upset conditions, which are very difficult to measure is an important area, and to ask that you keep the door open to changes that come along as the process goes on. That just needs to be watched until the last of the munitions and all those other wastes generated [unintelligible]. Thank you.

Commissioner Whipple: Thank you.

Richard Condit: Good afternoon, my name is Richard Condit one of the attorneys that has been representing that opposition, along with Stuart Sugarman a local lawyer here, and my colleague on the telephone, Mick Harrison. We represent the Hermiston-based group G.A.S.P., the Oregon Wildlife Federation, the Sierra Club, and a number of individuals that live near, in close proximity to this proposed facility. I would like to acknowledge, given the short time we had to prepare for today's meeting, and with particular respect to receiving the report from the NRC, as you all did just a short time ago. I would like to acknowledge, with appreciation, the help of the Oregon CPR, G.A.S.P. folks, the Chemical Weapons Working Group, and other folks who have contributed to help us to quickly get a handle on understanding [unintelligible].

I'd like to start by addressing how we got here, and I think that's a significant issue because part of the problem is that this whole incineration process being proposed by the Army, seems to happening in a rather haphazard fashion from the point of view of those citizens who are concerned about health and safety. You all—some of you may not have been on the Commission at the time, but the EQC essentially approved a hazardous waste permit for this facility in February of 1997. G.A.S.P. and others then sought reconsideration of that decision in April of '97 and that reconsideration was denied shortly thereafter. We then petitioned for review in the local court here, in the Multnomah County Circuit Court, and that led us into a court process that you are undoubtedly very familiar with.

That court process resulted in a December 1998 decision indicating that the Court felt it did not have authority to second guess you all, given the authority that you have coming from the legislature, but it was concerned that it did not understand where you all stood on the question of carbon filters and their significance in the permitting decision. And so it sent the matter back to you for clarification on that matter, which you are undoubtedly aware of, as you subsequently put together a proposed [unintelligible] order that said although carbon filters weren't the be all and end all of our decision making on allowing incineration to be chosen as the best available technology, they are simply an additional safety measure, and with that the Court recently concluded the proceedings thus far.

But before doing so, it did raise a concern and it was concerned about the fact that there is a lot of evidence accumulated, much of what we submitted, that is based on both new developments overall, and operational history, if you will, of the Utah facility in particular, that we have submitted to the Court and are trying to get the court to address as part of it's review process. And in concluding the proceeding the Court decided to get agreement form counsel for you all that we would have an opportunity to have those issues addressed for you, before the Court would consider them. And of course, one of those issues was carbon filters and whether they are reliable, and whether they were functioning, et cetera, et cetera. So that is how we got here.

We are still troubled by the idea that this Commission has, in the view of my clients, and the folks that I have been working with, and a number of the members from the public, flip-flopped considerably on its attention to carbon filters as being a key component of the incineration system. One only needs to look to the quotes of Henry Lorenzen through the record of previous proceedings of this Commission, to understand that at least from the person sitting in the audience perspective there was pretty much no doubt that carbon filters were the deciding factor, in the view of many in choosing incineration over possible alternatives.

That is a troubling issue which you may or may not decide to deal with. You certainly have provided a clarification, such as it is called, in terms of your new finding and order, indicating less significance of carbon filters. But you need to really understand that you labor under some criticism or concern by the public, given the record that existed before that new decision. I want to talk a little bit about the scope of my testimony today because we are here because the Commission invited us, and because the Commission is focused at the moment on carbon filters only. And although I will make references to some other issues that are very troubling in this incineration program that the Army has, I want you to understand that it is not my intent to have those issues aired here today.

We fully expect that we are going to get additional process to air those issues, as was part of the agreement that I think came out the conclusion of the recent Court process. So again, although my comments may focus on some other matters, I am solely addressing the carbon filter issue for the purpose of the discussion today. Now, the intent of my testimony also needs to be discussed a little bit before we get into the specifics. The folks I represent and work with do not intend to suggest that the DEQ or EQC should reject carbon filter technology as a potentially meaningful method to reduce some of the risks of operating the incineration system.

My client's concerns are not a basis for refusing or failing to provide desperately needed safety systems for the proposed incinerator. However, you will see, based upon review of the evidence at the moment, that the Army does not have a proven carbon filter technology to bring to the facility. If a carbon filter technology is not deployed then some other technology or combination of technologies must be added to reduce or eliminate the impacts of emissions, accidents, malfunctions on public health and the environment. So, the reason I am telling you that is because I want you to understand that we are not opposed to additional safety measures.

We are opposed to being experimented on, that is not acceptable and that is the message we want you to take from the totality of the discussion today. Now, what is the regulatory posture of the carbon filter system in the Army's permit, this is a confusing question to us. Sitting in the back of the room today and listening to the NRC presentation and an earlier presentation, I thought to myself, wow, this is really interesting stuff, too bad it hadn't occurred four years ago. How is it that we are in the throws of construction and a significant percentage of construction being done, and we are still trying to figure out the design for a safety system. I don't understand that. How can that be?

Was the application that Army submitted to the EQC for the permit of this facility originally defective, so seriously defective that we're still talking about options and plans and what type of system and what type of carbon and what the configuration should be? All things that should be well under control by now. It should have been well under control at the time you approved this permit. So I find it very troubling from a regulatory perspective that we are here at this moment dealing with that issue. And, the same goes for the Dunnage issue. It is very interesting that the Army is wanting to reconsider its Dunnage options at this point and time. –

Now, re-considerations in and of itself is not necessarily a bad thing if it's going in the right direction, but it's fascinating that this incineration technology has been painted for years as the mature and only technology capable of dealing with this problem and yet the history of it suggests quite to the contrary. Why do we have hundreds of permit modifications at the Utah facility if it's so damn mature? I don't understand. And you folks need to grapple with that question and figure out where you stand on the maturity and capability of this technology and the continued changes that you are seeing throughout this process. It does not suggest maturity and strong development to me or to many members of the public who would be most affected by the operation of this facility.

And before I leave this area, the question that comes to me is why are we moving forward without a final design on carbon filters? I'm just at a loss, I don't understand this. Now I would like to turn my attention to the National Research Council report presentation and say at the outset, of course, as I mentioned earlier, that we have not had a great deal of time to review this, so our comments at the moment are preliminary, but there are a few, I think, large points that you could take notice of very early. One is, is that it appears that the primary function of the NRC report, which is essentially stated in the report, was to evaluate what the Army had done, really. It's not this far-reaching, independent, evaluative mechanism that's designed to look into all the corners of the literature on the technology of carbon filter beds, and things of that nature and give you some kind of independent analysis.

The NRC was provided lots of information from the Army and reviewed that information and probably looked at a little information on its own, but essentially the NRC is relying on the Army to inform it about the specifics of the carbon filter system that it is considering. So, don't walk away from this proceeding today, or walk away reading this report, thinking that "oh yes this is a wonderful, independent, thorough scientific examination of what the Army is offering. It is not.

Another, sort of, general criticism of the NRC report is that it relies on test burn results than on current operating realities. You've heard the discussion by the chair of the committee about the significance of the test burn results, regulatory concern, et cetera, et cetera, et cetera. What nobody is doing is adequately monitoring or obtaining information on how the facilities are actually operating and especially how are they operating when they have the major problems that they have?

And, one reason not to rely on the test burn results, for example, is that because of problems processing rockets at the Utah facility they have gone to a process where they chop some of the rocket, but instead of draining the agent out entirely, because the agent has congealed or gelled to some extent in the rocket they are burning that large piece of rocket and agent all at the same time. This of course is slowing down the process dramatically Now, when we recently asked Army officials whether or not they did a test burn on what kinds of emissions and other things you get from changing the process of burning rockets and burning the way I just described, the indication was that there were no such test burn. But yet, Utah officials much to the dismay of the public there, have agreed that they can be allowed to do that. You should not be so easy, quite frankly.

The NRC expresses concerns about the alleged risk of the continued storage of chemical weapons and that seems to be, as I was sitting in the back of the room again, something that everyone seemed to agree on. Oh, we just have such significant risk if we continue to store the stuff, that we must rush ahead, we must burn this awful material. Well, that again does not consider the operational realities. The operational realities are that the risk, the primary driver, as I understand it, of the risk of storage is the storage of rockets. Now, if the Utah facility is bogged down in producing rockets and processing them quickly and for example, recent information that I've heard is that they are allowed to process up to 40 rockets an hour and they are presently processing about two rockets a day. That's a very big difference, because of the problems that they have.

So, are we going to, if I assume for a moment, if I agree with you and the Army for a moment, that there is this all-present, pressing risk of storage, from the continued storage of these rockets, am I gonna get there, am I gonna alleviate that risk, by doing two rockets a day? Your stockpile has 105,888 M-55 rockets. If only 10% of those rockets are a problem, like the problem rockets they have in Utah, that would be roughly 10,000, O.K.? If there are just 10,000 that are a problem, and you can only do 2 rockets a day, it will take 13-1/2 years just to do those 10,000.

Now, of course, which you're going to hear from the Army, that this is another lesson learned. By golly, we are learning all the time on this mature technology of course, we are learning all the time, and by the time it gets to your site in Oregon, it's going to be fine. You can't buy that. You can't possibly buy that. You should have proof that it's fine long before it gets here and long before they decide to operate it. At the moment if you look at the Utah facility as the example and if your concerned about rockets getting out of storage then you probably ought to be thinking about an alternative technology to deal with those rockets, because incineration isn't getting the job done in Utah at the moment.

The NRC report refers to theoretical design and configurations of a carbon filter system for the Umatilla facility instead of evaluating a firmly established design and process plan for carbon filters in Umatilla and this is, of course, not the NRC's fault, but they basically had to work with what they had and the Army again, does not have a permanent design, and I won't reiterate what I said earlier, but it seems at this stage of the process that that is a significant weakness and significant problem. Finally, in terms of the overview points let me say that the Army's credibility has seriously been damaged I think by this report. And I am going to read a passage to you, to tell you what I am talking about. If you look at page 47 of the report concerning the evaluation of major design changes. And I have to confess that I had to read this like eight times to make sure that I really [unintelligible] what this said. Let me see what you think.

It says on the bottom of the second column on page 47 it says [quoting] "the Army could consider installing the carbon filter units in accordance with current design and permitting requirements but not loading the filter elements. A PFS without the HEPA filters and activated carbon would be simply an elaborate piece of duct work that would minimize or eliminate the risks associated with operating the PFS, as well as the cost increases and schedule delays associated with removing the PFS." [end quote] Now, I can't believe somebody would write that down.

I can't believe that someone would suggest that it's a viable option that we build a PFS carbon filter system and not operate it because it's going to help us meet the cost, I mean, the scheduling issue. I can't believe that would even be suggested. And I hope that you will certainly not go along with a plan such as that. In the earlier part of today's presentations on the Dunnage, there was all this talk that we're concerned about cost, we're concerned about cost.

You know, to build some elaborate duct work would probably cost tens of millions of dollars and then not have it operate seems to rather fly in the face of being concerned about cost. Moreover, that statement is, from the NRC report, is such a cynical and manipulative statement that it's difficult to comprehend. I think it evidences, quite frankly, a desire by the Army to move mountains if necessary to simply have its agenda to continue, to have incineration continue at Umatilla and elsewhere. And I think that you ought to be wary, based on that statement, of what is to come down the road on this carbon filter issue.

That statement, combined with the evidence of the fluidity, if you will, of design and other important aspects of the carbon filter system at issue for Umatilla, suggests again to me that perhaps there was not an accurate statement made about carbon filters in the Army's original application. And perhaps there haven't been accurate statements made all along about the carbon filters, and I would strongly suggest to the Commission, and the DEQ for that matter, that they ought to go back and look carefully at what they were told and what they've been sold on this carbon filter issue.

And perhaps there are concerns about false statements being made by Army officials in the application to get this facility rolling. Those questions should be seriously examined, I am not saying that they're related, but I'm saying that the unusual nature of the fact that we're here, where we are today, however many percent construction complete and we're still trying to figure carbon filters, suggest to me that they never had a handle on this from the start. That's the overview of the NRC report.

Let me talk about a few specifics that we had time to pull out of the NRC report. The NRC does, to its credit, recognize and is somewhat troubled by, the fact that there are no final plans and that certain risk evaluations have not been completed, and things of that nature. So that is a good point. We are concerned when reviewing the report, with a question of whether or not the Army or the NRC provides evidence that carbon bed filters will reduce the potential dioxin and agent air pollution under normal, upset, and accident conditions. The NRC references and discussions of actual incinerators seem to be limited to carbon injection, which is a different design of the filter, of the filter mechanism or pollution control mechanism than a carbon bed filter. So we are concerned that there aren't a great deal of references in the NRC report to actual experiences with carbon bed filtration. That's something that the Commission and the DEQ staff should be looking into.

One other concern that we picked up in going through the report was that the NRC recommends that the carbon filter bed be bypassed in the case of upsets or accidents. Now, this appears to us to diminish the significance, or importance, or purpose of the filters. And if you have to bypass them when you are in a critical event, then one of the main functions of this additional protection we were hoping to have was, I think, to give us some additional security in the event of a critical event or a serious malfunction. If I'm reading it correctly, it seems to me that the NRC report suggests that the carbon filter system may not be able to handle such an event.

You heard a little earlier about the use of coconut shell carbon beds, and it's unclear to us, in looking at the literature cited, that that would be, that that kind of carbon, would be the best kind of carbon for the carbon filter system. Many of the industrial, current industrial processes that have carbon bed filters use some kind of crushed coal or other type of carbon, and so you should look into that questions, staff should look into that question carefully as to what would be the best, if you go forward with this, what would be the best type of carbon to use.

We were a little concerned that the references used by the NRC to support the carbon filter bed technology were not necessarily as comprehensive as we hoped they would be, or perhaps as current as we hoped they would be. For instance, there is a reference to a 1994 presentation by Professor [unintelligible] about five-stage gas cleaning system as being state of the art technology in Europe, but that same researcher did a more current and peer-reviewed analysis of current technology in 1996, which I don't believe was referenced by the agency. It's a more current document.

In addition, to make the point again about kind of combing the landscape to understand what's possible in terms of pollution control and further protection. We didn't see any reference in the NRC report to current development of any disposal technology at the Department of Energy's Idaho National Energy Laboratory. There is a fair amount of literature and information out there right now about the Department of Energy's effort to deal with the very significant mixed low-level radioactive waste and hazardous waste, waste stream problem, and the information we've reviewed thus far indicates that they are looking at a thermal system with about eight steps in terms of pollution control in affecting the ability of the gases to be as clean as possible.

In addition, their target is to decrease the offgas pollutants to a factor of ten below the regulatory emission requirements. You've heard reference to meeting, or below, regulatory standards, they're specifically targeting to get a factor of ten below in that facility. So when we're thinking of state of art and we're thinking about the importance of the safety of the people living near this facility, we should perhaps be thinking more broadly and more creatively about what might be possible in terms of pollution control and protection [unintelligible] considered by the NRC report at this point.

Appendix F of the NRC report contains a description of, what the NRC even terms, as a briefly considered two alternative filter processes, carbon injection and catalytic oxidation. It's unclear to us from that analysis why one versus the other would be better. There doesn't appear to be a significant enough development of the information of the choice to be made in that Appendix, to go with one choice versus the other, and the staff, or the Commission should look more closely at that information in Appendix F.

Now, what's important about carbon filter system, if one can exist, or some other types of devices to enhance the safety and protection of the public, is that, as I mentioned earlier, we do have real world, not test burn, real world obtainables of the current operation of the Utah facility, for instance, that demonstrate to us that there are other protections that are needed to try to shore up the system. That, of course, also says to us that a technology other than incineration needs to be chosen. But we don't know that you are of a mind to consider that option. So if you are going to consider some additional protections, you need to think about a couple of issues. I mentioned earlier the great difficulty that the Utah facility is having in processing rockets.

In addition, there have been a number some stack alarms at the Utah facility that you may or may not be aware of. The stack alarms from the devices, that are supposed to be capable of detecting agent at fairly small quantities, that tell us that there is a danger, or a potential danger. Those alarms, as you probably realize are very significant not just for the immediate workers in the vicinity, but to trigger emergency response and other types of activities if necessary. What we are learning, in our view, about what's happening in TOCDF is that, the alarms themselves, or the devices that are used to trigger these alarms are—seemed to be inaccurate or seem to be unreliable from our point of view.

When we ask Army officials or contractor officials to explain that certain alarm, the explanation always is "it wasn't agent," and then when we ask "what was it?" the answer is "we don't know." And so what's happening in Utah is that there are significant quantities of some chemical going out the stack, which is claimed not to be agent, and perhaps is not agent, but that its toxicity, or the toxicity of a variety of chemicals if it's more than one, is not known, it is not assessed in the risk assessment, it is not being handled in the regulatory structure. You should not settle for that kind of ambiguity in the system that is going to be set up in Umatilla.

An example of that problem is a March 30, 1998 incident, which some of you may have heard of, maybe not, where during the course of processing MC-1 bombs, a bomb was allowed to go into the metal parts furnace, that had not been completely drained. The device that was used to detect whether or not the bomb had been adequately drained was apparently malfunctioning and there were some bad decisions made by the operators, the people, that were in charge at the time, and the bomb went into the metal parts furnace. It had approximately 70-75 pounds of agent GB in it. Now, to put that in context, the metal parts furnace is only permitted to have very small quantity of agent in any of the metal parts that end up in that furnace.

So what happened was, immediately as the bomb began to be incinerated, there was a temperature excursion of great significance because the agent GB was acting as a fuel and so the temperatures got really hot, so there had to be a quench to cool it down. The duct from the metal parts furnace, that leads to the main stack, had an ACAMS unit in it, one of these units that supposedly detects agent, and it alarmed, and when it was read by one of technicians later on, it basically alarmed off the scale, it pinned the device in terms of how far, of how high it can read.

About seventy to eighty feet from that device are the stack ACAMS, which interestingly enough did not alarm. Now it's only because we have been engaged in litigation with the folks operating, with the Army and other folks operating the Utah facility, that we eventually learned that, interestingly enough, at the time that this event was occurring there was a technician involved in challenging or doing other things with some of the ACAMS alarms in the stack. So there's a question, a serious question, about whether or not those alarms where properly functioning.

Absent those alarms going off, the Army's response was is that no agent went out the stack. Despite the fact, that 70 or 80 feet away, they don't deny that agent was present in the duct work going to the stack. Now, one of the ACAMS alarms was determined to have been saturated by some chemical and didn't go off, for some reason that's unclear to us.

And so, you know, the problem with this incineration technology, and the problems that you are encountering as regulators, are that there are so many pieces of this that have to be done really perfectly, and frankly, aren't being done perfectly. That should cause you enough concern to be thinking about alternatives and thinking about other ways to treat this waste. Because I don't think we can rely on the fact that these devices are going to protect you, give you adequate warning of agent going out the stack, or other things. It just does not seem to be something that we've got the science to really [unintelligible] down well enough.

And so other means of dealing with disposal of agent, that are more closed, and don't involve stacks and things of that nature are probably really critical for you to consider, especially since we seem to still be in the design phase of this facility, given the status of carbon filters.

There are also at the Utah facility concerns about the waste stream, the characterization of the waste stream. There was arsenic for instance in some of the ton containers. There had to be all kinds of testing and re-testing done to determine whether it was just arsenic or whether there had actually been Lewisite, another type of agent, that wasn't supposed to be present in any of these tanks or containers. But in any case there is arsenic that they have to deal with, that they didn't know they had to deal with. So the question of the proper characterization of the wastestream and the materials in the munitions is an important issue for you to consider when you are considering safety systems like carbon filters or anything else or when you are more appropriately considering new technology.

The NRC mentions something that I hadn't seen before, or heard too much about, which I'm interested in and I think you and the DEQ staff should probably follow up on, which is this issue of frequent puffs. Puffs in my experience with other types of incinerators, occur when there is a pressure problem in the kiln, or the devices around the kiln, such that the gases have to escape so they escape through seams in the unit, things of that nature.

So, I'm not too sure exactly what they mean by puffs, I'm not sure what causes the puffs, whether there are pressure problems or other problems. I'm not sure how often they occur or if somebody has characterized what's in them to [unintelligible]. Do they have agent in them? Do they have just other types of contaminants like dioxin or the other things we're concerned about? I think you need to explore the question of puffs.

Let me conclude, before asking if my colleague Mick Harrison has any comments to add, a couple of request that we have of the Commission and or the DEQ staff and we ask you to very seriously consider these requests despite the obvious magnitude of them, or at least what you feel is the magnitude of them. We request that the DEQ revoke or suspend the current permit because a major component of the permitted facility, the carbon filter unit, is presently unproven and lacks the specifics in design and risk assessment necessary to meet regulatory standards. Moreover—

Commissioner Eden: Wait a minute, which component are you talking about?

Richard Condit: Sorry?

Commissioner Eden: Which component are you referring to?

Richard Condit: The carbon filter. Moreover, no substitute for the protection needed from some additional safety system, or systems, like the carbon filter system, has been offered by the Army. Second, request that the EQC in it's consideration of the carbon filter issue make a factual finding regarding the ability of the proposed or whatever proposed carbon filter system you see, to collect and retain chemical warfare agents. What's the ability of the carbon filter system to do that that you're ultimately presented with? Specifically, you must determine under what conditions of temperature and humidity will the carbon filters release the agent collected.

Because, we have a circumstance with carbon filters, yes, it's great, maybe you're collecting a lot of things. But there are certain conditions under which those materials collected on the carbon filters will be released. Accidents perhaps, or temperature excursions, or a variety of things. How is that going to be regulated, how carefully in control will that be? And again, in trying to get to the bottom of the carbon filter controversy we ask that the EQC request that the Army perform a mass balance analysis of the currently employed carbon filter technology used for cooling the air inside the facility buildings, commonly referred to as the HVAC, heating, ventilating and air conditioning carbon filters. The purpose of mass balance analysis would be to carefully monitor the amount of agent in the air flow before entering the carbon filters and then taking the carbon filters out of service to analyze how much of the agent was actually captured or other chemicals, for that matter.

The EQC must perform a careful review of the data provided for the mass balance analysis in order to determine whether or not the Army can really pull this off and whether or not the carbon filters will really be a valuable addition. And again I want to emphasize that, if carbon filters are decided not to be an appropriate technology, then the search should go if you are going to continue with incineration, to find other means of providing the additional protection necessary to deal with the real world problems that we are seeing in the operation of this facility in Utah.

Finally, to follow up on a comment that Tom made about public participation, or to add to it, I should say. We have recently reviewed the records available in Umatilla for this facility. And, despite my experience with hazardous waste, in particular chemical weapons facilities, I am not able to make heads nor tails out of the status of the permit, or the modifications of the permit. And so we request that the EQC or DEQ provide us as soon as possible with a current copy of the current permit and all approved modifications so that we can better understand just where this facility stands, not just with carbon filters, but with the rest of the process as well.

I appreciate the opportunity to have spoken to you today, I would be happy to address your questions if you have anything during the question session. We do have a few more minutes and I would like to ask my colleague Mick Harrison if he has anything to add.

Mick Harrison (via conference phone): Thank you Richard. Let me check to make sure the volume is O.K. Can the Commission hear me O.K.?

[Commissioners]: Yes.

Mick Harrison: Thank you. Just a few details that might be of some benefit to the Commission to follow up on what Richard has already stated. First of all in terms of the status of the decision process at this point, if the permit application initially submitted by the Army was incomplete in regards to the design of the carbon filter system for the stack, for the pollution abatement system then the Commission may have been without authority to act on such an incomplete application.

Had the clarification regarding Mr. Condit's comment, the lack of trial burn data regarding rockets that are unable to be drained, rockets full of agent, there is a broader data gap, in terms of that trial burn data. There are other munitions beyond rockets that are expected to have a substantial residue of agent that is incapable of being drained, based on the current Tooele, Utah experience. We call this situation heavy heels, or heels greater than 5% residual agent.

The trial burns were done, basically on artificial heels, not real residual agent and they were done with 5% quantity, not the rather larger quantities now being encountered, and that will be encountered. So, reliance on this trial burn data is, as Mr. Condit points out, insufficient. There are a number of situations that will be experienced at the Umatilla facility, whatever technology is used, that will involve weapons that cannot be drained, not just rockets. And the impact of that large amount of agent being put in a furnace at one time is really unknown in terms of emissions, and this is important in evaluating the carbon filter system for the stack or alternatives to it, in terms of these systems' ability to deal with these situations that are now easily predictable from the Tooele and JACADS experience.

Regarding Mr. Condit's discussion of the NRC contemplating at one point that they might simply put a sham, what I would call a sham filter structure in place, a frame without a filter, or a non functioning filter, to avoid the inconvenience of a RCRA permitting and modification. I think it may be clearly implied, but use of such a sham filter would be a violation of RCRA and would be a major circumvention of public participation requirements and I'm assuming that no one is contemplating it, from any authority at the moment.

It's important in deciding on whether to go with the carbon filter or some alternative or even some other treatment technology, to understand that combustion processes like the baseline incineration system are used. You can expect agent releases out of the stack of the incinerators, with virtual certainty at this point. There are admitted agent releases that have happened at the JACADS prototype. The March 30 incident was clearly from our experience in the Utah federal trial recently, an incident that involved actual agent release out the stack. It's probably not widely understood beyond those in the audience during the Utah trial, but the Army had taken the position publicly prior to that time that the chemical released from the stack on March 30, '98, from the metal parts furnace, was not agent, based on the Army's understanding that the stack ACAMS had not alarmed and based on what we call the DAAMS tubes analysis, the D-A-A-M-S, the Depot Area Agent Monitoring System Analysis, which the Army had said publicly had shown that the chemical was not agent, although as Mr. Condit pointed out, they were at a loss to name the chemical, which they admitted did come out the stack.

But, when push came to shove at the trial, it became clear from Army and contractor witnesses, that of the three ACAMS in the stack, which the Army had relied on as not alarming, one of them was off-line, but its strip chart shows the presence of a chemical which appears to be agent, it simply did not alarm because it was not on-line. The second of the three ACAMS monitors in the stack was saturated with the chemical coming out of the stack at that time which rendered it incapable of alarming, but its strip chart showed a chemical which appeared to be agent. The third of the three ACAMS also showed a peak in the strip chart of something substantial coming out the stack, perhaps not in the agent gauge, but that ACAMS is set up differently with a different analytical column, which may have accounted for that difference.

So the stack ACAMS data actually support the conclusion that agent came out the stack on March 30, 1998 at Tooele, something important to know in determining what type of pollution control devices are required for the Oregon facility. The DAAMS tubes, which the Army had relied on, for disproving the assertion that agent came out the stack on March 30, it turns out during the trial that there was no tracking or chain of custody on those tubes during this incident. In fact, a Manager instructed the monitoring technician explicitly to not track the tubes removed from the stack DAAMS at the time of the incident. So they were thrown in a box with forty some other tubes and no one knows whether they were ever analyzed in a laboratory or not. So, when it came time for the Army to offer those DAAMS tubes into evidence to prove their point they withdrew the exhibit. They were not offered into evidence and we presume because we had objected to the lack of chain of custody, that that was the reason.

A couple additional details, in terms of the mass balance idea that Mr. Condit explained, the Tooele facility should be capable of performing such a mass balance of the agent going into the filters as compared to the amount of agent captured on the filters when that carbon is taken out of service. To our knowledge, such a mass balance analysis has never been done. The reason it's important is that we know from the experience we've only alluded to here, that the ACAMS and DAAMS in the stack are not reliable, may not be reliable in the HVAC stack, we presume not, and it really would be good to know just how much agent has been collected in the carbon in the HVAC filters at Tooele, in order to basically put the Army to the test.

Is the carbon an effective filtration system? We have been told by a former Dugway engineering technician, Mr. Anthony [unintelligible], that in his experience, agent can either escape through the carbon relatively rapidly due to a phenomena I call channeling, because the carbon doesn't pack properly it leaves little avenues for the agent go through the filter, or because of the desorption or volatilization off the filter at higher temperatures, and that that sort of desorption can start to happen at high ambient temperatures, such as 90 degrees Fahrenheit, and it can be relatively complete, in other words, a complete off-gassing, at 400 degrees Fahrenheit or so. So it's an important issue, you know, the carbon filter may capture agent for awhile, but will it retain it, and under what circumstances?

The Commission should know, and I don't if the Army has brought this information forward to the Commission, that the carbon filter for the stack idea was proposed for the Tooele facility and later abandoned. And the apparent reason for the abandonment was a rather pointed notice of deficiency sent by the State of Utah to the Army regarding the [unintelligible] carbon filter in the stack. This notice of deficiency identifies numerous very difficult technical questions that the State of Utah wanted to have an answer by the Army before the State of Utah would consider approving use of carbon filter in the stack. I think it would be important for the Commission to find out if not only what these questions were, but what the answers were that were submitted, or if they were not submitted to the State of Utah, why not?

I believe that, well just one other detail, our concern about the need for some technology that can capture agent that otherwise would be released from the combustion stacks, if the Commission insists on going forward with incineration. One of the reason we're concerned about the need for [unintelligible] technology, and as Mr. Condit pointed out, at the moment the carbon filter in the stack can only be seen as experimental. And, I think, none of the clients that we represent in Oregon, wish to be guinea pigs in this regard, we thought that Congress had told Army to not treat the public as guinea pigs in this program. But one of the reasons we're concerned about stack release as a reality, and the need for some kind of technology regarding these stack releases is that at Tooele there had been numerous stack ACAMS alarms that have been associated in time with waste feed cut-offs because of some combustion or pollution control upset. And those are the very circumstances when you would expect that this alarm would not be cause for some sort of interferant, but would be real, from agent.

So given the time restrictions, let me stop there. I appreciate the Commission allowing me a chance to comment and I appreciate Mr. Condit sharing his time, and I'll turn it back over to Mr. Condit.

Richard Condit: That concludes our comments. Thank you.

Commissioner Whipple: Thank you, I would just remind you, although I know you know, this being the case is that comments will be accepted on this issue until the 20th of September and anything that you certainly wish to provide in writing to supplement and support your position on the carbon filters, certainly we're looking for that. I think, what we need to do at the moment, is ask somehow we need to sort of gather all the folks who have spoken before us here this afternoon and I think—I really think it would be easier if you'd move to the front of the room, the folks most likely to receive questions. Maybe I should see if the Commission has any questions.

Commissioner Eden: Madame Chair? Initially, Mr. Condit, I wanted a couple of reference points for statements that you made that you seem be referring to the NRC report and I just wanted to go back and be able to look at those. One of them I think, if I've written this correctly, the "NRC discussion was limited to carbon injection systems not carbon bed systems." Do you have a reference in the report for that?

Mr. Condit: I would generally refer you to, I don't have the page reference in the text of my prepared comments, but I would generally refer you to the discussions where the NRC was talking about the experience in other countries and things of that nature and our concern there was that when we looked at some of those articles or abstracts of those articles, it seemed to be a carbon injection issue as opposed to a carbon bed issue. We will try to, in our written comments, provide you with those details.

Commissioner Eden: That would be helpful. And the other spot was "the NRC suggested that carbon bed filter be bypassed in upset conditions." Is that a correct statement?

Mr. Condit: That is.

Commissioner Eden: O.K.

Mr. Condit: And I am not sure, it looks like it's at page 47.

Commissioner Eden: O.K., thank you.

[Unidentified Speaker]: The last paragraph of the second column.

Commissioner Eden: O.K., so that's the one you were referring to earlier? OK, thank you.

Commissioner Van Vliet: Mr. Condit, in the last statement you give an implication that there was a court case in Utah?

Richard Condit: Yes.

Commissioner Van Vliet: What was the outcome of that?

Mr. Condit: It hasn't been determined yet, the trial occurred over a two week period in June, and frankly we're backlogged in terms of getting a transcript from the proceedings. So we have not been able to, the parties, the Army and we have not been able to submit proposed findings and conclusions of law. Once that is done, then the judge will make a determination on the case. But, I imagine, Mick might have some more specific information at the moment, but I imagine it is going to, unfortunately, be some months before we get through briefing and the judge has an opportunity to reevaluate all the evidence.

Commissioner Whipple: OK, are we ready to open for discussion? Does anybody have a question? I was not at all successful in getting people to move to the front. O.K. let's sort of regroup here a little bit, and I can ask questions a little bit, frankly I can't see you folks over here—

Commissioner Van Vliet: I would like to see if there is some responses to some of the things that were said.

Unidentified Speaker: I would be happy to [unintelligible].

Commissioner Whipple: Sure, O.K., Department, the Department folks in the front row there, we have some Army, Raytheon folks available.

Dr. David Kosson: If it's possible, I've got three of our folks here that I would like to join with me.

Commissioner Whipple: Certainly.

Dr. David Kosson: [unintelligible] answer questions [unintelligible].

Commissioner Whipple: Just don't go too far away.

Dr. David Kosson: If I may?—

Commissioner Whipple: Could I ask you to hold on just a minute? And a question for—I just sort of want to make sure that we sort of cover appropriately what we're to cover in this work session. One of my concerns, a bit, I think, was that, I know we are specifically are having a work session on carbon filtration, carbon filter technology. We have gone through a kind of a critique of the NRC report. Do we need or want to or are appropriately spending time delving into that report. I just don't want to get too far afield here, in terms of the critique, is that a problem?

Larry Knudsen: I am not sure I am following your question, but are you asking if it would be appropriate to get a response to some of the critiques?

Commissioner Whipple: Well for instance, you know the question of the time; there was not enough time to thoroughly read the report. We are all very aware, we just got the report yesterday as well. So, and we were, we specifically asked them to submit that, and as I say we have another 30 days to get information. I don't know that any of us feel like that we're thoroughly prepared to have a detailed critique of the report as well, I mean I think there are other issues that were covered too.

Larry Knudsen: Let me see if this helps. I am assuming that we are going to, I am hoping, that we are going to get additional written comments from the NRC, and the Army and G.A.S.P. on the NRC report and probably on statements or positions that were taken during this meeting. And that all of that will come in before the deadline and that will be helpful in advising the Commission on what it might want to do. In addition, if the Commission wishes it hear it, certainly there's nothing inappropriate with hearing more from the Army or NRC in response to issues that have been raised on carbon filter technology. That probably ought to be done through the questioning process, but it can be done

Commissioner Whipple: I think that is what I'd like to do, we're up against of couple of things, one is, sort of, our time for adjournment was 3:00, I don't think we're necessarily totally locked into that though, we do have some, particularly scheduling, some plane reservations that I wouldn't want to go much more than 30 minutes beyond, I wouldn't want to go much more than 3:30, if the Commission at that point feels comfortable.

OK, I heard Commissioner Van Vliet suggest that he had some questions ready to go and I prefer I think the question, I would like to draw out first what the Commission's concerns are relative to what we've heard this afternoon and then give, if we've left something, you know, a big blank out there, we'll cover that, but I really want to be sure that the Commission gets the opportunity to ask questions.

Commissioner Van Vliet: Well, mainly my question was we had just heard the opening statement about not wanting to eliminate carbon filters or reduce additional safety measures and then we heard basically everything that was wrong with carbon filters. I would like to hear responses to some of the comments that were made about viable carbon filter technology, the final design, some of the things that were said at the end about analysis of the NRC and so on. And so if you could just, maybe you've already pinpointed some of those things already.

Dr. David Kosson: O.K., for the record, Dr. David Kosson, Chairman of the NRC. What I would like to do, if it's agreeable, is at least clarify what I believe came from misunderstandings that were presented earlier, probably due to the brief time that was available to read the report, because I think there' was some very significant misinterpretations that were made. Maybe it would be helpful to clarify those going through. Then after I get through I would ask my colleagues also, if I left anything out [unintelligible] they would like to contribute also [unintelligible].

The first is the issue of independent analysis. The NRC process is one where, yes, we receive information the Army, we also go out to other sources both domestically and internationally for [unintelligible] through the current literature and by direct contact with professionals, that are experts in other areas of the field, beyond those members directly on the committee. Considerable amount of analysis and calculations of process design and evaluations was carried out beyond what the Army had provided.

After an NRC report is concluded as a draft report, it is further sent out to independent technical review, to approximately ten reviewers that are blind to us as members of the committee. At the final report, something recently that came back, they were listed in report, a change to prior NRC Policy. What happens is it goes out to those reviewers then we get back comments, in the case of a typical report we get well over 100 comments. We are then required to respond to each of those comments in writing, and make any modifications to the report as appropriate based on these comments.

It then goes to independent parties, selected by the NRC, based on their expertise, to review the comments from the external reviewers, our responses and modifications to the report, and then reach a judgement whether or not our responses were adequate on a technical basis. That person also has the luxury of adding their own comments in, that we get to respond to also. After we have satisfied that person, it goes to another NRC person, also chosen based on their expertise, to review it once again, as a third check on the process and the evaluation that was carried out.

That's for all the NRC reports, not just for this one. Finally, after we've satisfied those folks then it has to go the NRC internal approval process of through the NRC chain of command before its finally issued. The review process, and the independence of that review process is probably the most complex and thorough of any review process that exists. Far more thorough than any peer-reviewed literature that you may find, in typical peer-reviewed publications in the literature. I just wanted to assure you of that.

The second is that the issue of storage risk was great and release of agent. It's important to recognize that there is agent release from leakers of both rockets and projectiles that occur during storage, which is a release of agent. And if you look at the recent history of what has happened [unintelligible] I think it would be helpful for you to review, [unintelligible] contrast with a release during the actual incineration process. Whenever an upset condition occurs the Army does brief the NRC on those very rapidly and very thoroughly. And when we do our reports we can comment on those, and there is a forthcoming report, which is going through the final steps of that arduous review process right now, which reviews the first few years of operations at the Tooele facility. And you can look towards that being issued over the next couple of months. And [unintelligible] will provide insight there for you.

Not operating the PFS, the carbon filtration, that statement [unintelligible] on Page 47, that was neither intended to be cynical nor manipulative. What it was intended, was to say, given the state where we are, we recognize that the inclusion of the carbon filtration process is a judgment call. That being, that the process is adequate without it, the emissions were very low, without the presence of carbon filtration. Some people would rather have carbon filtration as an added safety measure, and it can provide additional levels, or additional reductions in emissions by its presence.

However, other people, based on their judgment, may balance things differently, and prefer not to have the added cost of that, or may not want to have the added worker risk, that, again, is a small amount, that may come as a consequence of that. And so, in our suggestion there, we are saying well, given the state of where things are, what are the options you may have? Obviously, if you were not to operated the carbon filtration system, or load them as was suggested as an option, that would have to go through the RCRA permitting process. There is no intent on our part to ever suggest circumventing that kind of process. But trying to be realistic, when you get into the realm of judgment calls, what the options may be.

The next is whether or not we compared carbon bed filters, versus carbon injection. The Appendix provided in the report, that lists more than twenty-five installations, are those of carbon bed installations, not carbon injection installations. In the report itself, we do mention some data that comes from carbon injection systems. Based on that, [unintelligible] the limited amount of data, and kind of data, that can be used to calculate equilibrium partitioning, or distribution of components between the vapor phase and solid phase. We did not restrict ourselves strictly to carbon bed information, we went to the breadth of the scientific literature and information that was available to verify the calculations, to make calculations beyond that which have been provided by the Army, or had been provided by the Army, to assure ourselves about the capacity of the carbon filters to remove agent, if it were released into the carbon filters, or other contaminants of concern.

The issue of bypass accidents—the issue of whether or not carbon filters can be bypassed during operation was, again, a contingency issue, it's not during upset conditions. The carbon filters were considered initially in our recommendations to be a safety consideration, or a reduction of emissions in the event of transients occurring upstream of them during the combustion process, and in the event that perhaps contaminants of concern made it to the carbon filters, they would be removed at that point.

However, we did also recognize the concerns that other people have raised about the potential for fires or other upsets in the carbon filters themselves. At that point, the bypass would occur so that you would isolate the carbon filters so that the release that one of the gentlemen spoke about, the rapid release potentially of contained materials, would not occur. We also carried out calculations that are discussed in the report, indicating that if a sudden release of material accumulated on the carbon were to occur, that it would not exceed safety, or risk, thresholds, based on the information that we had available.

The issue of coconut shell versus other carbon, what is best, I think it's important to recognize that the Committee did examine other applications, and other applications do have other types of carbon. However, when you look at other applications, often lignite is chosen, or lignite-based carbon, because it is must less expensive than other applications, but the issue is not which is the best carbon, because one carbon being better than another carbon is a trade-off in how much carbon you use, in many cases. The question is, will there be sufficient carbon, with sufficient capacity, to meet the needs of the application?

And that's the question that we answered in the report, that we believe the carbon that's selected, or alternative carbons that could be selected, adequate quantity would be present to absorb transient upset, or even a significant upset, of the system. Under normal transients that may occur in the system we felt that the carbon [unintelligible] is adequate to last for long period of time, in excess of a year, or perhaps for the full duration of the facility, depending on operation, depending on the final design. We also indicate that in the event of a major upset, [unintelligible] if for some reason that carbon made it through the system, and got to the carbon filters, rather than being destroyed in the combustion process, that the carbon would have adequate capacity to absorb that agent. But we also indicated that, at that point, it would have to be evaluated whether it would have to be replaced immediately, before the facility continued in operation.

The next point that you had here was the issue of catalytic oxidation versus carbon injection, versus filter beds. If you go back to earlier reports that the NRC has done we also looked at other alternative technologies that would be potentially there, to varying degrees. We had to look at carbon filter beds because they are passive, that if you had loss of induced draft, or if you had upset conditions, they're always there. Carbon injection requires an active process, you're continuously renewing it. So that was not an oversight on our part, it was a deliberate approach that we took then.

The issues of arsenic and the waste characterization and puffs. Arsenic, or waste characterization—we live in an uncertain world, we will always live in an uncertain world. There will be some things in the waste that aren't exactly, down to the nines, that we expect. The air pollution control system that's currently in there, even in the absence of carbon filtration, is designed to remove those, under those circumstances. We go further on, a statement in the report, should transients occur, such as introduction of other materials that were not fully expected, we do expect that the filters will be effective in reducing metals that have not been quantified, we state that in the report. We also do state that we expect that the carbon filters would be effective in reducing those, and we expect reductions there.

Puffs, here in the report, again, I think that's a misunderstanding. If you go to Page 8, in the footnote, the first time we use the term "puffs," we refer to it and explain it, so that misunderstanding wouldn't occur. And it says "puffs refer to transient increases in concentration in the exhaust gas as distinguished from pressure excursions, which are sometimes also referred to as "puffs." The literature is not uniform in its definition of puffs, that's why were careful in the footnote there.

Pressure excursions cause gas to leak out of the incineration system into the containment area, which is important that these incinerators unlike hazardous waste incinerators or municipal solid waste incinerators are built in rooms that are further contained, so that if you have a leakage out of that incinerator, it would go in turn to another air pollution control system, hence the activate carbon that is used for the HVAC, the ventilation system, so those were not of a concern to the Committee because of the secondary treatment that would occur. Puffs are attenuated by the pollution control system and the activated carbon beds are designed to eliminate or mitigate those puffs, or those transients that we are talking about, those are the very reason why they were suggested.

The other thing, the ability for the agent, for the carbon, to collect agent and subsequently release that, we did address that directly in the report. Also keep in mind that agent is not static on the carbon, I mentioned that earlier, there are degradation processes, that the carbon reacts—not the carbon reacts, that the agent reacts, with the carbon and degrades or while it is on the carbon it further degrades. So even though you put in on now, over a certain period of time some portion of it will degrade.

It is important to recognize also when talking about comparison between the ventilation system, the HVAC system and the activated carbon beds for the incinerator, that we're talking about two different operational regimes. That being the agent in the air coming out from the munitions processing area that goes through the ventilation filtration system, is much more laden with agent, much more heavily contaminated then what we would expect coming through the incineration system. And the behavior of carbon is proportional to the concentration that you see in that vapor phase. That's why [unintelligible] it's important not just take a straight extrapolation from one type of applications to another, to convince ourselves and do the rigorous analysis that it would be appropriate for the low levels agent as well as the high levels of agent in the different operating conditions that are possible, as well as upset conditions in the system.

I think that addresses the issues that I think were brought up by the earlier person, I think, I hope, clarified some of the misunderstanding or misinterpretations, which I believe were probably due to the rapid nature—it takes us a year or two years to produce a report like this. It is unreasonable to expect everyone will digest it fully in a matter of hours or a few days. I would like to ask if either Dr. May or Dr. Kelly have anything further they would like to add at this time?

Dr. Walter May: [unintelligible] I have just a couple of little comments to augment what you said. Agents are not all that stable of materials. On carbon, as it turns out, decompose surprisingly rapidly. If you look on page 29 of the report, there is a little discussion there about the decomposition of agents over time—

Unidentified speaker: Excuse me, could I ask you to speak into your mike a little bit more?

Dr. Walter May: I'm sorry, is that better?

Unidentified speaker: Thank you, that's better.

Dr. Walter May: A long time ago, when the Army was interested in establishing a 5X criteria, that's the 1000 degrees at fifteen minutes that destroys everything, they did some experimental work to just find out what the rate of decomposition was. The people who did that experimental work went to great trouble in their apparatus to make it extremely dry, because if they left any ordinary moisture on the glass vessel the rate would be quite a bit higher, in their experimental work. So anyway, but they did come out with rate data, the rate of decomposition, and you'll see on Page 29 the use of, our use of that information.

Lately, the Army commissioned some experimental work on decomposition of the carbon that came out just about the time we were writing our reports. It is reviewed very briefly in the report. To give you an idea, I quote here, the half-life of GB on carbon, dry carbon, but its not really dry, because there is moisture in the air, was reported to be about 63 days, at 30 degrees centigrade. Well 63 days, that's half gone in 63 days, if you have run one of these carbon filters for years, a year or so, you have to extrapolate that half-life business, and so a very large fraction of this stuff will be done. I really think that if you were try to do a mass balance on the carbon, by figuring out how much went on, and then try to figure how much came off, it'd hopeless. You just simply could not get the stuff off, it's gone. That's one point.

I would like to make a comment on one other thing, and that's about the mechanism for bypassing the filter. You make a point; you have to have a bypass arrangement there because there are times when you must bypass it. If you have to bypass because there's something going wrong, then I expect that that will cause call for some other action. You are certainly gonna want to bypass the filter, but you probably are gonna want to shut down the flow of agent. That is an operating feature here that the Army will have to give a little thought to. Incidentally, the bed is a pretty big thing and so if you do start getting a little combustion occurring in it somewhere, it takes up a significant length of time to heat up, and you've got time, you've got lots of time to respond, shut down big valves, open other big valves and so on. That's an operating feature that should not be a real problem. Kathryn?

Dr. Kathryn Kelly: Just to add a word with regard to risk. Chemical agent is the riskiest substance this toxicologist had come into contact with – hypothetically speaking. And we wouldn't all be here today if it weren't for the inherent hazards of these chemical agents. And as you sort through this difficult issue of the carbon filter, I would say that to sum it up from a risk perspective, that the carbon filter themselves don't increase or decrease the risk to the off-site population or environment in any appreciable way. No big gains, no big drawbacks, it's risk neutral, as has been stated in the report.

What is very clear to us is that the major risk is the ongoing stockpile of chemical weapons that have the potential to leak or in other ways be disturbed and thereby become a source of exposure to nearby residents and the environment. That's true at Umatilla, as well as the other eight sites in the United States. So as you think through these decisions, please understand that's how we ended up with a recommendation to have, to not go ahead with carbon filters at Tooele and JACADS, because any delay—let me rephrase that, what is clear with the carbon filters is that any permit-related delay will, of necessity, increase the ongoing risk to nearby populations by delaying the disposal, the destruction, of the stockpiles. So that's why you end up with, what seems at first to be an inconsistent recommendation, to leave Tooele and JACADS as they are, because to retrofit them would cause a delay.

This also leads to a recommendation to leave Umatilla and Anniston with the carbon filters unless there is some way to make a permit decision, otherwise, yesterday, on it. And at Pine Bluff it is still early enough in the process that they have the choice to go either way. So, to me those are the issues that, if I were in your position, seemed inconsistent at first glance in trying to explain from a risk standpoint, why they may appear inconsistent, but if you keep the big picture in mind about off-site risks to human health and the environment in perspective then perhaps it becomes more clear.

Commissioner Whipple: Thank you.

Commissioner Reeve: One quick question? Just to follow up on the risk issue for a moment and worker risk, although, as a toxicologist I guess you're not looking at that as much. But just so I understand, kind of this balancing of worker risk. I take it at Umatilla we don't have a comprehensive risk analysis, the level 2 or QRA2 or whatever it's called, because, in part, the facility isn't completely designed, or everything isn't known about it in terms of all the inputs that would go into evaluating worker risk and obviously a risk management plan tries to mitigate those risks. I take it it's a sort of an ongoing process, back and forth. I guess I wanted to get some sense of the relative magnitude of worker risk compared to other types of facilities, not necessarily facilities with contaminants or toxic agents, but just—I take it these are largely industrial type of accidental risks? Things falling, people getting hit, all that sort of thing. Is that mainly what we are talking about?

Dr. David Kosson: Yes. Let me clarify perhaps two aspects of that. First off, on page two of the Executive Summary, down about two-thirds of the way, or half-way down the first paragraph, that talks specifically about this—but let me clarify the level of detail that goes into the Phase 2 QRA. It goes down to who was working where when something happened. In other words, if somebody is doing the maintenance check, where is that person located, where is everyone else in the plant located. That depends on specific procedures for what people are doing. That's not a design, it's actually a procedural issue and it has an extreme level of detail and that's why it waits until those procedures are all finalized, and [unintelligible] systemization [unintelligible] included.

Also, when you do the QRA, you use it as a learning tool so it then feeds back into the process to make improvements when you identify difficulties. So it is a very much a living process. In putting it in contrast to other risk, what we indicate here is that the risk with the PFS is about three times ten to the minus fifth, without it it's about one times ten to the minus fifth, and that's in contrast to four times ten to the minus fourth for the overall risk. That means that the incremental increase due to the addition of the PFS is at least ten times less than the overall worker risk due to other issues at the site.

Then what we do is we try to put that risk, that overall risk, in contrast to manufacturing risks, which are about three times ten to the minus fifth, that's about the same as the PFS, per year, as compared to the PFS, which is estimated for the entire operation of the facility. And also, ten to the minus fourth for construction workers. Two aspects, which I think are interesting comparisons and useful because part of the operation of this whole demilitarization program is a large construction operation. Just building the facility before you operate it, and then the operation is probably analogous to chemical manufacturing or other types of manufacturing environments. I would also like Kathryn to comment on [unintelligible] one of our risk experts [unintelligible].

Dr. Kathryn Kelly: If I understood your question correctly, I don't think the risks at these sites have been adequately quantified, to answer your question. We don't know where the major sources of risk are coming from, but they are in the process of being dealt with and why it hasn't happened until now, is a lot of reasons. A lot of good people making the decisions with the best information they have, but certainly part of it is that most state Departments of Environmental Quality do not have worker health in their jurisdiction, it has not generally been an issue at these sites, until NRC raised it with the Army.

Dr. Walter May: I just wondered if you know in general what the worker risk is for plants around the country in all sorts of different occupations, and if you don't, I would certainly recommend you get a hold of this little book which is put out every year, and it is really based on the census of fatal incidents, which is run by the federal government, which lists death due to accidents and they take them apart in every conceivable way. Age, sex, place, workplace, work type, type of accident, et cetera, et cetera. So that's the sort of, sort of base information with which you can compare our plant.

Dr. David Kosson: For the further benefit of the council, just to read into the record, that report is called "Accident Facts" and is put out by the National Safety Council.

Commissioner Whipple: There was a quote in the—it certainly isn't attributed to Mr. Condit, though it is attributed to the spokesman for the folks who are asking that some of these decisions be reviewed. Again, the source is the newspaper, and I think we all know we need to look at that at least little more. Nonetheless, the comment was that, it was quote, it was poor technology at other plants there have been explosions caused by carbon filters. Is there some documentation supporting that position?

Dr. Walter May: I've never heard of an explosion, however, there have been a number of fires, but they, none associated with carbon filters on incinerators. Carbon filters have been used a lot for adsorbing vapors from paint rooms, or something like that. And there we're not talking about nanograms per cubic liters, we're talking about percents of vapor in the air that would be adsorbed in the carbon, so you get a lot of adsorption. When it adsorbs it, it heats up the carbon a bit, and there is lots of air around. There have been cases where the combination of heating due to adsorption, plus the fact that the stuff being adsorbed may pretty easily combustible.

Ethers, for example, may be readily burnt and so it would catch fire and that's not uncommon. But incinerators, we're dealing with a totally different thing. We are talking about terribly low concentrations, relatively speaking, parts per million rather than percents, and the result is that I have not seen any fire directly in a carbon filter—there is one fire, that is always reported, in a plant that had a carbon filter, that was an incinerator plant. The fire however, was in the stack; they had a stack that had an inside organic insulation in it. I'm not sure exactly what it was. But that insulation in the stack caught fire and then you had a regular chimney fire, which can be terrible. And how did that thing catch fire?

They never did come to a decision, but one of the possibilities was that carbon dust from the carbon bed had accumulated in the nooks and crannies and that [unintelligible] it did occur. And maybe it smoldered a little bit and set this thing on fire. So that's the closest that I've come to of any sort of incident in a carbon filter on an incinerator. Lots of fires in other carbon filters.

Commissioner Whipple: Questions from the Commission?

Commissioner Reeve: I noticed that regarding the build-up of combustible materials, I noticed that the adsorption rates, I guess, I forget the technical term, but when materials—the length of time materials will stay in the carbon. The volatile materials will not stay very long, they're really expected to be gone by the time the filter beds are changed out, right?

Dr. Walter May: There's a lot of stuff that's adsorbed very weakly, in a short time it [unintelligible] right through and then after that it's as though the carbon filter isn't even there.

Commissioner Reeve: OK, so the chemical, or the substances of concern, that the benefit that we're trying to achieve through the carbon, would be either agent or dioxins or metals or things of that nature. And those, I take it, have a longer life in the carbon?

Dr. Walter May: I think, you see numbers in here that 95% of the cancer risk associated with the stack is due to materials that will be retained by the carbon. There are other things. Benzene, for instance, is present in extraordinarily low levels, but it's there, and it's retained by the carbon bed only very briefly, it just goes right on through. There are a few percent of the cancer risk that is not affected by the carbon.

Commissioner Reeve: O.K., I guess my question then, just to follow up on this concern about possible fire or whatever, would be the materials that are adsorbed longer—are those combustible or are those not?

Dr. Walter May: A lot of—the agent is very, easily combustible.

Commissioner Reeve: O.K., then the question has to be, at what level?

Dr. Walter May: Well, look, first of all, what I said is that the concentration of these material is so extraordinarily low, that the agent, if it's present at all, is parts per billion, and it may be zero, so that their adsorption cannot increase the temperature significantly. So they will not drive temperature up. There is nothing that you see that will drive the temperature up, to create a fire. Now, if there is some mess-up in the operation, there is a process for re-heating the air so as to lower the relative humidity. If that goes wild—it would be stupid, but stupid things happen—then you would be concerned with exactly what you are saying.

Indeed, MitreTek, the people who did the analytical work for the Army looked at that eventuality and it is reported in our report. They conceived the thought that, hey after we've run the bed for a long time, 144 weeks, and then something goes wrong, up goes the temperature and nobody does anything, everything is driven off in an hour, is that bad?. Well it wasn't all that bad, they looked at the things called the ATV, California EPA criteria hazard, and none of the materials exceeded the ATV. I think the analysis, you have to be a little careful of it, but it does not appear as though that driving this stuff off real quickly like this, first of all it's not a likely incident, but it's also—it doesn't seem to be a super hazardous thing.

Commissioner Reeve: O.K., that's described on page 28 as a filter upset, and you're right, a desorption in a short period of time, and it says if it's desorbed in an hour there would no material that would exceed the acute threshold level. Is that ATV, it didn't say, I saw in the report, whether that—is that at the exit of the stack or is that ground level?

Dr. Walter May: I think that's at ground level.

Commissioner Reeve: So, there is some dispersion assumed?

Dr. Kathryn Kelly: They're ambient concentrations within their draft criteria developed by California, but were never officially adopted. So I wouldn't give them regular credence.

Commissioner Reeve: Well, is there something else that you would give credence to in terms of looking at those levels?

Dr. Kathryn Kelly: I don't think that the work has been done yet. I think that they are in the process of developing those scenarios and estimates, but we don't have, for instance, an exposure concentration to workers of any of those compounds of concern under any of those scenarios.

Commissioner Reeve: And why not?

Dr. Kathryn Kelly: Well, it's—I think historically the effort was focused on the RCRA Part B Permit and worker health and safety has not historically been an integral part of the RCRA Part B Permit. It has been something that the NRC, and perhaps others have asked the Army to address, above and beyond what was required of it by regulatory guidance or statutes.

Commissioner Reeve: I guess, what I am wondering though is, doesn't OSHA or other regulatory agencies have permissible exposure levels or other guidance levels—exposure limits that you can look to for these compounds?

Dr. Kathryn Kelly: They do, but you can't—unless you have exposure concentrations to compare them to, you have no analysis that can be done. We have not received yet—and we have asked for it—but we have not received any exposure concentrations under these various worker scenarios. Which is why you'll see, interspersed several times throughout the report, the statements that the worker risks are probably the driving risks at the carbon filter and we do not believe that they are adequately quantified.

Dr. Walter May: I think these ATV numbers here were not associated with the workers. It was assumed the material was driven off the carbon beds and went up the stack—

Commissioner Reeve: Right.

Dr. Walter May: —And then it dispersed in the normal way to the surrounding populations.

Dr. David Kosson: I think it's important to recognize, and we call it out several times in the report, that we feel that additional evaluation of worker risk is warranted and should be considered. It's also important to recognize that there are mitigating factors in the plant environment. One is that—it makes these sorts of estimates very difficult—one is, within the plant environment, how an accident would occur, its propagation and the like, is a difficult estimate that has a lot of uncertainties and also perturbations to it that need to be considered. Secondly, there are personal protective equipment, such as all the workers carry respirators and the like. Even when we go in the plant we are required to—that are also further mitigating measures and also other features, so it's not a simple question, it's something certainly that we asked for more information on, but it is also something that is a considerable effort to [unintelligible].

Commissioner Eden: If I may, is it an appropriate place to ask the Army whether it plans to consider these issues in the Phase 2 QRA?

Rick Holmes: That's what the Phase 2 QRA is supposed to do, to look at the worker risk from an agent perspective and additionally from an industrial type perspective to look at the postulated accidents that could occur through the SOP hazard analysis that's accomplished. I mean, the worker has to do job X, what are the things that could occur while that worker is doing job X? Now that process is not a quantitative analysis. You find a tripping hazard when somebody's going to do something, you either put up a sign or you move it so it's out of the way. You find something that needs to be fixed; you fix it, or make sure that the worker is actually trained to do the steps in this particular sequence so that the job is done properly. So, that absolutely is part of what we will do for the PFS, which is what we do on every system, operation in the plant.

Larry Knudsen: Madam Chairman, could I request that the speakers identify themselves, we want to keep this record—

Commissioner Whipple: You bet.

Rick Holmes: I'm sorry. For the record I am Rick Holmes.

Dr. Kathryn Kelly: These are the very difficult issues that Dr. Kosson alluded to. Trade-offs between worker and public health risks. How do increase one and not increase the risk of the other? Trading off quantified versus unquantified risk is a very difficult decision.

Commissioner Eden: Can I clarify for the record that you are Kathryn Kelly, is that correct?

Dr. Kathryn Kelly: Oh, yes [unintelligible] a toxicologist [unintelligible].

Commissioner Eden: Thank You.

Commissioner Whipple: We're sort of approaching the time I suggested that we wanted to bring this to a close. I have a feeling that all the questions haven't been answered. On the other hand—

Larry Knudsen: I guess I'll just reiterate here that we do have the opportunity to take additional comment and to a certain extent I think if the Commissioners have questions that they either didn't have time to express or might come across later, I think it would be appropriate to let staff know and they will present them to various folks that have been assisting us today. At least, hopefully, we would be able to get some kind of a written response.

Commissioner Whipple: O.K.

Richard Condit: Madame Chairperson, may I request a couple of [unintelligible] response [unintelligible]? We've had a lot of time by the NRC and other folks. I'm not asking for a lot of time, but I think it's appropriate to recognize a couple of items for clarification purposes.

Commissioner Whipple: Mr. Condit, if you have a couple of quick comments, I would entertain them, but I will keep you short.

Mr. Condit: [unintelligible] gavel me [unintelligible]. I want to say first that I certainly appreciated the clarifications by Dr. Kosson, Dr. May, Dr. and Dr. Kelly on the NRC report, however, one issue that I have a question about is in terms of this independence question. It is my understanding, and I would like to be corrected if I am wrong, that drafts of what the NRC is working on are provided to the Army for comment also during the process, is that right, or what?

Dr. Kosson: That is incorrect, actually what I would like to do is ask Don Siebenaler to come up and clarify formally what the NRC policy is relative to that and how drafts are handled.

Don Siebenaler: Don Siebenaler, Study Director for the Committee on Review and Evaluation for the Army Chemical Stockpile Disposal Program, or Stockpile Committee. The review process at the Academy of Sciences in Washington is really one that is fairly independent of the

Committee itself. The reviewers are gotten from all sources, commissions, boards, and other sources within the Academy of Sciences. They come recommended to me, or to other people within the staff of the Academy of Sciences, from anywhere and everywhere. They can come from sources like yourself or people who are aware that we were doing such a review and then they are submitted up the chain of command of the Academy of Sciences for approval. And these are people with, I think, Dr Kosson described earlier, the kind of—for example, we have chemical engineering problems that we may be looking at in a particular report, and we will get chemical engineers to look at those kinds of problems. We may have health risk assessment or quantitative risk assessment. We will seek to have at least dual coverage, on those kinds of things, in the oversight by reviewers of the report. Now, when these come in, they come in completely anonymously to me. And what we do, is we farm them out to the Committee for response and all that. Now, I don't want to bore you with this, so where do you want me to be quiet?

I think the point is, is that it is really a completely separate issue from the work of the Committee, if we're talking about independent review. If you're saying are we independent of the Army? Absolutely. The Army can suggest a reviewer to me if they wanted to, anybody can suggest a reviewer to me, but we really—we send usually maybe ten or fifteen reviewers up the command within the Academy of Sciences for approval. I don't necessarily—I may be told you have to add more reviewers, you have to get more coverage of a certain expertise in the review process and we do that. We go out and seek people to do those kinds of reviews and then the review is done completely independent of comments from the Committee.

Commissioner Whipple: Thank you.

Dr. Walter May: I think it's important to reiterate the point that the first time the Army saw this report is when you saw it.

Richard Condit: I think they are given privilege of a short period of time—

Don Siebenaler: We are able to give the Army a prepublication that can be, doesn't have to be, and really it depends, up to 10 days. So in this particular report, we provided a prepublication, which is essentially what we provide to the National Academy Press, so that the Army, as the sponsor of this committee can have a look at the report. The report is done, it's finished. They can comment all they want on it, but the report, at the time I turn it over to the Army as a prepublication draft, I handed it to the National Academy Press for final printing. So there is, there may be, NAP may find a small edit of a the, this or that that they might change from a prepublication, but other than that, the Army gives no input to us whatsoever from the prepublication to make us fix it, it's already being printed.

Commissioner Whipple: O.K., thank you.

Richard Condit: Thank you for that clarification, just a couple of other items. With respect to the worker risk issues, it has always been our interpretation, I think many peoples' interpretation, that when you're considering public health, you go through Oregon Statutes or RCRA. The workers are members of the public. So, I don't view it as a novel idea that workers would be considered in the idea of whether or not we're adequately protecting public health. And I don't think the statutes were intended to be restrictive in excluding workers from the rest of the population.

With respect to the comment on arsenic and the waste characterization, not being perfect, well, that may be true and I appreciate the imperfections, but RCRA requires that we know what the waste is and I think that's an obligation that the Army has to meet, there's no question about it. With respect to the comment on the HVAC carbon filter situation or set-up not being the same as the circumstances we might find in a carbon filter PAS system, my response is that, that is the only carbon filter system that Army has operated, so why don't we look at what is happening with it to figure out might be happening analogously with a similar type of system. That at least is something that is functioning and/or currently being used by the Army in this situation.

Commissioner Whipple: Mr. Condit, I am going to gavel you, but I would encourage you to submit your questions again, particularly during this open comment period, as you well know

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also includes asking questions, and it strikes me that many of the questions that you would like to have answered, we would like to have answered also, so we anticipate that you will submit those questions. Staff, anything more we need to know? Quickly.

Wayne Thomas: I think there is a lot more we need to know. Quickly, my recommendation is that staff will wait until the end of the comment period, receive all the comments, collate those, summarize those, and review the information that we receive, and come back to the Commission in November with a staff report and a recommendation on the carbon filter technology.

Commissioner McMahon: Who should we send questions to?

Commissioner Whipple: Any specific questions that Commissioners want to be sure are addressed will go to Wayne Thomas.

Stephanie Hallock: Madam Chair, I was just going to say that I was glad that Wayne said that, because I was going to waffle on when we could get back to you, but since he committed to getting back to you in November we will do that.

Commissioner Whipple: OK, anything else from the Commission? Thank you all very much for attending, I know many of you came from quite a ways, we do appreciate it. In case you haven't figured it out this Commission thinks this is a very big deal and we intend to study all the details that come to us in the next bit of time, so thank you very much and we'll see you next time.

[The meeting was then adjourned.]
[End of audio recording.]

ATTACHMENT A

AGENDAS FOR THE MEETING OF THE ENVIRONMENTAL QUALITY COMMISSION

AUGUST 18, 1999

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AGENDA

ENVIRONMENTAL QUALITY COMMISSION MEETING

August 18, 1999
DEQ Conference Room 3A
811 S. W. Sixth Avenue
Portland, Oregon

◆

Note: Because of the uncertain length of time needed for each agenda item, the Commission may deal with any item at any time in the meeting. If a specific time is indicated for an agenda item, an effort will be made to consider that item as close to that time as possible. However, scheduled times may be modified if agreeable with participants. Anyone wishing to listen to the discussion on any item should arrive at the beginning of the meeting to avoid missing the item of interest.

◆

Beginning at 10:00 a.m.
Work Session

10:00 - 11:30 a.m. **Informational Item**: New Technology to Replace the Dunnage Incinerator at the Umatilla Chemical Agent Disposal Facility

12:30 – 3:00 p.m. **Informational Item**: Presentation on Carbon Filters

Hearings have already been held on the Rule Adoption items and the public comment period has closed. In accordance with ORS 183.335(13), no comments can be presented by any party to either the Commission or the Department on these items at any time during this meeting.

The Commission will have lunch at 11:30 a.m. . No Commission business will be discussed.

The Commission has set aside September 30-October 1, 1999, for their next meeting. The location will be in Coos Bay, Oregon.

Copies of staff reports for individual agenda items are available by contacting the Director's Office of the Department of Environmental Quality, 811 S. W. Sixth Avenue, Portland, Oregon 97204, telephone 229-5301, or toll-free 1-800-452-4011. Please specify the agenda item letter when requesting.

If special physical, language or other accommodations are needed for this meeting, please advise the Director's Office, (503) 229-5301 (voice)/(503) 229-6993 (TTY) as soon as possible but at least 48 hours in advance of the meeting.

July 20, 1999

EQC Agenda

Environmental Quality Commission Special Meeting

Umatilla Chemical Agent Disposal Facility

August 18, 1999
10:00 a.m. to 3:00 PM
MEETING ROOM 3A
DEQ Headquarters
811 S.W. Sixth
Portland, OR 97206

Time	Agenda topics	Presenter
10:00 a.m.	Introduction	DEQ
10:10 a.m.	Dunnage Incinerator	U.S. Army Program Manager for Chemical Demilitarization
11:00 a.m.	Question and Answer Session	EQC
11:30 a.m.	**Lunch break**	
12:30 p.m.	Introduction	DEQ
12:35 p.m.	Application of Carbon Filter Technology to Stack Emissions	National Research Council
12:55 p.m.	Current Design of Carbon Filter System at UMCDF	U.S. Army and Raytheon Demilitarization Company
1:15 p.m.	Carbon Filter Technology	G.A.S.P., et al.
2:15 p.m.	Question and Answer Session	EQC and all Presenters
2:45 p.m.	Summary Discussion	EQC/DEQ
3:00 p.m.	Adjourn	

ATTACHMENT B

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

Presented to the Environmental Quality Commission
by the U.S. Army

August 18, 1999

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PMCD
Program Manager for
Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY (UMCDF)

Presented to:
Oregon Environmental Quality Commission

Mr. James L. Bacon, Program Manager for Chemical Demilitarization
Mr. Mark Evans, Chief, Operations Team, Project Manager for Chemical Stockpile Disposal
Mr. Loren Sharp, Deputy Project Manager, UMCDF, Raytheon Demilitarization Company

18 August 1999

PMCD
Program Manager for
Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

UMATILLA
chemical agent disposal facility

PMCD Charter: Dispose of the stockpile at Umatilla Chemical Depot while ensuring MAXIMUM PROTECTION to the workers, the public, and the environment

Strive to provide best value while ensuring NO COMPROMISE to our maximum protection charter

Not a cost/benefit trade-off -
no sacrifices in safety or environmental
protection are tolerated

PMCD
Program Manager for
Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

UMATILLA
chemical agent disposal facility

- Current RCRA permit correctly identifies the DUN as the best available technology for disposing of secondary waste

- Planning in support of JACADS closure indicates that equally-protective, more cost-effective approaches may be possible - but these approaches remain undemonstrated

PMCD wants to ensure environmentally - responsible, cost effective means are implemented at the UMCDF

PMCD
Program Manager for Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

UMATILLA
chemical agent disposal facility

- "Maximum protection" means that changes that impact the start date of stockpile destruction operations must be avoided
- Time for meaningful public involvement must be included in any change assessment process
- Oregon's strong preference for DEMONSTRATED technology applications must also be taken into consideration

The challenge: Deriving an approach to allow for consideration of demonstrated alternatives while maintaining the start date for stockpile destruction operations

PMCD
Program Manager for Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

UMATILLA
chemical agent disposal facility

- The dunnage incinerator was designed and permitted for waste streams with different characteristics
- In order to accommodate these wastes, the DUN was designed for the worst case for each waste as compared to the design requirements for any one waste stream
- This manifests itself in cost ($30M)

The DUN meets environmental standards but is a relatively expensive unit to procure, install, and operate

PMCD
Program Manager for
Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

UMATILLA
chemical agent disposal facility

- Work in support of JACADS closure has identified different approaches for each waste stream permitted for the DUN
- Preliminary analysis indicates that these alternatives are “risk neutral” from an environmental and risk (chronic and acute) perspective
- Preliminary analysis also indicates that cost savings in the range of 13-20 million dollars are possible

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

- Alternative approaches will not be demonstrated in time to allow for permit modification and installation at Umatilla (if warranted) prior to the scheduled start of stockpile destruction operations
- 85% of cumulative public risk from stockpile destruction operations will be eliminated during the first disposal campaign at the UMCDF

The challenge: Identify a way to allow for demonstration and possible use at Umatilla without delaying the start date

PMCD
Program Manager for
Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

UMATILLA
chemical agent disposal facility

- Proposed approach:
  - Develop a firm compliance schedule tied to testing and demonstration activities at other sites and to critical milestones at the UMCDF
  - The DUN remains on-hold pending decision process
  - Ensure that Oregon DEQ has FULL and OPEN access to all developments in secondary waste

Approach consistent with "maximum protection", Oregon desire for demonstrated solutions, and prudent fiscal practices

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

- What is the down side?
  - Some wastes in storage longer than originally anticipated
    - ✓ 50% of charcoal was originally programmed to be disposed of in closure - now 100%
    - ✓ Protective clothing from first campaign would also have to be stored for later processing
  - Oregon concerns over "legacy wastes" - will the Army commit to the disposition of these wastes in a timely manner?

PMCD
Program Manager for
Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

UMATILLA
chemical agent disposal facility

- Public/worker risk from proposed approach will be minimal and will follow practices demonstrated at the JACADS
- Compliance schedule with clear, tangible commitments will allow State to have sufficient control over process to ensure legacy waste issue is not created at UMCDF

The Army needs to work with the DEQ to ensure the State has adequate visibility and control of the process

UMATILLA
chemical agent disposal facility

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

Raytheon

- Raytheon Demilitarization Company uniquely positioned:
  - ➤ Operating, Maintaining, and Closing JACADS
    - ✓ First-hand knowledge on DUN design and performance
    - ✓ Ten years experience with handling and storage of charcoal, PPE, and other secondary wastes
    - ✓ Programmatic Lessons Learned Program to feed experience forward

UMATILLA
chemical agent disposal facility

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

Raytheon

- Raytheon Demilitarization Company uniquely positioned: (continued)
  - ➤ Currently designing the JACADS carbon micronization and thermal decontamination system
    - ✓ Responsible for installation, testing, and operations
    - ✓ Developing permit modifications

Raytheon Demilitarization Company ensures Oregon not only a demonstrated technology but a demonstrated performer

TIER 1 1ST FURNACE TURNOVER (MAY 00)	**TIER 2** START OF THERMAL OPS (JAN 01)	**TIER 3** START OF STOCKPILE DESTRUCTION OPS (OCT 01 - FEB 02)	**TIER 4** COMPLETION OF 1ST CAMPAIGN (FEB 03 - JUL 03)
• Submittal of compliance plan permit mod • Submittal of permit mod for storage pending on-site disposal • Submittal of waste analysis plan update	• Submittal of waste management plan for stockpile destruction operations (1st campaign) • Submittal of waste minimization plan for destruction operations (1st campaign) • Submittal of GB test results for TDS • Submittal of permit mod to allow contaminated wood to be processed in MPF and to address misc. wastes • Furnish copy of JACADS permit mod packages for TDS & CMS	• Submittal of Permit package for PPE disposal • Submittal of report on initial operations of JACADS CMS	• Submittal of permit package on carbon disposal

UMATILLA
chemical agent disposal facility

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

Raytheon

Additional initiatives:

- DEQ participates in JACADS Closure integrated process team (IPT)
- DEQ witnesses installation, testing, and operations at JACADS, CAMDS
- Creation of new IPT to guide/oversee development of all Tier 1 modifications

Full participation and involvement

PMCD
Program Manager for
Chemical Demilitarization

SECONDARY WASTE PROCESSING AT THE UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

UMATILLA
chemical agent disposal facility

- PMCD remains committed to executing the program in a manner which ensures maximum protection and satisfies State of Oregon requirements
- PMCD desires the latitude to continue to pursue prudent cost-reduction initiatives while ensuring no compromise to environmental protection or worker/public safety
- PMCD looks forward to working with the DEQ to develop/finalize a compliance schedule modification to allow process to continue

**Maximum protection, best value -
and NO compromises to environment/safety**

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ATTACHMENT C

"Carbon Filtration for Reducing Emissions from Chemical Agent Incineration"

Findings and Recommendations
Presented to the Environmental Quality Commission
by
Dr. David Kosson, Chair
National Research Council
Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program
National Academy of Sciences

August 18, 1999

CARBON FILTRATION FOR REDUCING EMISSIONS FROM CHEMICAL AGENT INCINERATION

Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program
Board on Army Science and Technology
Commission on Engineering and Technical Systems
National Research Council

National Academy Press
Washington, D.C.

NATIONAL ACADEMY PRESS • 2101 Constitution Avenue, N.W. • Washington, D.C. 20418

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competencies and with regard for appropriate balance.

The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce M. Alberts is president of the National Academy of Sciences.

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COMMITTEE ON REVIEW AND EVALUATION OF THE ARMY CHEMICAL STOCKPILE DISPOSAL PROGRAM

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Executive Summary

The Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program (Stockpile Committee) of the National Research Council has endorsed incineration (with comprehensive air pollution control systems) as a safe and effective procedure for destroying chemical agents and munitions. Recognizing, however, that some public opposition to incineration (based primarily on substances of potential concern [SOPCs] that could escape into the atmosphere with the combustion gas) has always existed, the committee also recommended that the Army study the addition of a carbon filtration system to improve the existing pollution abatement system. This recommendation reflected the committee's belief that (1) reductions in emissions resulting from carbon filtration systems, however small, could increase public confidence, and (2) a carbon filter would virtually eliminate the possibility of an accidental release of a chemical agent through the stack.

When the first recommendations were made in 1991 and 1992, carbon filters were being introduced in Europe. Since then, the Army has evaluated the European experience and decided to add carbon filters to the baseline incineration systems for the disposal of chemical weapons stockpiles at Anniston, Alabama; Umatilla, Oregon; and Pine Bluff, Arkansas. Carbon filters are called for in the Resource Conservation and Recovery Act (RCRA) permits for the Anniston, Umatilla, and Pine Bluff sites, where construction of the disposal facilities is already under way.

Since these decisions were made, data from trial burns conducted at the operating Tooele Chemical Agent Disposal Facility (TOCDF) near Tooele, Utah, have become available. Although this facility does not have a carbon filtration system, the data show very low emitted concentrations of SOPCs, including dioxins and metals. The concentrations measured at the TOCDF were either the lowest or among the lowest emitted concentrations in the Environmental Protection Agency's (EPA's) Hazardous Waste Combustor Emissions Database. Chemical agent, if present at all, was below the detection limit, which is also below the levels generally believed to have deleterious environmental or health effects. Nevertheless, an Army study modeling the performance of carbon filters concluded that they would reduce many SOPCs to even lower levels. The committee concurs with this judgment.

The carbon filter system, including associated gas conditioning equipment designs, had not been finalized at the time this report was prepared. Suggested design alternatives were available, however, and the committee concluded that an effective pollution abatement system carbon filter system (PFS) design could be implemented.

The Utah Department of Environmental Quality's Division of Solid and Hazardous Waste, which conducted the health risk assessment (HRA) for the Tooele facility, determined that the health risk to the public posed by the incinerator stack gas emissions was below the level of regulatory concern. HRAs have also been conducted by Army contractors for the Anniston and Umatilla facilities in which the effects of adding carbon filters to the baseline incineration system pollution abatement systems were considered, but only in terms of changes in the exhaust gas flow rate and temperature, not reduction in emissions of SOPCs. These studies did not quantitatively evaluate the potential benefits of the PFS, but even without carbon filtration systems, emissions are expected to be below the levels of regulatory concern.

Based on quantitative risk assessments (QRAs) (estimates of the probability and consequences of accident scenarios that could lead to a release of agent) completed at Tooele and under way at Anniston and Umatilla, the increased risk to the public from an accidental release of agent associated with carbon filters was found to be negligible (i.e., orders of magnitude below the risks people face every day). This was not so for worker risk. In the Anniston QRA analysis carried out using the Phase 2 QRA from the TOCDF, modified for the presence of a PFS, the only type of upset condition that would increase the risk of agent release was blockage of the exhaust gas flow by the PFS coupled with loss of the induced draft (which maintains the pressure drop for the exhaust gas flow). The risk of an explosion of agent vapor caused by blockage of the PFS represents 3 percent of the total worker risk. Individual worker fatality risk from agent over the facility life attributable to upsets in the pollution abatement system are estimated at 3.3×10^{-5} with the PFS and 1.1×10^{-5} without the PFS. This is in contrast to total worker risk from agent over the facility life of 4.1×10^{-4} as estimated for TOCDF. These findings also can be compared with the worker accidental death rates of 3×10^{-5} *per year* for manufacturing and 1.5×10^{-4} *per year* for construction industries during 1996. The increased risk at the TOCDF is within the range of the uncertainty of worker risk analysis at the facility but significant enough to warrant further evaluation.

The QRAs assess the risk of accidental releases of chemical agent, but they do not address "normal" industrial risk to workers. Hazards to workers from operating and maintaining an industrial facility (hazards not related to agent) will be evaluated during design and prior to commissioning, as part of the health, safety, and environmental evaluations for baseline facilities. If carbon filters are used, they will be included in these evaluations and the risk management and safety programs of each facility. Two risks that are frequently mentioned in this connection are risks associated with potential fires and risks during disposal of the carbon. PFS design and monitoring plans substantially mitigate the risk of potential carbon fires. The amount of potentially contaminated carbon from the PFS that will require disposal is small in comparison to the amount of agent-contaminated carbon that will require disposal from the treatment of the ventilation air for the facility.

The QRAs for three sites (Tooele, Anniston, and Umatilla) to date all confirm the committee's previous observations: (1) the major hazard to the public is from the stored agent and munitions in the stockpile itself; and (2) the risk introduced by stockpile disposal processing is relatively small (less than 1 percent of the stockpile storage risk). Major changes in a RCRA permit may engender a considerable delay that would increase the overall risk to the public. However, the magnitude of the increased storage risk depends on the length of the delay (which is uncertain). The increased risk from prolonged stockpile storage has been estimated on a *per year of storage* basis. For the population 2 to 5 km from the Anniston Chemical Agent Disposal Facility, the individual public fatality risk is 1.4×10^{-5} per year, and the societal public fatality risk is 2.6×10^{-2} per year. This risk is in contrast to the disposal processing risks for the same population of 3.8×10^{-8} per year (individual public fatality risk) and 1.8×10^{-5} (societal public fatality risk). Thus, the *per year* risk from storage is at least three orders of magnitude higher than the risk from disposal processing. Hence, very short delays would increase public risks more than the total public risk from disposal. A delay of approximately one year would result in increased individual public risks of the same order of magnitude as the estimated increase attributable to the PFS in individual worker fatality risk over the *entire* period of disposal processing. Consequently, public risk will be minimized by the expeditious safe destruction of the stockpile.

Conceptually, the committee agrees with the Army's decision to proceed with the current designs at Anniston and Umatilla and not to alter the operating configurations of JACADS and the TOCDF. Removing or adding carbon filters at this point is likely to cause delays that will increase the risk to workers and the public. However, potential increases in worker risk from the carbon filters, which were initially estimated to be small, require further evaluation. To mitigate the potential adverse consequences of adding carbon filters at Anniston and Umatilla, worker risk should be evaluated quickly and managed effectively, including changing the PFS design, if necessary.

The Army's initial attempts at public outreach using its change management process (CMP) in PFS decision making did not elicit meaningful public involvement or comment during the decision process, and several shortcomings of the CMP have now become apparent. First, public involvement must be initiated much earlier in the process of evaluating change. For example, public involvement could have helped the

Army formulate the questions to be answered during the PFS risk evaluation. Second, public involvement should allow for public input prior to making decisions on major process changes, even if initial assessments indicate that no change is preferred. Third, for the CMP public involvement process to be credible and engender public trust, the Army must provide clear guidelines for initiating the CMP, which should not be circumvented by executive decision.

The Army's decisions not to change the configurations at Tooele, Anniston, and Umatilla were made in the context that the original intent of the PFS was to reduce risk and increase public confidence. These goals were to be achieved by adding another air pollution control system component to polish the effluent and curb whatever pollutants would have been emitted without the PFS. However, the results of the Army's analysis showed that changes to risk would be small, that these changes could be improvements or degradations depending on the population considered and the uncertainty analysis, and that the risks could be different for the public and workers. In addition, the Army's presentation of the risk evaluations was difficult to understand and was not issued in a self-contained document delineating (1) comparisons of each risk component with and without the PFS and (2) the Army's rationale for making no changes to the current site configurations. These crucial lapses all but precluded the public from following the process or influencing the results.

FINDINGS AND RECOMMENDATIONS

The estimated concentrations and emission rates of SOPCs from chemical agent incinerator operations developed during the permitting processes for the Anniston Chemical Agent Disposal Facility and the Umatilla Chemical Agent Disposal Facility were below the thresholds of regulatory concern, whether or not a passive carbon filtration system (like the PFS) was included in the facility design. Therefore, the committee considers PFS to be risk neutral to off-site populations.

The addition of a PFS to the PAS would probably reduce the already low emissions of some SOPCs during normal, transient, and upset operating conditions. However, a PFS would also increase worker risk by making the facility more complex and by introducing new scenarios for potential facility upsets and failures. The extent of the increase in worker risk is not clear because all of the applicable risk evaluations (e.g., Phase 2 QRAs and health, safety, and environmental evaluations) and resulting risk mitigation measures have not yet been completed. Preliminary assessments, however, indicate that the increase in worker risk would be small.

Significant changes in permitted facility designs require permit modifications, which could cause substantial delays. Because risk analyses consistently indicate that the storage risk to the public and workers is much greater than the processing risk, changing the permitted configuration at any stockpile site is likely to increase the overall risk by delaying destruction of the stockpile.

Finding 1a. The reported emitted concentrations of SOPCs measured during trial burns at the JACADS and TOCDF incinerators are among the lowest reported to the EPA. TOCDF emissions are the lowest, or at least one of the lowest, in dioxins, mercury, cadmium, lead, arsenic, beryllium, and chromium. The reported emissions of some SOPCs were based on the analytical detection limit for the constituent, which means the actual concentration could be much lower than the reported concentration. Maximum emitted concentrations from JACADS were used for the HRAs for other baseline facilities to ensure that estimates of risks would be conservative.

Finding 1b. In 1992 and 1994, the NRC recommended that the Army investigate using carbon filters for two purposes: (1) to contain transient stack emissions or accidental releases of agent and (2) to increase public confidence in incineration. Activated carbon filters in use at several large incinerators in Europe meet very stringent regulations on emissions of chlorinated dioxins/furans and are considered to be the state-of-the-art technology for this purpose. Based on preliminary design evaluations, activated carbon in the PFS of the Army's baseline incineration system is likely to have sufficient adsorption capacity to reduce emitted concentrations of dioxins, furans, HD, VX, and GB for more than a year of normal operations before the activated carbon would have to be replaced. The activated carbon would also have the capacity to adsorb a chemical agent in case of a major upset; however, a major upset would necessitate the immediate replacement of the activated carbon.

The addition of carbon filters to a baseline incineration PAS does not appear to reduce the health risk to the surrounding population substantially because the health risk is already small (see Finding 1a). Nevertheless, reinforcing public and worker confidence is an important goal.

Recommendation 1. The Army should only consider removing the carbon filtration system from the permitted designs of the Anniston, Umatilla, or Pine Bluff facilities if, after a thorough implementation of the change management process to ensure meaningful public involvement, the public supports that decision.

Finding 2. Based on the evaluation of preliminary PFS design alternatives, an effective design for the PFS is feasible. Operating facilities in several countries now have significant experience in the design and operation of activated carbon filters.

Recommendation 2. The Army should take advantage of the experience of other users of carbon filters through appropriate consultation.

Finding 3. The Army has evaluated the implications of adding or removing passive carbon filter systems to the baseline incineration systems at the Tooele, Anniston, and Umatilla disposal facilities. Some of the impacts on risk to public health from stack emissions were evaluated by comparing the HRAs for the existing baseline facilities to estimates of the upper bound of public health risk posed by the addition of the PFS. However, the potential reductions in public health risk were not estimated, and the evaluations of impacts to off-site populations were incomplete.

An estimate of the impact on risk of accidents leading to agent-related public fatalities was made by expanding the Anniston and Umatilla Phase 1 QRAs to consider the addition of the PFS. The impact of the PFS on worker risk, which is not evaluated in the Anniston and Umatilla Phase 1 QRAs, was estimated by extrapolating the Tooele Phase 2 QRA results (which does include worker risk) to these other facilities. The Phase 1 QRAs for the Anniston and Umatilla facilities were also used to estimate increases in risk to the public from extended storage of the stockpile due to the PFS. Thus, the QRA evaluations completed to date are initial estimates of the magnitude of increased risk to the public from accidental releases of agent resulting from the addition of the PFS, but they are not complete evaluations of worker risk. Moreover, the range of potential delays to stockpile destruction caused by permit modifications and physical changes to the current site-specific baseline incineration configurations has not been defined.

Based on these estimates, the Army concluded that "[the] current plan to install and operate the PFS at the ANCDF [Anniston] and the UMCDF [Umatilla] remains the best course of action for maximizing human health and environmental protection," and that the TOCDF should continue to operate without a PFS. The decision to continue with the current configurations at permitted facilities eliminates increases in risks to the public and workers from potential delays in stockpile destruction caused by facility modifications or permit changes. Although worker risk from current PFS configurations is uncertain, based on the available risk estimates and projected schedules, the committee concurs with the Army's conclusion.

Recommendation 3. To minimize increased risks to off-site populations and on-site workers from delays in stockpile destruction, the Army should proceed with the current configurations, which include carbon filtration systems at Anniston and Umatilla, and should continue operations at Tooele, which does not have a carbon filtration system.

Finding 4. Only the Phase 1 Anniston and Umatilla QRAs have been completed. The risk of acute hazards to workers, probably the receptors at greatest risk from a mishap involving the PFS, has not been adequately characterized. Early initiation of the Phase 2 QRAs could identify these risks while facility design and construction are in progress and give the Army greater flexibility to modify facility designs and operating procedures, if necessary.

Recommendation 4a. The site-specific Phase 2 QRAs for Anniston, Umatilla, and Pine Bluff, which would identify and analyze specific failure modes, should include a complete evaluation of worker risk associated with the addition of the pollution abatement system filter system. The Phase 2 QRAs for each site should be initiated as soon as possible and should be completed and reviewed by independent technical experts before systemization of the facilities at Anniston, Umatilla, and Pine Bluff is completed.

Recommendation 4b. A risk management plan should be developed to minimize worker risk during the operation and maintenance of the pollution abatement system filter systems. The evaluation of operating and maintenance risks should include the operational experience of similar systems. If the increased risk to on-site workers is found to be substantial, the Army should consider making modifications, as long as they do not substantially increase overall worker or public risk from prolonged storage.

Finding 5. If increased worker risks and hazards are identified, it is not clear what steps the Army would take to mitigate them. Nor does the Army have a clear decision basis for balancing reductions in public risk and increases in worker risk.

Recommendation 5. The Army should clarify to the public and facility workers the risk management actions that would be taken if increased worker risks are identified. The Army should also clarify the decision basis for balancing reductions in public risk against increases in worker risk while fulfilling its mandate to protect both workers and the public.

Finding 6. The PFS was assumed to have no effect on concentrations of SOPCs in the HRA calculations for Anniston and Umatilla. The effects of SOPCs emitted from the stacks at these facilities have been estimated to be below the thresholds of regulatory concern without the benefit of the PFS. However, changes from installing a PFS have not been determined in a way that facilitates quantitative comparisons.

Recommendation 6. Future health risk assessments should include estimates of emitted and ambient concentrations of SOPCs, with and without the PFS, for all substances that contribute significantly to the overall risk. Because PFS performance cannot be based on actual measurements, the analysis should consider the implications of reducing emissions to both the method detection limit and the levels indicated by engineering calculations, including quantitative evaluations of the uncertainties associated with each risk estimate. The results, including the acute and latent risks, should be reviewed by independent technical experts. The results should then be presented in a way that facilitates public input to decision making.

Finding 7. Because of the length of time required to complete the preliminary PFS risk assessment, the fact that this evaluation is still incomplete, and the status of construction activities at Anniston and Umatilla, meaningful public involvement in the decision to include the PFS at these sites is no longer possible. The CMP Plan and the CMP Public Involvement Outreach Plan were not effectively implemented during the Army's analysis of the PFS. The lack of public involvement in this process represents a lost opportunity for the Army to develop its CMP and to implement the CMP public outreach process.

Recommendation 7a. The health risk assessment and quantitative risk assessment for Pine Bluff should be completed as quickly as possible and communicated to the public in a timely manner so that there can be meaningful public involvement in the decision process to retain or remove the carbon filter system. The risk assessments should be subject to independent expert review and the findings incorporated into the decision-making process.

Recommendation 7b. The Army should continue to refine its change management process and the change management process public involvement plan. Public involvement should be an integral part of future evaluations of the pollution abatement system filter system, especially at Pine Bluff. The committee repeats its recommendation that the Army involve the public meaningfully in the Chemical Stockpile Disposal Program as a whole.

ATTACHMENT D

"An Analysis of Kriistina Iisa's Report Concerning the Emission of Dioxin and the Use of PAS Carbon Filters for the Oregon Environmental Quality Commission"

"Exhibit 74," Attached to DEQ Item No. 99-0704
("Petitioners' Opposition to Respondents' Supplemental Motion for Summary Judgment," dated April 12, 1999)

X

I HEREBY CERTIFY THAT THE FOREGOING IS A COMPLETE AND EXACT COPY OF THE ORIGINAL THEREOF.

Attorney for

IN THE CIRCUIT COURT FOR THE STATE OF OREGON
FOR THE COUNTY OF MULTNOMAH

RECEIVED
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Trial Division, Dept. of Justice
Salem, Oregon

G.A.S.P., SIERRA CLUB, OREGON WILDLIFE FEDERATION, KARYN JONES, SUSAN JONES, HEATHER BILLY, DEBORAH BURNS, JANICE H. LOHMAN, LEANDRA PHILLIPS, MERLE C. JONES, CINDY BEATTY, ANDREA E. STINE, DOROTHY IRISH, MARY BLOOM, ROBERT J. PALZER, JANET NAGY, LADONNA KING, JOHN SPOMER, CHRISTINE CLARK, STUART DICK, GAIL HORNING, DAVID BURNS, PIUS A. HORNING, KARLA STUCK, AND MELANIE BELTANE,

Petitioners,

v.

ENVIRONMENTAL QUALITY COMMISSION OF THE STATE OF OREGON, AND DEPARTMENT DEPARTMENT OF ENVIRONMENTAL QUALITY OF THE STATE OF OREGON,

Respondents,

UNITED STATES ARMY,

Intervenor.

CASE No. 9708-06159

AFFIDAVIT OF
LISA P. BRENNER, Ph.D
and
THOMAS B. STIBOLT, M.D.

Hon. Michael H. Marcus

My name is Thomas Bodley Stibolt Jr. I am a Senior Physician with Northwest Permanente, PC and a Clinical Associate Professor of Medicine at Oregon Health Sciences University in Portland, OR. A true copy of my Curriculum Vitae was included in Exhibit 27.

1. To briefly summarize my academic credentials and current position, I received a Bachelor's degree in Electrical Engineering from Stanford University in 1971 and a MD from Rush Medical College in Chicago, IL in 1975. I was a house officer at The University of California Hospital in San Diego, CA from 1975 to 1977, A fellow with The Division of Computer Research and Technology of the National Institutes of Health from 1977 through 1980, A pulmonary fellow with the National Heart Lung and Blood Institute from 1979 through 1980 and a Pulmonary Fellow at Rush-Presbyterian St. Luke's Medical Center in Chicago, IL from 1980 to 1981. I joined the faculty at Rush-Presbyterian St. Luke's Medical Center in 1981 then moved to The Oregon Health Sciences University in Portland, OR in 1985. I moved to Northwest Permanente in 1989. Beginning in 1987 I have had significant involvement in Incineration Issues and Air Quality Modeling at a number of sites. I have used existing modeling programs and a number of my own programs to review and evaluate a number of incinerators.

2. My name is Lisa (Elizabeth) P. Brenner. I am Staff Scientist and President of Oregon Clearinghouse for Pollution Reduction, Portland, OR. A true copy of my Curriculum Vitae was included in Exhibit 27.

3. To briefly summarize my academic credentials and current position, I received a Bachelor's (1966) , Masters (1969) , and PhD (1976) from the University of Illinois, Champaign-Urbana, where I specialized in interactive educational computing. After a post-doc in psychophysiology with the University of Illinois Department of Psychology, I returned to the University of Illinois Department of Medical Computing, to become an Assistant Research Professor. During this time, from 1978-1981, I was principle investigator and contract manager on interactive computing software development grants. While at Rush University in Chicago, from 1980-1985 I was Director of the Division of Computer Based Education and Computer Literacy as well as serving as an Assistant Professor of Psychology. Beginning in 1985 I have devoted my time to environmental service, including appointment to several State and County advisory

committees. I have recently been primarily involved with air quality and incineration issues, including consulting, writing reports and critiques and working on air quality testing projects.

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An analysis of Kriistina Iisa's Report Concerning the Emission of Dioxin and the use of PAS Carbon Filters for The Oregon Environmental Quality Commission

Introduction

The question before the Court and the EQC is whether the report authored by Kristiina Iisa, PhD (Iisa Report) is a deliberate attempt to mislead the reader, or instead simply poor writing on the part of an individual who is unskilled in or inexperienced with scientific inquiry and reporting techniques.

It is generally accepted that the practice of scholarly scientific writing requires the author to conform to several rigorous tenets. The author must: 1) set the context for the reader, indicating where controversies lie, what is certain or uncertain, and what is hypothetical and conjectural as opposed to what is conclusive; 2) write succinctly, including only germane material; 3) cite references for all assertions, particularly for major claims, and include original data supporting such claims; 4) quote sources accurately in both fact and in emphasis; 5) choose as sources scholarly (refereed) journals that are representative of the topic; 6) use sources addressing the subject with major rather than minor or peripheral emphasis; 7) use the most current findings, particularly recent reviews of the literature; 8) provide complete bibliographic citations, including pagination, for reader verification; 9)paraphrase or quote directly from those references for which there is a possibility of obfuscation or confusion in interpretation; 10) not alter or suppress aspects of cited reference material which contradict claims being put forth by the author, and, 11) having a consistent format for reference citations. References are either numbered consecutively and listed for each use in the back or numbered according to their first use, and then referred to repeatedly by that number.

An examination of the Iisa Report using these principles for analysis results in the following observations:

1) The Report selectively chooses from its references only that material which seems to support a predetermined agenda: a) that incineration of mustard, albeit with its high chlorine content, simply does not increase dioxin emissions because chlorine is not important in dioxin production, and b) that static carbon filter beds are a viable technique, effectively eliminating all dioxin emissions from the proposed incinerator under all conditions.

2) In response to EQC requests for calculations, the Iisa Report provides none and instead redirects attention to its assertion that chlorine has no relationship to dioxin emissions. It is significant to note that not one of the references cited in support of this assertion actually includes such a statement in its conclusions.

3) The majority of the Iisa Report's direct answers to EQC questions are not referenced nor are they supported by standard calculations. (Question one: yes. Question two: only one of the three answers is so supported. Questions 3, 4, and 5: no)

4) Of the twenty-three sources cited, in twelve instances the reference quoted does not support the assertion, in ten instances the usage of the reference slants the conclusions in ways not intended by the author, and in six instances the references directly refute assertions made elsewhere in the report.

5) Only eight of the twenty-three sources cited are from refereed journals. Of these, only one is correctly used, and even that reference refutes other assertions made elsewhere in the report. Moreover, all eight scholarly sources contradict one of more of the Report assertions, some repeatedly so.

6) Only four of the references include Report assertions in their own conclusions.

7) Three of the articles cited must fairly be considered surveys; however, two of them are not so cited, nor are their contexts and conclusions quoted or paraphrased in the report which would

give the reader fair textual judgment about them. The article which actually is cited as a review is not presented to the reader within its political advocacy context. Furthermore, with this reference, the author misleads by substituting the article's conclusions (true of a set of extant incinerators), as the conclusions applicable to a single, proposed incinerator.

8) No pagination is provided to assist the reader in verification or further inquiry. Moreover, a significant proportion of the references are not readily available to the general reader or researcher. Sixteen of the references are not available through inter-library loan anywhere in the country. They must be purchased. (The authors of this critique did so, except for one report which is a 700 page document costing $100, for which the publisher's description only was obtained.)

9) It is significant to note that NO quotes from the references are included in the Iisa Report and that only one paraphrase is provided. This is not consistent with typical scientific reporting.

10) Six of her references contradicted Iisa's major assertions.

11) Although every reference listed is used at least once in the report, no other uniformity was followed. Two of the references are listed twice, with separate numbers; and others are repeatedly cited with their original number. Reference (23) is sited out of order. The appearance is of more references than actually exist.

The most important example of the Iisa Report's poor use of references is that in the context of the proposed Umatilla incinerator, the Iisa Report's analysis of the use of PAS carbon filters fails to support the conclusion that PAS carbon filters would provide additional protection for public health and the environment.

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The Approach of a Previous Rebuttal to the Report

An excellent technical critique of the Iisa Dioxin Report to the EQC was submitted by Pat Costner (Greenpeace) during the Motion for Reconsideration. That critique was in the form of a scientific debate, using other references and statistics from the performance of the prototype incinerator. The Costner critique did not directly question Iisa's logic, approach, or use of references. It presented other literature and data that contradicted the Iisa Report. The Iisa rebuttal to the Costner critique was primarily a restatement of her original findings rather than response to the new data provided.

Errors not brought to the attention of the EQC

We found nothing in the record to indicate that the DEQ or EQC requested or received copies of Iisa's references or her credentials. We found no instance in the record of the EQC being provided a copy of Iisa's cover letter which acknowledges that she is the sole author of the report.

In fact, the transcript of the EQC Chair Henry Lorenzen's decision at the November 22 meeting stated, "And my conclusion in this regard is directed substantially by the results of the two professors from Oregon State University and the testimony provided at the last commission meeting by Professor Iisa ..." It appears that he believed that the academic who signed the contract to do the work, Jim Frederick, PhD, full Professor and head of the OSU Department of Chemical Engineering participated in the report. Frankly, a hurried document by an academic of Dr. Frederick's stature will be taken quite differently than a report by a recent PhD and recent Assistant Professor.

Thus, the EQC was not asked to consider errors of commision, omission and obfuscation embodied in the Iisa Report during either their original decision or during the motion for reconsideration.

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The Focus of Our Analysis

The following critique brings no outside information to the Iisa Report other than the content of the references therein. The critique attempts to deconstruct Iisa's knowing manipulation of the data by using the report's own sources, looked at in their entirety. Additionally, this critique points out fallacies and tactics used to distract and mislead the reader of the report.

The document before you consists, then, of: 1) the above summary of the critique, 2) the critique in detail, 3) Iisa's references, as our Appendix I, annotated and augmented with actual quotes which are pertinent to the charges herein; Appendix II, which lists relevant document record numbers; and Appendix III including complete copies of all but two of the referenced articles. Every attempt has been made to be scientific, accurate, and thorough. The reader is invited to analyze the original sources in a manner not possible in the original Iisa Report.

Detailed Critique of Dr. Kriistina Iisa's Dioxin Report for The Oregon Environmental Quality Commission

EQC Questions: 1. Sulfur and Dioxin Formation

a. The DEQ has received technical information indicating that sulfur is an inhibitor to the formation of dioxins. Does sulfur act as an inhibitor to the formation of dioxins and will the sulfur present in mustard (HD) act as an inhibitor for dioxin formation in the proposed incineration process for the UAD incinerators?

Iisa's answer to the EQC's question about sulfur does not accurately represent the six references used in her Report. In fact, Iisa seriously misquotes several references when she equates the effects of sulfur operating alone and sulfur operating in the presence of coal.

Her initial answer, *"The inhibiting effect of sulfur on the formation of dioxins has been confirmed by several studies./1-6/"* is confirmed by four of her references, but not by reference (3), which finds that sulfur only acts as an inhibitor if there is carbon build-up in the incinerator, and reference (2), which finds the role of copper as a catalyst negates the effects of sulfur. Reference (2) states:

Addition of SO_2 to these "baseline" synthesis conditions appears to have little, if any, effect on the production of PCDD at all three temperatures, 300,400, and 500° C." (2)

Iisa next concludes *"Thus the sulfur in the mustard gas will behave in exactly the same manner as sulfur dioxide added to the incinerators in the tests or sulfur in coal and the results are applicable to combustion of mustard in the incinerators."*

Five of the six references which she cites, ranging from 1986 to 1996, investigate the use of coal as an additive to incinerators, not the use of sulfur alone. Reference (2) explores the interaction of copper as a catalyst with sulfur. The five references explore the reductions possible from coal, which adds fuel and higher temperatures to the process as well as its sulfur constituents. It is an overstatement (or oversight) by Iisa to imply that these sources confirm data about sulfur used alone.

Iisa's most recent, 1996 reference (5) concludes:

> " Small scale combustion tests were carried out with an addition of gaseous SO_2, coal, and pure sulfur reagent to the test fuel, and the following conclusions are obtained: 1) Dioxin reduction occurs by gaseous SO_2 addition to the test fuel. **2) Dioxin reduction occurs by coal addition to the test fuel and this effect is greater than the case of gaseous SO_2 addition.** It indicates that effects of dioxin reduction varied depending on the mode of sulfur addition."
> Table 2: Dioxin production -- SO_2 only in three tests(4500,3400,1800) -- coal only in three tests (41,33,14) -- Coal and Sulfur reagent in two tests (39, 9.1).

Later in the sulfur inhibitor discussion Iisa uses reference (4) to support a sulfur to chlorine ratio of 0.64 and 1.34, saying *"At these levels the dioxin emissions were less than one tenth of those that were obtained without any sulfur in the gases/4/."*

The results section of reference (4), however, cautions the reader:

> "It is important to note that the S/Cl ratio at which the inhibitory S effect was observed in this work is the lowest reported in literature and much lower than the suggested value of 10."

If this finding had been proven in later research, one would have expected her to cite the reference in which it was presented as confirmed, rather than as the anomaly noted by the author.

After presenting additional unreferenced figures in her response, she concludes: *"In another study sulfur to chlorine ratios as low as 0.1 were sufficient to reduce dioxin concentrations by a factor of one hundred./5/"* In actuality, this reference is one cited above which found COAL to be the best additive, not SO_2 and, as noted above, found only about a threefold reduction in dioxin formation at a sulfur to chlorine ratio of 0.5 using SO_2 corresponding to the ratio in HD and a negligible effect at a ratio of 0.1. Moreover, Iisa does not reveal an important fact noted in the same study, that the presence of other sources of chlorine when incinerated with HD was found to lower, rather than raise this ratio.

Compounding this error of fact, Iisa extrapolates upon these figures, which are based on coal additives, not on sulfur alone, to claim that given the molar ratio of sulfur to chlorine in mustard, *"Reductions in the amount of dioxins by at least a factor of ten could be expected."* The claim sounds reassuring, until one realizes that the premise is wrong in its factual base, and that the anticipated outcomes do not actually follow correctly upon evidence of sulfur operating alone.

In summary, five of the experiments cited compare coal to sulfur compounds, and with one exception, find that sulfur alone does not reduce dioxin production as much as coal. In addition, sulfur alone does not always reduce dioxin emissions as might be predicted. Only one of the articles recommends the use of sulfur gas for dioxin reduction. The others recommend the use of coal and further experimentation. These are decidedly different conclusions from those which the Iisa Report would have us believe.

Chlorine Arguments by Iisa

Because the effects of chlorine are fundamental to the Iisa Report, focused attention is herein given to the discussion presented in that document.

Summary of This Chlorine Critique

In response to EQC questions, the Iisa Report mixes definitively stated specific answers, notably unreferenced, with generalized references unrelated to the question, the purpose of which, it would appear, is to support a non-germane assertion that it is impossible to predict dioxin emissions from a facility based on the chlorine content of the feed. Further, Iisa uses the logic tactic of substituting conclusions applicable to surveys of the entire range of incinerators having many uncontrolled variables for conclusions applicable to a specific incinerator with known variables. General statements may be true of broadly generalized situations, but when specific instances and details are known, they can be analyzed with specificity. Iisa's own references do not support her generalized assertion, nor even some of her specific assertions, such as that above 1%, dioxin emissions are independent of chlorine concentration. Ironically, most of her references actually do present calculations about dioxin emissions for specific incinerators based on chlorine input, something which Iisa initially claims is impossible. Later she cites, with notable specificity yet without any reference sources or calculations, dioxin concentrations such as *"5 ng/m^3 dioxin production with one ppb chlorine in the flue gas."* Such reversals and internal inconsistencies are dizzying for the reader. The confusion is not remedied by any substantiating data or quoted references clarifying what would otherwise seem to be deliberate obfuscation.

Iisa further fails to advise the EQC what her own references cautioned her, namely that this is a contentious area in which the industry is attempting to fend off probable regulations by EPA to limit chlorine input to incinerators. Conclusions in such a volatile context remain more problematic than Lisa is willing to report.

EQC Questions: 2. Chlorine and Dioxin Formation

"a. Can dioxins be formed in a combustion process when chlorine is not an ingredient in the waste feed (i.e. chlorine in trace amounts as combustion air)?"

"b. Because the UAD incinerators are natural gas, would one expect other natural gas fired combustion facilities such as the Co-Gen facilities in the area, to form dioxin if chlorine was not a key component? If so at what mass emission rate would dioxin be produced?"

"c. How would the dioxin mass emission rate for the UAD incinerators while operating on natural gas compare to mustard (HD) is introduced into the incinerators versus not introduced into the incinerators? What is the dioxin reduction for the UAD incinerators if HD is not burned?

In calculating the dioxin emissions, the calculations should include: start up, shut down, normal operations, and upset conditions."

Introduction to Section 2a, b, and c

Note that in the second and third set of questions the EQC is asking about dioxin production for specific incinerators. Various comparisons are called for: a gas Co-Gen facility from the area and the proposed incinerator when chlorine is not present, and possible dioxin emissions when mustard, which is 41% chlorine, is burned and not burned in the proposed incinerator. Lisa was provided with schematics of the proposed incinerator and data on trial runs of the prototype incinerator, and clearly was expected to provide some predictive calculations. Last, the EQC wants calculations under differing operating conditions.

In response, Iisa does not provide specific, numerical answers to the EQC's questions. Instead she offers general conclusions, but no calculations. Iisa's answers to the first two sets of questions are actually unreferenced, something not immediately apparent because of the layout of her text. Her answer to the third set of questions is based on data from the trial incinerator, which data she then spends three and a half pages discounting and minimizing.

What follows is a detailed analysis substantiating the claims made in this introduction.

Answers to questions 2a

Iisa's answer to question **2-a** is, *"Yes, any chlorine in the incinerator regardless of the source of the chlorine can contribute to dioxin formation. Even trace amounts of chlorine can lead to dioxin formation."* She gives no reference for these statements. She continues to obfuscate the role of chlorine in dioxin production. Her later discussion is no substitute for citing a good reference to support this important point.

How do Iisa's references view the role of chlorine in dioxin production?

The authors of the references which Iisa cites assume that chlorine is the critical, determining factor in dioxin production during incineration, with variables such as carbon, heat, additives and catalysts important only in attempts to control and capture the dioxin produced by chemical reactions in the presence of chlorine. Reference (15) , which Iisa includes in support of the importance of copper as a catalyst was actually an excellent "Critical Review" of the field, posing the basic questions as:

> "Purpose and Structure of Review. Basic questions regarding PCDD/F formation are as follows: (1) What is the influence of process parameter -- reactant, surface, chlorine source, temperature, catalyst, reaction time, atmosphere, and water -- on the formation process? (2) What reaction mechanisms are involved in formation? (3) What kinetics can be used to describe

> PCDD/F formation, and can laboratory scale experiments explain the formation rates in real incinerators? What differences exist between formation on collected and uncollected fly ash? We will attempt to answer these questions with the published literature..."

This article should have been distributed to the EQC, for it summarizes current models for calculating dioxin emissions. It also provides a valuable admonition:

> "Conclusions and Recommendations ..."This (result) might have several reasons, one of which is simply the fact that authors use fly ash from different incinerators. The different rate constants found probably reflect to some extent the range of de novo synthesis rates in various incinerators. **In any case, even the highest rates found cannot explain the levels of PCDD/F found in incinerator emissions."**

It is worth noting that this particular review of the literature concludes with the sobering observation that all the models and measurements under-predict the actual levels of dioxin produced by incineration in the presence of chlorine. An objective author would have made this reservation an important finding in any discussion of dioxin. But instead of fully discussing this reference, which is from a credible journal, Environmental Science & Technology (American Chemical Society, publishers), Iisa provides her own review:

"Laboratory and pilot scale studies done in well controlled conditions usually indicate that increasing the amount of chlorine by e.g. addition of hydrogen chloride increases the yield of dioxins /4,7-8/. Full scale studies on the other hand have failed to show any trends with the chlorine concentrations./8-10."

Repeating her unsubstantiated, faulty assertion, she contends that: *"Overall, factors other than the chlorine content are more important in setting the level of dioxin emissions during gas combustion in an incinerator/11-12/"*

Iisa's major point in this section is substantiating the claim that *"In general the existing data on the effect of chlorine concentration can be concluded to imply that at relatively high concentration of chlorine in the feed, of the order of percents, the dioxin emissions are independent of the chlorine content of the feed."* Later she says, *"...assume that the dioxin emissions are directly proportional to the chlorine concentration until up to 1 weight % and that above this concentration the dioxin emissions are independent of the input concentration. This seems a reasonable assumption based on the data available."*

It is worth noting that these strong claims are at this point hedged by Iisa with phrases such as: "In general," "can be concluded to imply," "assume," and "This seems a reasonable assumption." Without substanting reference sources, such hedges are unfortunately necesssary.

In fact, Iisa's own references do not support the assertions she makes. Ironically, her own first reference (1), used by her in responding to the question about sulfur, actually makes as its central conclusion the statement that:

> ***" Chlorine gas is seen as a key intermediate in the formation of chlorinated dioxin compounds..."(1).***

And her reference, (14) states in its conclusions:

> **"The relationship between the HCl concentration and the generated PCDD/PCDF concentrations under fixed combustion conditions appears to be exponential." (14)**

This finding was arrived at not just in the "laboratory:"

"Hydrogen chloride was injected in concentrations between 150 ppm and 4.5% in gasoil combustion gasses in a domestic burner and an experimental combustion chamber." (14)

Reference (14) thus refutes Iisa's claim that: " *Full scale studies on the other hand have failed to show any trends with the chlorine concentrations./8-10/*" . This very reference cites a trend with an operational incinerator using chlorine concentrations up to 4.5%, directly refuting Iisa's "reasonable assumption" of 1% .

Reference (14) and particularly(15) also present data that Iisa could have used to model dioxin emissions in answer to the EQC's questions. Not doing these calculations puts her under the suspicion of avoiding results which would have shown higher dioxin production with the chlorine in mustard. In this matter the Iisa Report fails to be a fair and objective evaluation of the literature.

Iisa uses reference (14) to assert that: *"During gas combustion factors such as sooting (formation of small particles consisting mainly of carbon) may have a greater impact on dioxin formation than the chlorine content./7/14/"* Although the study discusses the role of soot in dioxin formation, it makes no such conclusion. It merely states that:

> "If this direct contact (chlorine with flue gases) cannot be avoided, the use of gas fuels or optimizing the combustion toward low soot and CO levels, will minimize PCDD, PCDF formation according to our results."(14)

Isa's reference (7) does not vary the amount of chlorine in its feed during the experiment and draws no conclusions about the relative impacts of chlorine and soot.

The introduction to her reference (12) , which she also uses to support her point about chlorine not being the most important factor in dioxin production, states the thesis of the paper:

> "Combustion and process parameters can play a major role in determining PCDD/PCDF formation (3). Understanding these effects can lead to better control technologies."(12)

The conclusions in reference (12) are:

> "In municipal waste combustion, significant PCDD(F) formation takes place in flight over short time scales and is fly ash mediated. Good combustion quality is an (sic) important for reducing PCDD/PCDF formation. Co-firing waste combustors with coal is a possible option for PCDD/PCDF control technology." (12)

Reference (12) makes no reference to chlorine as an important or unimportant variable, although Iisa cites it as if it does so.

In her discussion of factors more important than total chlorine content, she says *"The form at (sic) which chlorine is present in the flue gases is believed to influence dioxin formation more than the total amount of chlorine in the gas phase: elemental chlorine is more reactive than hydrogen chloride for dioxin formation/13/".*

Reference (13) discusses experiments in petroleum refining in which unchlorinated Furans become chlorinated, a quite different process than incineration. Here is an extensive quote from Reference (13) to illustrate how inappropriate is her use of this citation:

> "The formation of polychlorinated dibenzofurans (PCDFs) and Polychlorinated dibenzo-p-dioxins (PCDDs) in catalytic reforming, a petroleum refining process, was studied using a laboratory apparatus." ... "In the catalytic reforming process, coke accumulates on the catalyst surface. The coked catalyst is regenerated at temperatures of 380-525°C by burning off the coke in a controlled oxygen atmosphere followed by reactivation of the catalyst by the addition of chlorinated compounds such as CCl_4, 1,1,1-trichloroethane, and HCl. Catalytic reforming is a major source for the aromatic and high-octane aliphatic constituents of unleaded gasoline."

> "Conclusions...We believe that our chlorination experiments indicate that dibenzofuran and possibly biphenyl and similar hydrocarbons act as PCDF precursors and become chlorinated

> in the catalyst regeneration process. Corrosion products on the steel piping of the process plant seem to be the most likely chlorinating agent. Furthermore, PCDFs can form by *de novo* synthesis from chlorinated hydrocarbons like TCE, DCM, and CCl_4 in the presence of $FeCl_3$ and HCl or Cl_2.
>
> This pathway of formation of PCDF's and possibly PCDDs could also be of relevance for other sources of PCDFs and PCDDs like municipal waste incineration ..."

It is quite a stretch to use this reference. Iisa seems to be extrapolating a statement about laboratory findings describing how unchlorinated dibenzofuran becomes chlorinated in petroleum refining into a statement of major findings about the relationship of the type of chlorine in incinerator feed to dioxin production. In fact the laboratory experiment found only that Chlorine gas converted more DBF to PCDFs than HCl. Iisa earlier asserted that laboratory studies did show a direct relationship between chlorine feed and dioxin production. In another confusing reversal she now uses a laboratory study to question that relationship. More interesting is this study's hypothesis about the effect of corroded piping leading to dioxin production. A fair scientific report might have included this finding as germane to the inquiry.

Iisa's last point in the discussion of factors more important than total chlorine content is, *"Metals such as copper and iron catalyze dioxin formation, and the presence of them in the flue gases greatly increases dioxin formation./15-17/"* The first two references do discuss catalysts, but make no comment about catalysis being more important than total chlorine content. Here are quotes from two of the three references:

> "The role of Cu compounds both in ring condensation and chlorination appears well established."(15)

> "In conclusion, fly ash has very active sites that produces dioxins from precursors at 250-300°C. Formation of dioxins by catalytic activity of fly ash from PCP precursor at 300°C can

be prevented or reduced using TEA or CaO inhibitors. " TEA = triethylamine, CaO= Calcium Oxide(16)

The third reference (17) does not discuss the issue or even use the words "metal" or catalyst."

Later Iisa reiterates her main assertion *"... and it is impossible to predict dioxin concentrations solely based on the chlorine content of the feed."* She could/should have then proceeded to use the formulas presented in her reference (15) to do calculations for the proposed incinerator, in which best and worst case calculations would be made given the specific structure of the incinerator, fuels, and control technology. Instead she commits the fallacy of substituting what one can say about the full range of incinerators in the country with a specific incinerator plan.

Iisa's reference (9) which she uses to support her assertion that there is no relationship between chlorine and dioxin production is cited inaccurately, having an erroneous title and date. No pagination is provided, although the document turns out to be a lenthy report of 716 pages. This reference is unavailable through inter-library loan and costs $100, making it not readily available to the general reader or scholar wishing to review it. This particular document was not purchased, athough the publisher's description was obtained. This description concludes with the following disclaimer which would make most researchers highly wary of using this source for drawing conclusions:

> "This effort was not intended to: develop emission factors, evaluate control system performance, generate new data, assess PCDD/F and chlorine relationships in liquid effluents or solid residues, evaluate the removal of particulate bound PCDD/F in emission control devices, nor assess other studies addressing this question, except to make sure that relevant data were obtained."(9)

In context: Referenced Authors Participating in a National Lobbying Campaign

Reference (6), which is also listed as (8) and reference (11) are authored by the same three individuals, who work for Dow Chemical Company, the operators of a large number of incinerators. They state their purpose in the Introduction to (6) (8):

> "The U.S. EPA Waste Minimization National Plan indicated that EPA supports the view that the higher the feed rate of halogens, the greater the mass emission rate of halogenated organics. Based on this assumption, the EPA has considered waste feed limitations for halogen waste as a means of reducing dioxin emission (1) As a response to these views, an industrial data gathering was carried out to obtain factual information verifying or refuting this theory."(6)

These authors set the context in which they acknowledge that they are working against EPA's expected regulations to limit the incineration of plastics (with it high chlorine content) in U.S. incinerators. A fair representation of this reference would have included its highly prejudicial stance. A fair report would have presented both sides of the issue, and one would have expected it to recommend a course to the EQC that represented the best supported conclusions of the scientific community. This was not done in the Iisa Report.

The Dow Chemical authors survey 23 operating hazardous waste incinerators of all types and ages and control equipment. They then "muddy the waters" with all the confounding factors of these incinerators to conclude that the amount of dioxins put in the air depends on lots of factors, not just the amount of chlorine in incinerator fees. Of course a new incinerator with superior control technology will better prevent the formation and eliminate dioxins from the emissions than an old incinerator, and one that adds coal will have different results from one that does not. This statistical obfuscation is pointedly offered by the authors to provide "fuel" to those who wish to stop EPA's investigation of prohibiting the incineration of plastics, the major source of halogenated organics in the waste stream. Their results are a statistical tactic, not a dismissal of the central importance of chlorine in dioxin production. Using their results as a credible sources is akin to letting the fox guard the chicken coup.

The fallacy in Iisa's report is substituting results found for a large set of incinerators having widely varying characteristics for a specific incinerator in which the dependent variables are known. Iisa was provided with the plans for the proposed incinerator. She was supposed to address dioxin production for that particular incinerator, not for a generalized collection of all hazardous waste incinerators in the United States. Henry Lorenzen, the EQC chair felt that something was wrong but couldn't "put his finger on it" when he referred to her "counter-intuitive" conclusions.

It is notable that none of Iisa's discussion of her chlorine assertions provides documented answers to the EQC's actual questions. Iisa concludes her response to the EQC's question with another unreferenced paragraph that claims, *"even minute amounts of chlorine may lead to substantial dioxin formation if the conditions are right"* along with an unexplained and unreferenced figure of 5 ng/m^3 dioxin production with 1 ppb chlorine in the flue gases of an incinerator. If her assertion about dioxin emissions being independent of chlorine were correct, she would not be able to make such a calculation. One would expect her to then go on to evaluate conditions from the schematics and present specific calculations for operation without chlorine in the feed in Eastern Oregon. She does not.

Answers to questions 2b

Her answer to question **2-b** is also unreferenced and she gives the EQC no calculated emission numbers based using the proposed the incinerator plans or specific test data on dioxin emissions from gas-fired generators. Instead she juxtaposes the comment that *"Generally, natural gas fired combustion facilities are deemed not to produce significant amounts of dioxins."* with *"Measurements in the literature have indicated, however, dioxin concentration well above 30 ng/m^3 during gas combustion without other chlorine sources except impurities in the fuel and combus-*

tion air." And then concludes *"These measurements ... are probably not applicable to ...the Co-Gen facility."* We could find no support for or even mention of any of these claims in her references. Not providing a specific reference to a direct question seems puzzling enough, but she is even more confusing when she says that sometimes there are no dioxins in these facilities and sometimes there are lots of dioxins in these facilities, but none of the data probably relates to the facilities in question.

Answers to questions 2c

In the next four pages, as she discusses questions 2c, Iisa cites only two references (relating to a minor point of sulfur reactions) and includes the table from the prototype incinerator. She uses phrases such as *"some increase in the dioxin emissions may occur"*, *"the emissions...are expected to be below 1 ng/m^3 and thus it is impossible to give an estimate,"* and *"emissions...are not either expected to exceed 30 ng/m^3."* The reasons behind these expectations is not clear. Again, they appear to be unsubstantiated assumptions. However, the question posed relate to a specific incinerator design, and clearly this question requires some actual calculations. These were never done.

Iisa's paragraph discussing mustard refers back to her unsupported hypothesis that there *"is no direct proportionality of dioxin formation with the input chlorine concentration..."* described in her answer to the EQC's first question about sulfur. With no references or calculations, she concludes, *"Overall the expectation is that despite the high chlorine content of mustard the dioxin emissions will be low."* It is again unclear why she would expect this, as it remains unsupported by her references. Figure 2 in reference (5) suggests that the 0.5 molar ratio of sulfur to chlorine in HD would result in about a threefold reduction in dioxin at best.

In her next paragraph, Iisa states, *"One way of comparing the emissions during combustion of mustard or GB is to assume that the dioxin emissions are directly proportional to the chlorine concentration until up to 1 weight % and that above this concentration the dioxin emissions are* *independent of the input concentration. This seems a reasonable assumption based on the data available."* Iisa gives no references for this statement. This may be because it is contradicted by the references (1) and (14) (previously discussed) which state that the relationship is exponential, with experiments showing a relationship up to 4.5% chlorine.

Next Iisa claims, *"Further, based on the data presented in the answer to the first question (about sulfur reducing dioxin emissions) it is safe to assume that the sulfur in mustard decreases the dioxin emissions by at least a factor of ten."* As noted in the critique of her answer to that first question, her own references did not make or support this claim.

Iisa makes the concrete assertion that *"The dioxin emissions from the proposed plant could be best estimated based on the trial burns at Johnston Atoll." ... "The comparatively high emissions from the deactivation furnace with VX and the dunnage furnace with GB may seem surprising at first."* She then goes on to discount the numerical results with completely unsubstantiated speculation including salty air, the presence of metals (which would also be present at Umatilla); and that previous soot buildup in the incinerator could be causing residual effect (the only assertion with a cited reference.) Iisa's discounting of the data is in contrast to her defense of these figures after the Costner critique shows how the table understates actual dioxin emissions.) After more verbiage, Iisa invokes the addition of carbon filters without references to say *"With the carbon filters it is possible to decrease the dioxin emissions by several orders of magnitude. Thus an estimate of actual emissions below 0.1 ng/m^3 is reasonable and below 1 ng/m^3 conservative".*

Resorting to personal authority, Iisa then says: *"The emissions during start-up, shut-down or upset conditions could be higher. However, with the safety procedures proposed for the plant I do not expect them to be exceed 30 ng/m^3."* Carbon filters are invoked as solutions to each of the conditions discussed that would increase dioxin emissions, but when she discusses the unavailability of a carbon filter, she makes the unreferenced claim that *"In this case, the dioxin emissions are expected to be comparable to those measured at Johnston Atoll and they would still be* *below the limit 30ng/m^3....All of the precautions seem adequate to ensure that the dioxin emissions during upset conditions do not exceed 30ng/m^3"* None of her reasoning in this critical statement is explained or referenced. The reader is left to wonder just why upset conditions should have the same results as best-case test conditions for the prototype?

There are no additional references in the last two pages of Iisa's discussion to question 2-c, nor are there calculations from referenced formulas.

Iisa concludes with a brief presentation of conditions that would increase the dioxin emissions. Again there are no references to the extensive conditions which include: a) improper combustion conditions in the incinerator, b) lack of cooling in the quench tower, c) unavailability of a carbon filter d) formation of hot spots in the carbon filter. Dispite the list, Iisa curiously dismisses the results of any of these conditions with an unsupported claim that: *"However, with the safety procedures proposed for the plant I do not expect them to be exceed (sic) 30 ng/m^3."*

Question 3 Combustion technology and dioxin.

a. What is considered state of the art design technology for preventing dioxin formation in a combustion process?

Iisa dismisses combustion technology altogether by saying that *"the design of the incinerator is not crucial."* This is in direct contradiction to many of her own references, most notably (17) which is also (19). This article reviews improvements in incinerators in Great Britain. The authors found that improvements in combustion led to the greatest improvement in inhibiting dioxin formation:

"In Summary The three principle techniques discussed, which are used to destroy dioxins present in the incoming waste stream and inhibit formation later in the incineration process are:

Reduction Stage	Quantitative Effect
1. Combustion Control	Reduces dioxins from 100 to 10 ng/Cu M

2. Cool gases to below 250° C	Reduces dioxins from 10 to 1 ng/Cu M
3. Activated carbon injection	Reduces dioxins from 1 to 0.02 ng/Cu M"

(17)(19)

Thus, contrary to her claim, the design of the incinerator can produce a greater reduction in dioxins than the control equipment put on that incinerator.

EQC Question: 4. Pollution Control Technology and Dioxin

a. What are the essential design elements of a pollution abatement system for controlling dioxin emissions from a combustion process?

Iisa's starts out with the two recommended principles to minimize dioxin release, rapid cooling of the exhaust gasses and adsorption of dioxin. She reiterates the basic principles for minimizing dioxin release, to : a) prevent the formation of dioxin and b) destroy or remove dioxin.

Then she strays from the findings of her own references without citing a reference. *"The formation of dioxin occurs in a relatively narrow temperature window of 250-400°C. Above 400 °C and below 250°C the net rates of dioxin formation are negligible."*

Her own reference (14) which reviews dioxin formation states that

> "...PCDD and PCDF formation was found over a temperature range from 900°C to 240°C."

Iisa suggests that by cooling rapidly to below 250°C *"formation of dioxins is easily decreased by factors of ten to hundred./19/"* Reference (19) quoted in the previous discussion indicates a ten fold reduction by cooling. It does discuss three changes to incinerator operation which together can achieve the hundred fold and higher reduction, but Iisa should have used the lower number that related only to cooling.. This article also provides other tables showing that the reduction based on cooling ranges from four fold to twenty fold among the post cooling tests.

Iisa then goes on to suggest that other technologies exist although these are not proposed for the Umatilla incinerator. Her reference (20) describes injecting $CaCO_3$ in a laboratory environment only and does not discuss limestone, as she says it does. Reference (22) discusses injecting three substances, including limestone; but the author does not recommend limestone because of its awkwardness in handling.

"Lime was by far much more difficult to handle and feed accurately."(22)

Iisa next discusses sulfur. Her misrepresentations as discussed at the beginning of this critique were not corrected, and activated carbon, the most common substance used for adsorption is discussed without citing any references.

When she gets to carbon beds, she states, *"With a proper selection of this (sic) very high reduction efficiencies can be obtained. The efficiency of activated carbon filters is unsurpassed by other methods."* Her support for these claims is one reference (23), of which she says: *"An activated carbon filter used in the incineration of solid radioactive waste in Germany was reported to decrease the dioxin emissions by factors ranging from 250 to 5700 with an average reduction by a factor of 1700 in nine tests./23/. These correspond to reduction efficiencies of 99.6 to 99.98%."*

It is notable that in fact, her reference (23) describes a six month long test use of activated carbon filter beds for the emissions of three small incinerators. Two of the three little incinerators were for solid and one for liquid waste, while Iisa claims that there was one incinerator for only solid waste. The two solid waste incinerators had a throughput maximum of 50kg/h, and the liquid waste incinerator a throughput maximum of 30kg/h. The liquid waste incinerator had been in operation since 1988, with 7,000 hours of operation. This is not a large or heavily used incinerator!

Table III in the article reflects filter efficiency, giving the dioxins measured upstream of the filter and downstream of the filter. Only numbers are given for the ten tests (not nine test as Iisa states), such as "September 7, 1993 15.9 ng/m^3 upstream of the filter, 0.076 ng/m^3 downstream of the filter." The article does not give dioxin emissions from the three incinerators before and after implementation of the test filter. The article does not mention reduction efficiencies. As was previously discussed, dioxin production can be reduced through incinerator design and operation, or through adsorbing the dioxins before they go out the stack. A poorly operating incinerator could produce a large amount of dioxin, making a filter with "99.6-99/98%" reduction still leave a significant amount of dioxins in the emissions. Ultimately, it is the amount of dioxins in the emissions that count, and Iisa should have let the numbers actually presented in the article stand on their own.

Iisa does not present the article's extensive discussion of the drawbacks of the filter or on-going safety problems and measures needed to maintain the filter. Nor does she mention the fact that the system was not operated long enough to exhaust the filter capacity or figure out how to dispose of the filter, once exhausted. The extensive discussion of problems with the filter in the article are included here to illustrate the complexity of the issues that she should have been grappling with:

> "The drawbacks of the filter are:
> -- Risk of spontaneous ignition of the coal
> -- Risk of dust explosion
> To avoid these drawbacks, the fixed bed has been installed and instrumented accordingly (see Fig.3).

Carbon monixide differential measurement is carried out at the flue gas inlet and outlet with a view to detect hot spots. This method is extremely sensitive. In case of a failure of this measuring device and the burning of the coal bed, temperature measurement is performed with the limit value set to 145°C. If this limit value is reached, the filter is isolated by the flaps located at the inlet and outlet and the flue gas is led through the bypass. Then, the fire is extinguished by the lack of oxygen. In addition, purging of the filter with pure nitrogen and, hence, inertization are envisaged. The overpressure, which may possible (sic.) be generated as a result of the temperature increase, is reduced by the safety fittings and the water tank. Excessive vacuum developing by cooling with the filter being isolated is avoided by other safety fittings. Coal dust explosion is excluded by constructional measures, such as the avoidance of ignition sources and grounding of the fixed-bed filter and pipelines to prevent electrostatic charge.

Experience Gained

The test filter has now been operated for 2400 hours. An increase in the differential pressure between filter inlet and outlet has not been observed. Once during the entire operating period, the incineration plant was shut down by the carbon monoxide differential measurement system. The filter was isolated automatically and purged with nitrogen for safety reasons. After about 3 hours, the incineration plant and the filter could be operated again. The carbon monoxide differential measurement system is interference-prone. Maintenance has to be carried out regularly. This is done once a week by cleaning the dust filters and daily by emptying the condensate collector.

Filter efficiency in terms of dioxin and furan retention was measured several (10) times during test operation. The results are represented in Table III. (all < 0.1ng/m^3)

Reduction, i.e. exhaustion of filter efficiency, has not yet been observed. Further measurements will be carried out with a view to find out when the activated carbon has to be exchanged."(23)

In contrast to her reference's presentation of the drawbacks of the filter, Lisa has no discussion of their drawbacks. Her only mention of drawbacks is buried in her answer to Question 2c where she states: *"Formation of hot spots in the filter. The formation of hot spots may cause fires and release of adsorbed dioxins from the filter. The carbon monoxide concentrations before and after the carbon filters are measured and used as an indication of possible hot spots in the filters. The carbon filters are also taken off line if the temperature of the inlet gas exceeds 130° F."* Not only are her brief comments buried in the answer to a different question, but the comments themselves are an extremely mild presentation of the dangers discussed above. "Spontaneous ignition," and "Dust explosion," are translated into, "Formation of hot spots..." by Lisa.

Lisa then proceeds to discuss the advantages of static carbon bed filters without references and gives no disadvantages or cautions at all! This question was supposed to be about proper design elements of a pollution abatement system, not an endorsement of a particular system or even a review of different approaches.

Moving on to proposals to use activated carbon together with limestone, she cites a reference, (21) as proof that the combined control processes can reduce emissions to less than 0.1ng/m^3.

Her first use of the citation is: *"The ability of dry, semi-dry and wet processes to reduce the toxic equivalent to values of less than 0.1 ng/m^3 has been demonstrated in Europe./21/"* In fact, the survey does not discuss any demonstrations of performance data. The article's abstract indicates the purpose of the review:

> "Investment cost and operating cost data are presented for various processes."(21)

This reference is a survey of post-combustion PCDD/PCDF control technologies that does not recommend carbon beds, nor does it present any statistics demonstrating emission reduction. The article includes a one paragraph description of static carbon beds:

"Static Beds of Carbon.

One of the advantages of such process is that a huge quantity of carbon is used, hence providing some buffering effect against surges of pollutants. It also has a good efficiency with respect to mercury control, but the same can be said of any process involving active carbon at a reasonably low temperature. It suffers from a few drawbacks. First of all, as will become apparent on the figures, it requires a large investment, because the engineering is not so simple. Secondly, there are some concerns about safety; especially fire hazard. This is due mostly to poor gas distribution and local hot spots in the carbon bed. Extra measures have to be taken, like nitrogen blanketing of the collection hopper, and CO detection upstream and downstream of the reactor, so as to detect problems. The pressure drop is also fairly high, which translates into electrical power requirement for the fan. This turns into the following figures: incremental investment costs of 11 M$ and typical operating costs of 890,000/year or 8.8$/ton of incinerator capacity. "

A graph shows carbon beds at almost $8 per ton operating cost vs. their recommended wet dediox process at $2 a ton, and investment costs of 11M vs. 1.3M for their recommended process. She does not mention all these disadvantages in her report, nor the fact that the survey does not recommend carbon beds. This article most emphatically disagrees with her (previously discussed) statement that *"The efficiency of activated carbon filters is unsurpassed by other methods,"* if we consider that the word "efficient" typically refers to cost effectiveness. This article concludes that the static carbon beds are the most costly (i.e. least efficient) of all approaches.

If the European experience with static carbon beds is as positive as she states, she should have been able to come up with credible references to support her claim

Iisa's next, unreferenced, sentence briefly mentions disadvantages of the control techniques of adsorption in general: *"A disadvantage of these methods is that the wastes are mixtures of the carbon that has been contaminated by dioxins and other pollutants together with the limestone* *and possibly ash from the combustion process. The disposal of the waste mixture creates a problem."* One would expect referenced examples of disposal techniques and costs. But none is provided.

In the next paragraph she states *"Several other methods for the reduction of dioxin emissions are being developed. (24)"* Reference (24) is a laboratory experiment with the use of metal-doped zeolite. It is certainly only one experiment, not "several other methods. "The authors conclude:

> "It should be noted that the time intervals used in the catalyst deactivation studies presented here were quite short compared to catalyst lifetimes required in practice. Therefore, further tests of catalyst long-term stabilities under realistic conditions encountered in commercial MWIs will be necessary."(24)

Iisa's next example is *"...catalytic reduction of dioxin emissions": "...High destruction efficiencies can be obtained if the temperature in the catalyst is high enough./21,25/"* This is not a correct use of reference (21) either; because, again, the article evaluates cost of construction and operation, not performance. Even in the realm of cost, the review, doesn't recommend this method either, for it is the second most expensive method, next to static carbon beds(the most expensive.) The survey actually recommends a control method that is not discussed by Iisa:

> "...the wet dediox process, followed by the Flugström and the SCR" (catalytic reduction process)

Reference (25) is a correct use of a reference, for the article does show that the SCR process can reduce dioxin emissions in that incinerator to under the German limit of 0.1 ng/m^3. The conclusion section, points out that:

> "Another aim, the acceptance of incineration technology by politicians and the public, could not be achieved."

Not quoting from this reference avoids the uncomfortable situation of reminding the EQC that European standards for dioxin emissions are far more stringent than those in the U.S. A scientist wishing to be fair would have included all relevant facts, comfortable or not.

EQC Question 5 Design of the carbon filters and best available control technology. My opinion on the pollution abatement system (PAS) carbon filter design and comment as to the carbon filter system applicability as being the best available technology for incineration design was asked.

Iisa's unreferenced conclusion is that, "*...activated carbon filters together with rapid quenching of the flue gases is the most efficient methods(sic) of reducing dioxin emissions. No other method seems to be able to offer higher reduction efficiencies.*"

What does this mean? Iisa repeatedly used carbon filters throughout her document as the "magic bullet" that would eliminate all dioxin that one would normally find in incinerator operations. Having done so, there was a large burden of proof on her to demonstrate the consistent reliability of this control method. But she did not marshall a single substantial reference to support her assertion. In fact, she did not include the disadvantages listed in her reference (21) of cost and engineering problems, nor that carbon beds are not a recommended technology. It is evident that she read the article because she cites it and does so correctly. Is this incompetence or deliberate misrepresentation?

Under risks, she states, "*There is a possibility for the formation of local hot spots that could lead to fires and release of the adsorbed compounds from the carbon. Also, condensation of water in the filters might render the filters unusable. The preventive actions proposed for the carbon filters at the Umatilla facility seem adequate for reducing the risks associated with the use of the carbon filters.*"

lisa's language about the fire hazard is so understated as to be misleading, particularly when she could have simply quoted her reference; and she does not present the safety measures that her reference states are necessary to reduce the fire danger or compare those measures with the ones proposed for the Umatilla incinerator. Such oversights are dangerously counterproductive to reaching a fair understanding of the situation and consequently to a sound solution to the problem.

I, Lisa (Elizabeth) P Brenner and Thomas B. Stibolt have produced and read this affidavit and the same is true that I verily believe.

Lisa (Elizabeth) P. Brenner

Lisa (Elizabeth) P. Brenner

Subscribed and sworn to before me this 17th day of April 1999.

Stuart a, Sugarman

Notary Public for Oregon

My Commission Expires:

OFFICIAL SEAL
STUART A. SUGARMAN
NOTARY PUBLIC-OREGON
COMMISSION NO. 056731
MY COMMISSION EXPIRES AUG 26, 2000

Thomas B. Stibolt

Subscribed and sworn to before me this 17th day of April 1999.

Stuart a Sugarman

Notary Public for Oregon

My Commission Expires:

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ATTACHMENT E

"Review of Affidavit by Lisa P. Brenner, Ph.D. and Thomas B. Stibolt, M.D."

Technical Memorandum
Ecology and Environment, Inc.
September 15, 1999
(DEQ Item No. 99-1528)

FILE

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99-1528

ecology and environment, inc.
International Specialists in the Environment

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TECHNICAL MEMORANDUM

Date: 9/15/99
To: Sue Oliver, DEQ
From: Gordon Randall and Julie Wroble, E & E Seattle; Richard Freeman, Ph.D., E & E Tallahassee
RE: Review of Affidavit by Lisa P. Brenner, Ph.D. and Thomas B. Stibolt, M.D.

Ecology and Environment, Inc., (E & E) has completed a review of the affidavit by Lisa P. Brenner, Ph.D. and Thomas B. Stibolt, M.D., regarding Professor Kristiina Iisa's October 29, 1996 report to the Oregon Environmental Quality Commission (EQC) on dioxin emissions and carbon filtration. Our overall conclusion is that the statements made by Professor Iisa in her report were correct given the information available at the time. Overall, Professor Iisa's report accurately summarizes the information presented in her references. The statements and claims made in the affidavit are largely without validity. Some statements accurately highlight the uncertainty related to dioxin emissions, but these uncertainties were acknowledged by Professor Iisa and would not change the conclusions of her report.

Since Professor Iisa's report, some additional EPA guidance and other information have become available that directly relates to issues in the report and affidavit. Drs. Brenner and Stibolt seem unaware of these more recent technical documents. Of particular interest is EPA's August 1998 "Guidance on Collection of Emissions Data to Support Site-Specific Risk Assessments at Hazardous Waste Combustion Facilities." This report includes a chapter on dioxin and furan emissions, including a summary of dioxin and furan formation mechanisms. Many of the references EPA cites in this chapter are the same references cited by Professor Iisa, and the conclusions from these references are the same as those made by Professor Iisa. The complete text of this chapter and the references section from the report are attached to this memorandum; the full report is available at http://www.epa.gov/epaoswer/hazwaste/combust/burn.pdf. The following is a summary of some of the relevant excerpts from this document, along with the corresponding statements made by Professor Iisa.

On sulfur's effect on dioxin/furan formation –
Professor Iisa:

> "The inhibiting effect of sulfur on the formation of dioxins has been confirmed by several studies. /1-6/ Both laboratory and full scale plants [sic] experiments have shown that the addition of sulfur decreases the formation of dioxins. The presence of sulfur in coal is believed to be the reason for negligible dioxin emissions in coal combustion." – response to EQC question 1a.

EPA:

> "D/F (dioxin/furan) inhibitors, such as sulfur, have been commercially marketed as feed stream additives to control D/F emissions. These same compounds may naturally be present in fossil fuels (such as coal) or hazardous waste fuels. Raghunathan and Gullet (1994) and Raghunathan and others (1997) conducted bench and pilot-scale tests of municipal solid waste combustion facilities and concluded that co-firing with coal can

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effectively reduce D/F emission rates. Significant decreases in D/F emission rates were observed at a sulfur to chlorine ratio of 0.64 (Raghunathan and Gullet 1994). Depletion of active chlorine by sulfur dioxide through a gas-phase reaction appears to be a significant inhibition mechanism, in addition to sulfur dioxide deactivation of copper catalysts." – Section 4.1.4.4, page 35

"Santoleri (1995) summarizes several operating conditions and parameters that are relevant to D/F formation and control as follows:" (one bullet deleted) " - Sulfur and sulfur dioxide have been observed to be effective in reducing Cl_2 to HCl, thereby reducing D/F emissions." – Section 4.1, page 26.

"Sulfur has been shown to interfere with the Deacon reaction, and thereby decreases D/F formation (Griffin 1986; Bruce 1993; Raghunathan and Gullet 1994)."

On the relationship between chlorine feed and dioxin/furan emissions -

Professor Iisa:

"In general the existing data on the effect of chlorine concentration can be concluded to imply that at relatively high concentrations of chlorine in the feed, of the order of percents, the dioxin emissions are independent of the chlorine content of the feed. At low chlorine concentrations at otherwise identical conditions an increase in the chlorine content may increase dioxin emissions. Factors other than the chlorine content have a greater impact on the formation of dioxins and it is impossible to predict dioxin concentrations solely based on the chlorine content of the feed." – Response to EQC question 2a.

EPA:

"While the presence of chlorine is necessary for the formation of D/Fs, there does not appear to be a be a direct correlation between the level of chlorine in the feed and the level of D/Fs in the flue gas in full-scale HWC facilities. The American Society of Mechanical Engineers (ASME) (Rigo and others 1995) analyzed over 1,700 test results with chlorine feed concentrations ranging from less than 0.1 percent up to 80 percent, and found no statistically significant relationship between D/F emission rates and chlorine concentration. Obviously, no D/Fs could be formed without the presence of chlorine. However, other parameters, such as APCD inlet temperature, are more statistically significant and any potential effect of chlorine feed input is effectively masked." – Section 4.1.4.1, page 34

On design technology for preventing dioxin production -

Professor Iisa:

"Most of the dioxin formation occurs at the low temperatures downstream of the combustion chambers at temperatures 250-400°C. Hence the incineration technology is not nearly as crucial as the design of the pollution abatement system for formation of dioxin. As long as conditions are maintained for the destruction of the agents at the desired level the design of the incinerator is not crucial." – response to EQC question 3a.

EPA:

"Recent studies indicate that even in systems achieving good combustion (with low carbon monoxide concentrations), D/F reformation may occur in cooler zones downstream of combustion chambers (Santoleri 1995). Critical operating parameters related to D/F formation in downstream zones include (1) presence of particulates, which allow for solid-phase, metal-catalyzed reactions, (2) appropriate temperature window (approximately 400 to 750 °F), (3) presence of Cl_2 and other precursors, including chlorinated aromatics, and (4) particulate residence time." – Section 4.1, page 25. Note that the range of 400 to 750 °F roughly equals 200 to 400 °C.

On design elements of a pollution abatement system for controlling dioxin emissions -
Professor Iisa:

> "The essential elements of a pollution abatement system for controlling dioxin emissions from combustion processes are: a) rapid cooling of the gases in a quench system to prevent dioxin formation…."
>
> "The formation of dioxin occurs in a relatively narrow temperature window of 250-400°C. Above 400°C and below 250°C the net rates of dioxin formation are negligible. The minimization of the exposure to these temperatures is one of the most efficient methods of preventing dioxin formation." – response to EQC question 4a.

EPA:

> "Ullrich and others (1996) describe the reduction of D/F emissions through the use of a rapid liquid quench, which decreases residence time in the D/F formation window. A liquid quench involves rapid quenching (on the order of milliseconds) from combustion temperatures to saturation temperatures of approximately 170 to 185 °F. HWC facilities that provide for rapid flue gas quenching to below saturation temperatures generally have low D/F emissions." – Section 4.1.2, page 28

Although the EPA document does not directly address the merits of carbon filtration or other emission control technologies or specifically discuss the potential for dioxin formation during chemical agent combustion, as can be seen from the above it supports the majority of Professor Iisa's conclusions.

The remainder of this memorandum addresses the specific technical issues addressed in the affidavit. Non-technical issues, including the following, are not discussed in detail.

- Typographical errors in Professor Iisa's report, such as the mis-ordering of references. While a few such errors occur, they do not affect the accuracy of the report.
- Stylistic differences of opinion, such as Professor Iisa's choice not to use substantial direct quotes from her references. This is a matter of preference and reflects her academic background and does not affect the accuracy of the report. In academia and in scientific publications (e.g., journal articles), authors do not frequently directly quote their sources to avoid accusations of plagiarism.
- Professor Iisa's use of references that are "not readily available to the general reader or researcher" and that must be purchased, or that are in some way otherwise faulty. In general, no technical publications or photocopied documents are free; a copyright fee must be paid for each document. This does not affect the accuracy of these references.
- Attacks on Professor Iisa's credentials and statements that the EQC was unaware of her authorship of the report. The suggestion that the EQC was not aware of Dr. Iisa's involvement is highly unlikely, as she presented the report to the EQC. As discussed below, her report was technically accurate and would not be any more accurate were it also signed by Dr. Frederick or any other professors.

The following address specific aspects of the critique of Professor Iisa's report in the affidavit, in the order that the critique is presented.

Response to Question 1a

The statements in the affidavit regarding this response and the following response (regarding the effects of chlorine on dioxin formation) generally criticize Professor Iisa's report on the basis that the literature sources show there are uncertainties in dioxin formation, and that different studies do not produce exactly identical results. While this is true, there are many factors influencing the production of dioxins and furans, as noted by Professor Iisa, EPA, and many of the references. Identical study results will never be achieved for different facilities or different operating conditions. However, the weight of evidence, including all of the references cited by Professor Iisa, clearly support her conclusion that, in general, sulfur will inhibit dioxin formation. Under some situations where dioxin formation is already extremely low and catalysts are not present, the ability of sulfur to inhibit dioxin formation may be unmeasurably small. As discussed later, the expected Umatilla Chemical Disposal Facility (UMCDF) dioxin emissions may be so low as to fall into this category. However, all relevant data supports the conclusion that sulfur will act as a dioxin inhibitor. The assertion that "Iisa seriously misquotes several references" is not correct, and in fact, the affidavit misquotes or misrepresents the references such that they are portrayed as stating the opposite of their actual conclusions.

The affidavit states on pages 8-9 that references 2 and 3 do not support the statement that sulfur inhibits dioxin formation; this is inaccurate. Reference 2 highlights the ability of SO_2 gas to interfere with the ability of copper to act as a dioxin catalyst; this is identical to the statement that sulfur acts as a dioxin inhibitor, and the conclusion of the reference is that "the apparent lack of PCDD and PCDF in the emissions from coal-fired combustors may be due to the relatively high concentrations of SO_2." The affidavit highlights one line from the reference that states that at certain temperatures (in particular, higher temperatures than those in the UMCDF incinerators after the quench) dioxin production may not be significantly inhibited by the addition of SO_2 gas; however, in some cases dioxin concentrations were below detectable levels in these tests even before the addition of sulfur, and the standard deviation in these results is large. These uncertainties were noted in the text of the paper and did not affect the conclusion.
Reference 3 is portrayed in the affidavit as stating that "sulfur only acts as an inhibitor if there is carbon build-up in the incinerator." This is an inaccurate oversimplification. The reference does indicate that the effects of sulfur on dioxin inhibition vary depending on operating conditions, the overall effect is "a dramatic decrease from 'usual' MSW incinerator dioxin levels in the order of 2.5 to nearly 10 ng toxic equivalents [TE]/nm^3 down to less than 1 ng TE/nm^3 with addition of coal."

The remainder of the critique of this response discusses the significance of the form of sulfur as related to the ability of sulfur to inhibit dioxin formation. The affidavit asserts, "It is an overstatement (or oversight) by Iisa to imply that [sources that investigate coal as an additive] confirm data about sulfur used alone." While it is true that, as noted earlier, different operating conditions and waste feeds will not produce identical results, it remains true that all tests of sulfur as a waste feed additive resulted in the significant inhibition of dioxin formation under most conditions. Furthermore, the potential physical processes by which sulfur inhibits dioxin formation have been identified; namely, that sulfur may reduce chlorine gas (necessary for dioxin formation) to hydrogen chloride, and that sulfur may react with cupric oxide (a dioxin catalyst) and produce cupric sulfate. Although the relative abilities for these processes to occur will depend on other factors (such as the presence of copper), sulfur in any form – including sulfur mustard – will likely significantly decrease dioxin formation under the majority of operating conditions for a high-temperature combustion process such as the UMCDF incinerators.

The exact magnitude that sulfur mustard will inhibit dioxin formation is difficult to determine. The ranges cited by Professor Iisa accurately represent the decreases described in the references, most of which result from the addition of coal (as noted in the affidavit). There is no reason to believe that sulfur mustard would behave in a significantly different manner than coal, nor is any such reason stated in the affidavit.

Professor Iisa's statement that "it seems safe to assume that the sulfur in mustard inhibits dioxin formation" is certainly supported by all references. Her additional statement that "reductions in the amount of dioxins by at least a factor of ten could be expected" is also well supported by the studies of coal. As described later, however, documentation of this decrease may be impossible due to the unmeasurably small amount of dioxin that is likely to be produced by the UMCDF.

Summary of Chlorine Critique

The general statements made in the introductory critique (on page 11 of the affidavit) and repeated in more detail in the following pages are discussed later in this memorandum, where the more detailed comments are made. Two particular statements made in the summary are addressed here, however. The first is Professor Iisa's statement (misquoted in the affidavit) that "with a chlorine content of 1 ppb (0.00000001 volume %) in the flue gases and a conversion of one percent of the chlorine to dioxins we could produce more than 5 ng/m^3 of dioxin." Professor Iisa's statement does not represent a real scenario, but rather a hypothetical mass-balance calculation demonstrating that even very low amounts of chlorine could be theoretically used to create "high" levels of dioxin. At no time does Professor Iisa suggest that this situation would ever occur. No reference is therefore necessary for the statement, and this is not a "reversal and internal inconsistency" as stated in the affidavit. The statement is only "dizzying" when taken out of the context of the original report.

The affidavit also suggests that the conclusions are "contentious" because "industry is attempting to fend off probable regulations by EPA." This statement is irrelevant and misleading; the technical accuracy of Professor Iisa's statements is in no way diminished by the perceived "volatility" of the topic. Furthermore, as discussed above, recent EPA guidance concurs with Professor Iisa's evaluation of the data regarding the relationship between chlorine feed and dioxin emissions, namely "there does not appear to be a direct correlation between the level of chlorine in the feed and the level of D/Fs in the flue gas in full-scale HWC facilities." (EPA 1998, Section 4.1.4.1, page 34.) The characterization that Professor Iisa's conclusions are representative only of industry and are not supported by EPA is incorrect.

Introduction to Section 2a, b, and c

This portion of the critique summarizes the EQC's questions and asserts that Professor Iisa failed to provide "specific, numerical answers" to these questions. This is an inaccurate summary of Professor Iisa's report; rather than providing no specific answer, Professor Iisa states that no numerical answer is possible without direct measurements due to the lack of a relationship between chlorine feed and dioxin emissions. The affidavit states that this answer is unreferenced, but the references listed in the response to EQC question 2a do support the Professor's statements.

Answers to question 2a

The affidavit criticizes Professor Iisa's introductory paragraph as being unreferenced. It is unclear why a reference should be necessary for these general remarks. The statement that the source of chlorine is unimportant is supported by the evidence that the extremely high temperatures in the furnace will destroy all sources into the same constituent molecules. The following section discusses with many references the lack of a correlation between chlorine feed and dioxin emissions.

"How do Iisa's references view the role of chlorine in dioxin production?"

The affidavit states at the beginning of this section that "the authors of the references which Iisa cites assume that chlorine is the critical, determining factor in dioxin production during incineration, with variables such as carbon, heat, additives and catalysts important only in attempts to control and capture the dioxin produced by chemical reactions in the presence of chlorine." However, this statement is actually the <u>opposite</u> of the main conclusions of several references:

> "The relationship between PCDD/PCDF emissions and the chlorine feed content is complex and far less significant than other factors governing the performance of an incineration system. Test burn data do not support the hypothesis that PCDD/PCDF emissions are related to chlorine feed." – Reference 6
>
> "The failure to find simultaneous increases in most cases and finding a few inverse relationships, indicates that whatever effect waste feed chlorine has on PCDD/F concentrations in combustor flue gases, it is smaller than the influence of other causative factors. Any effect chlorine has on PCDD/F concentrations in commercial scale systems is masked by the effect of air pollution control system [APCS] temperature, ash chemistry, combustion conditions, measurement imprecision, and localized flow stratification." – Reference 9
>
> "Scientifically, both organic and inorganic chlorine have a role in PCDD/PCDF formation, however, the role is very complex and apparently of secondary importance when compared to other factors governing emissions. These factors include:
> - PCDD/PCDF oxidative destruction reactions
> - PCDD/PCDF dechlorination reactions

> - PCDD/PCDF coupling reactions
> - Particulate formation, kinetic, and absorption phenomena
> - Coupled phenomena, including time, temperature and turbulence throughout the system
> - Catalysts, inorganic content, and other feed characteristics
>
> which undoubtedly overwhelm chlorine content in determining PCDD/PCDF emissions." – Reference 11
>
> "Dioxin emissions have been shown to be independent of chlorine feed to the incinerator, both prior to and after installation of the [enhanced carbon injection system]." – Reference 10

In addition, as described above, Professor Iisa's conclusions are consistent with those determined by EPA.

The affidavit (on pages 13-14) quotes extensively from Reference 15, which summarizes theories regarding the mechanism of dioxin formation. The purpose of the quotes in the affidavit is not apparent, other than to state that individual models of dioxin formation that evaluate only a single mechanism of dioxin formation frequently under-predict measured levels. This statement is consistent with Professor Iisa's statements that no reliable models exist and that "it is impossible to predict dioxin concentrations solely based on the chlorine content of the feed." Also, Professor Iisa's statements in the response to EQC question 2a are unrelated to concentrations, but state only that the presence of chlorine can lead to dioxin formation. Consequently, the tendency of models to under-predict concentrations is not pertinent to this response. Furthermore, as discussed by Professor Iisa in responses to later questions, dioxin emissions are extremely low; whether a model accurately predicts these levels is not relevant to the fact that the emissions are below levels of concern to human health or the environment.

The affidavit (on page 14) then dismisses Professor Iisa's statement that "full-scale studies... have failed to show any trends with the chlorine concentrations"; however, as described above, the cited references all indicate that this statement is accurate. Similarly, the following statement that factors other than chlorine are more important is also well referenced and accurate, and not "unsubstantiated" and "faulty", as the affidavit claims.

The affidavit (on page 15) criticizes Professor Iisa's use of language such as "in general" and "can be concluded to imply"; however, this language is justified and does not detract from the statements made by Professor Iisa. As stated in the conclusion of Reference 6, "some facilities show an upward trend with increasing chlorine content, while other facilities show the opposite trend." The weight of evidence provided by all of the studies indicate that no trend exists between chlorine feed and dioxin emissions; however, it may be possible that a positive relationship can be seen for some individual facilities. This is consistent with the statements made by Professor Iisa, such as that "at low chlorine concentrations at otherwise identical conditions an increase in the chlorine content may increase dioxin emissions."

The affidavit quotes (on pages 15-16) individual sentences out of various references in attempt to refute the statement that no relationship between chlorine feed and dioxin emissions can be found in full-scale incineration facilities. The first quote is a single line from Reference 1 that is unrelated to the topic; rather, it is a premise used to discuss the conclusion of the paper that sulfur is a dioxin inhibitor. The quote from Reference 14 is said to imply that the results from a "domestic burner" and from a "specially built experimental combustion chamber" are comparable to the UMCDF; however, this is not the case. Professor Iisa's statements include an acknowledgement that "pilot scale studies done in well controlled conditions usually indicated that increasing the amount of chlorine... increases the yield of dioxins"; the results described in this reference do not detract from the statement that full-scale facilities show no such relationship.

The affidavit (on page 16) suggests References 14 and 15 could have been used to model dioxin emissions. As noted, the experiments in Reference 14 were based on different, much smaller combustion units that are not representative of the UMCDF. In addition, the data from the test are limited and inadequate for use in deriving a quantitative relationship between feed and emissions that would apply across a broader range of conditions. Also as noted earlier, Reference 15 suggests the opposite of what is stated in the affidavit. This reference states that although some models have been derived, these vary widely and do not accurately predict emissions.

The affidavit (on pages 16-17) states that Professor Iisa is inappropriately citing References 14, 7, and 12, on the basis that these references do not discuss the relationship between chlorine feed and dioxin emissions. However, Professor Iisa references these documents to support the different (but related) statement that factors other than chlorine feed are important. These references all support the Professor's statement. The earlier statement regarding the lack of relationship between chlorine feed and emissions had been previously referenced, and is supported by References 8, 9, 10, and 11, as described above.

The affidavit (on pages 17-18) questions the use of a study related to a petroleum refinery as being inappropriate for the facility. However, as stated in the reference and partially quoted in the affidavit, the results "could also be of relevance for other sources of PCDFs and PCDDs like municipal waste incineration as well as other industrial processes involving the temperature range of 200-550 °C and the presence of chlorine, iron, and hydrocarbons." As documented in several references and described by Professor Iisa, measurable dioxin formation in combustion facilities does not occur in the incineration process itself, but rather downstream, under conditions that may be similar to those described in this reference. The nature of the process prior to dioxin formation is therefore mostly irrelevant. This reference is therefore appropriate and supports the statement made by Professor Iisa.

The affidavit (on pages 18-19) notes that References 15 and 16 do not relate to chlorine content; however, Professor Iisa's statement that references these documents does not state or imply that these documents should relate to chlorine content. These references support Professor Iisa's statement that metals can act as catalysts for dioxin formation. As noted earlier, the statement regarding the lack of relationship between chlorine feed and emissions had been previously referenced. The affidavit does correctly state that Reference 17 does not discuss metals; it is more likely that Professor Iisa's intention was to refer to Reference 18 ("Effects of copper contamination on dioxin emissions from CFC incineration") at this point. This typographical error does not affect the validity of the statements made in the report.

The affidavit (on page 19) repeats the assertion that Reference 15 should have been used to "do calculations for the proposed incinerator." As noted earlier, this reference actually suggests that models are not adequate for estimating dioxin emissions. Furthermore, it is unclear what calculations are proposed, particularly in the response to EQC question 2a, and given that trial burn data from the Johnston Atoll Chemical Agent Disposal System (JACADS) was available and is more relevant to the UMCDF than modeled results.

Lastly in this section, the affidavit (on page 19) criticizes Reference 9 as being unavailable through the library and costing $100. However, as noted above, the expense of this reference in no way reflects on its accuracy, and the unwillingness of the authors of the affidavit to purchase this document does not eliminate it from use. The "Major Finding" of this reference states:

> "The hypothesis that fuel chlorine content and combustor flue gas PCDD/F concentrations are related was not confirmed by the data analyzed in this study."
>
> "Of the more than 1900 PCDD/F test results collected at 169 facilities in the database, PCDD/F—and chlorine are simultaneously characterized at 107 units in 90 facilities. Seventy-two facilities (80%) showed no statistically significant relationship between chlorine input and PCDD/F measured in the gas streams. For the sets with an apparent relationship, ten displayed increasing PCDD/F concentrations with increasing chlorine, while eight demonstrated a decrease."
>
> "The failure to find simultaneous increases in most cases and finding a few inverse relationships, indicates that whatever effect waste feed chlorine has on PCDD/F concentrations in combustor flue gases, it is smaller than the influence of other causative factors. Any effect chlorine has on PCDD/F concentrations in commercial scale systems is masked by the effect of air pollution control system [APCS] temperature, ash chemistry, combustion conditions, measurement imprecision, and localized flow stratification."

> "The hypothesis that the amount or type of chlorine in the waste fed to combustion units is directly related to gaseous PCDD/F concentrations measured at the combustor outlet, part way through the air pollution control system or at the stack is not supported by the preponderance of the data examined by this study." – Reference 9, Executive Summary, page 1

This reference clearly supports the statements made by Professor Iisa. In addition, this reference makes the following conclusion about the full-scale hazardous waste incinerators evaluated in the report:

> "Scatter plots were used to display the relationship between total molar PCDD/F concentrations in the stack gas and percent chlorine in the feed. A variable relationship was found; 18 of 28 units with simultaneous PCDD/F and chlorine characterization information display no statistically significant relationship. Five facilities show an increase in PCDD/F concentrations with increased chlorine in the feed and five facilities show a decrease." – Reference 9, Executive Summary, page 7

This statement further supports the Professor Iisa's conclusion that predicting dioxin emissions based on chlorine feed rates is not possible, because no clear relationship has been demonstrated for the type of combustion facility most similar to the UMCDF.

"In context: Referenced Authors Participating in a National Lobbying Campaign"

The affidavit (on pages 19-21) suggests that the results from several studies are questionable because the authors are affiliated with the Dow Chemical Company, and that the data were a "statistical tactic" to argue against EPA regulations. This argument is irrelevant and incorrect for several reasons:

- The fact that the authors of these reports work for companies that operate incinerators does not in any way invalidate the results of these studies. The studies are technically accurate, and no contradictory studies are available from other sources.
- As described in the introduction to this memorandum, current EPA guidance supports the conclusions made in these studies.
- Some of the results in these studies are summarized from other, non-industry sources, which corroborate the conclusions.

Consequently, the statement that "using [industry] results as a credible sources (sic) is akin to letting the fox guard the chicken coup (sic)" is unsupported and incorrect.

The affidavit (on page 21) restates the claim that Professor Iisa should have been able to model dioxin emissions for the UMCDF. This is not supported. The references as a whole indicate that not only is it not possible to determine a general relationship between chlorine feed and dioxin emissions for all incinerators, but that even for a single incinerator variations in emissions will be seen based on variations in feed and operating conditions. Consequently, modeling of emissions is not possible even with detailed engineering designs. This is discussed in detail in Professor Iisa's response to EQC question 2c, where the results of JACADS testing are presented, and dioxin results can vary somewhat significantly even when the same agent is being fed during different tests.

Lastly, the affidavit (on page 21) states that Professor Iisa's discussion does not provide "documented answers" to the EQC's questions. As discussed at length above, this assertion is incorrect. The affidavit then repeats Professor Iisa's hypothetical mathematical calculations and suggests that these numbers are model results; it is clear from Professor Iisa's report that this is not the case.

Answer to EQC Question 2b

The affidavit questions Professor Iisa's response as being unreferenced. While Professor Iisa does not provide specific references for the statements in this section, her statement that "these measurements [of concentrations above 30 ng/m^3] come from small scale experimental facilities and they are probably not applicable to large scale applications such as the Co-Gen facility" is supported by many references presented in the response to EQC question 2a, which indicate that results from small-scale tests are generally not representative of large-scale facilities, and that predictions about dioxin emissions for facilities are not possible based only on comparisons to other, different facilities.

Answer to EQC Question 2c

Much of the discussion in the affidavit regarding this section is related to what is termed "unsubstantiated assumptions" by Professor Iisa that the dioxin emissions from the UMCDF will be below certain levels (such as 30 ng/m^3). However, these statements are generally well supported by the JACADS data presented by Professor Iisa in this response.

Since Professor Iisa's report, additional trial burn data from the Tooele Chemical Disposal Facility (TOCDF) has become available. These data were collected using more current sampling and analytical methods and should be more representative of UMCDF trial burn results. A summary of the TOCDF trial burn dioxin data from the two Liquid Incinerators (LICs) are as follows:

Summary of Dioxin Data from TOCDF GB LIC Trial Burns (2,3,7,8-chlorine substituted congeners)
Units: ng/sample (sample volume varies by run)

Congener	LIC 1 Run 1	LIC 1 Run 2	LIC 1 Run 3	LIC 2 Run 1	LIC 2 Run 2	LIC 2 Run 3
2,3,7,8-TCDD	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,7,8-PeCDD	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,4,7,8-HxCDD	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,6,7,8-HxCDD	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,7,8,9-HxCDD	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,4,6,7,8-HpCDD	not detected	not detected	not detected	not detected	not detected	not detected
OCDD	not detected	not detected	not detected	not detected	not detected	not detected
2,3,7,8-TCDF	0.029	0.030	not detected	0.052	0.031	not detected
1,2,3,7,8-PeCDF	not detected	not detected	not detected	not detected	not detected	not detected
2,3,4,7,8-PeCDF	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,4,7,8-HxCDF	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,6,7,8-HxCDF	not detected	not detected	not detected	not detected	not detected	not detected
2,3,4,6,7,8-HxCDF	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,7,8,9-HxCDF	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,4,6,7,8-HpCDF	not detected	not detected	not detected	not detected	not detected	not detected
1,2,3,4,7,8,9-HpCDF	not detected	not detected	not detected	not detected	not detected	not detected
OCDF	not detected	not detected	not detected	not detected	not detected	not detected
TEQ Equivalent, ng/m^3	0.00043	0.00046	0	0.00093	0.00051	0

Note also that 2,3,7,8-TCDF was detected in the blank sample from LIC 1 at a similar concentration to the detected concentrations in Runs 1 and 2. In addition, dioxin concentrations in the "fuel only" runs where only natural gas was fed were similar to or higher than those where agent was fed. The "fuel only" result for LIC 1 was 0.00094 ng/m^3 TEQ; the result for LIC 2 was 0.00050 ng/m^3 TEQ.

As these results show, dioxin is basically not present at measurable concentrations in the emissions from the incinerator. If present at all, dioxin concentrations are several orders of magnitude below estimated levels presented in Professor Iisa's report, even without consideration of the added carbon filters at the UMCDF. Professor Iisa's conclusions that "an estimate of actual emissions below 0.1 ng/m^3 is reasonable and below 1 ng/m^3 conservative" and that under upset or improper operating conditions emissions would not be expected to exceed 30 ng/m^3 appear to be accurate (and very conservative) based on the most current data.

In addition to the LIC results, trial burn data are also available from the TOCDF MPF (also fed with GB). Dioxin results are slightly higher than for the LICs but are still well below the concentrations presented in

Professor Iisa's report. In addition, concentrations were higher in the "fuel only" run (0.052 ng/m^3 TEQ) than in any of the three tests where agent was fed (0.033, 0.0001, and 0.042 ng/m^3 TEQ).

It is also worth noting that concentrations of dioxins in the TOCDF trial burns indicate that it will likely be impossible to verify the effectiveness of the carbon filters in reducing emissions. Because dioxin concentrations are generally below detectable levels without the carbon filters at TOCDF, any further decreases will not be measurable if the UMCDF incinerators operate as efficiently as those at TOCDF. This is also applicable to the sulfur in HD. While the sulfur may inhibit dioxin formation when HD is processed instead of GB, this will not be detectable.

The specific points discussed in the affidavit for EQC Question 2c generally either repeat earlier criticisms (such as that of the efficiency of sulfur in reducing dioxin emissions) or state that Professor Iisa's conclusions about emissions are not supported. As discussed above, the latter discussion is supported through the JACADS results presented in the report, as well as the more recent TOCDF results.

The discussion of sulfur largely repeats the statements made related to EQC Question 1. It is true that Professor Iisa provides no additional references in this response; however, the references from her earlier response are still appropriate. While it true that "Figure 2 in reference (5) suggests that the 0.5 molar ratio of sulfur to chlorine in HD would result in about a threefold reduction in dioxin" as stated in the affidavit, Figure 3 from the same reference suggests over a 100-fold reduction in dioxin emissions. Given the weight of evidence provided by this study and the other references, Professor Iisa's statement that "it is safe to assume that the sulfur in mustard decreases the dioxin emissions by at least a factor of ten" is a reasonable conclusion. Her additional conclusion that "[this reduction rate] would make the dioxin emissions during combustion of mustard the same as during destruction of GB" is also supported by the JACADS data presented in the report, where dioxin concentrations emitted during combustion of GB and HD in the LIC are nearly identical.

Response to Question 3a

The affidavit misrepresents the point that Professor Iisa is making in her response to question 3. She states that "incineration technology is not nearly as crucial as the design of the pollution abatement system for formation of dioxin. As long as conditions are maintained for destruction of the agents at the desired level, the design of the incinerator is not crucial." In other words, there are many ways to design the overall incineration system to achieve the goal of agent destruction with minimization of dioxin formation. Several combustion and pollution control technologies in combination are used at a variety of facilities to destroy hazardous wastes while minimizing dioxin formation. The articles referenced through Dr. Iisa's report explain a number of these technologies.

Reference 17/19 describes combustion control (a facility design feature), cooling gases to 250°C (a pollution abatement system [PAS] feature) and injecting activated carbon (a PAS feature). Reference 21 describes the cost and effectiveness of a variety of post-combustion control technologies, including a cooled dry process, semi dry process, direct active carbon injection, static beds of carbon, selective catalytical reduction, and a wet process. Other articles cite the use of calcium (as calcium carbonate or calcium oxide) to inhibit dioxin formation (References 20 & 22); the use of sodium bicarbonate, lime (calcium oxide), and carbon to control a variety of emissions, including dioxin (Reference 22); and the use of catalysts to promote complete combustion (References 24 & 25). These articles reflect the variety of pollution control technologies available but by no means compile an exhaustive list. Instead, Dr. Iisa cites these references to demonstrate that dioxin removal can be performed in a variety of ways.

Response to Question 4a

Figure 4 (Reference 13) and Reference 17/19 support Dr. Iisa's assertion that dioxin formation above 400°C is minimal. EPA (1998) also asserts that *de novo* dioxin synthesis occurs in a window from approximately 204 to 400°C. Reference 14, which states that dioxin formation can occur at temperatures up to 900°C, presents an array of experimental conditions that lead to formation of dioxin. These experimental conditions do not represent typical incineration configuration or operation. For example, in several tests, chlorine (as HCl) was introduced into the exhaust pipe following the combustion chamber.

Dr. Iisa's statement "formation of dioxins is easily decreased by factors of ten to hundred" is supported by Reference 19. This statement is taken out of context in the affidavit. Reference 19 describes two mechanisms for preventing reactions in the temperature range of 250-400°C; these are (1) combustion control, which in this reference refers to implementing a high temperature (>850°C) burning condition; and (2) cooling gases to below 250°C. In combination, these two conditions which serve to limit temperatures in the critical range are expected to result in a factor of 100 decrease in dioxin emissions. The authors of the affidavit incorrectly assume she is referring only to cooling. In fact, Dr. Iisa's statement is conservative when considered in the context of her report.

By controlling combustion and quench temperatures, dioxin formation can be limited. As an example, the permit conditions for the liquid incinerator at UMCDF (July 15, 1999) are consistent with the two temperature control mechanisms described above. Waste-feed cut offs occur in the following situations:

- Primary exhaust temperature greater than 1593°C or less than 1371°C.
- Secondary chamber exhaust temperature greater than 1204°C or less than 982°C.
- Quench tower exhaust gas temperature greater than 121°C.

These temperature cut offs are more stringent than the recommendations cited by Professor Iisa and demonstrate a desire to ensure the dioxin formation at UMCDF is minimized to the extent possible.

The affidavit incorrectly states that Reference 20 refers only to $CaCO_3$, and not limestone. In fact, $CaCO_3$ is chemical shorthand for calcium carbonate, which is a technical term for limestone.

The authors of the affidavit seem further confused when citing Reference 22. They state, "Reference (22) discusses injecting three substances, including limestone; but the author does not recommend limestone because of its awkwardness in handling. 'Lime was by far much more difficult to handle and feed accurately.'" Here, they assume that limestone (calcium carbonate, or CaCO3) and lime (calcium oxide, or CO) are the same. They are not.

For a discussion of issues relating to sulfur and dioxin formation, please see the response to Question 1.

Although activated carbon is not specifically referenced as noted in the affidavit, several of the articles discuss activated carbon as a treatment method for removing dioxin from a waste stream. In particular, References 17/19, 21, 22, and 23 discuss the merits of using activated carbon as an adsorbant as part of the PAS.

The NRC's *Carbon Filtration for Reducing Emissions from Chemical Agent Incineration* (1999) also reports control efficiencies of 99-99.9% for activated carbon bed filters. This is consistent with the findings of reference 23, also referenced by Professor Iisa, which reports reduction efficiencies of 99.6 to 99.98% for three incinerators in Germany. Although the facilities studied in this reference are small, they nonetheless demonstrates the effectiveness of carbon filtration systems. It is common scientific practice to study technologies first at the bench scale, and subsequently at pilot scale prior to implementation at full scale. Use of these data aids understanding of complex processes and furthers the body of knowledge about subjects of concern and helps prevent capital expenditures for full-scale facilities only to find critical design flaws.

The affidavit continues discussing the problems with expressing carbon filter results as removal efficiencies rather than actual emissions. In light of the data available for JACADS and TOCDF, significant levels of dioxins and furans are not expected to be emitted. The amount removed by the carbon filtration system likely would not even be measurable because quantities are so low (NRC 1999).

Question 4a does not ask Professor Iisa to provide detailed list of the drawbacks associated with design elements, but rather asks her to list the essential design elements. She should not be faulted for failing to outline all of the possible pitfalls. Reference 23 also specifies engineering controls to prevent spontaneous ignition of coal and dust explosion. A detailed description of these specific engineering controls with respect to the UMCDF would not be appropriate given design differences between the systems referenced in this article and those at the UMCDF.

Page 28 of the affidavit quotes several paragraphs from Reference 23 that describe problems associated with the carbon system at three small plants in Germany. Drs. Brenner and Stibolt seem to feel this information is critical to their purpose; however, the design elements and drawbacks of this system are not relevant for the UMCDF. The specific design elements and safety systems for the carbon filtration system proposed for the UMCDF are described in the permit application and in subsequent permit modification requests.

Regarding proposals to combine use of activated carbon together with limestone, Professor Iisa cites Reference 21, which describes a variety of post-combustion treatment technologies to achieve the European standard of 0.1 ng TEQ/m^3. This article indicates that each of the methods is effective in removing dioxin to required levels, and compares the capital and operating costs for each. Static carbon beds were reported in this reference to be the most expensive option evaluated, but cost should not be confused with their efficiency in removing dioxin from the waste stream. Professor Iisa addresses the drawbacks of several post-combustion treatment methods. Although her statements are not specifically referenced, they are supported by the cost and feasibility analysis included in Reference 21.

Page 31 of the affidavit points out that Professor Iisa's statement regarding "several other methods for the reduction of dioxin emissions" is not supported by the single reference (24) given in her report. This reference focuses on a single type of treatment involving catalysis, but describes different compositions for these catalysts. The other references cited in her response to question 4a support that "several other methods" for dioxin treatment and removal exist. Therefore, although her statement may be poorly referenced, it is supported many of the other references she has cited.

Also on page 31 of the affidavit, the authors claim that Reference 21 should not be used to support Professor Iisa's statements about the effectiveness of catalysts. As stated earlier, although this article is focused on comparing these technologies in terms of their effectiveness and cost, it also addresses the efficacy of catalytic reduction for dioxin removal; as such, the citation is appropriate.

Finally, the affidavit supports the use of Reference 25 on its technical merits but queries why quotes regarding acceptance of incineration by the public and politicians were not included. These issues are not relevant to the question put to Professor Iisa, and her exclusion of these statements is appropriate. Furthermore, the EQC is well aware of the specific issues of public concern regarding the UMCDF; issues concerning the public in Germany have no bearing on their decision.

Response to Question 5

Professor Iisa probably did not reference her response to this question because the discussion of carbon filters was referenced in her response to the previous question. As described in her response to question 4a, References 17/19, 21, 22, and 23 and the NRC report (1999) discuss the merits of using activated carbon as an adsorbant as part of the PAS. Reference 21, which was focused on effectiveness and cost of a variety of post-combustion treatment methods, ranked carbon filters highest in terms of cost; the reference does not state that they are not effective, as the affidavit implies.

She briefly describes the risks associated with use of carbon filters, rather than conduct a lengthy evaluation of the permit conditions associated with safe operation of the carbon filtration system at the UMCDF. The permit application contains this information.

Summary

The conclusions of our review of the affidavit are as follows:

- Professor Iisa accurately cited the available literature to support her answers to the questions posed by the EQC. Her conclusions are reasonable and well supported by the references, and her report is not misleading.
- The affidavit selectively quotes the literature and Professor Iisa to make conclusions that are not supported. In some cases the authors of the affidavit appear confused about technical information described in the references.
- Several of the main conclusions made by Professor Iisa are consistent with subsequent EPA guidance documents for evaluation of combustion facilities and the NRC report on carbon filters. In addition, new trial burn data from TOCDF indicates that her estimates of dioxin emissions based on JACADS data were accurate and conservative.

References

National Research Council (NRC), 1999, *Carbon Filtration for Reducing Emissions from Chemical Agent Incineration*, Committee on Review and Evaluation of the Army Chemical Stockpile Program, Board on Army Science and Technology, Commission on Engineering and Technical Systems, National Academy Press, Washington, D.C.

Unites States Environmental Protection Agency (EPA), August 1998, *Guidance for Collection of Emissions Data to Support Site-Specific Risk Assessments at Hazardous Waste Combustion Facilities,"* Peer Review Draft, Office of Solid Waste and Emergency Response, EPA530-D-98-002.

ATTACHMENT 1

EPA's Guidance on Collection of Emissions Data to Support Site-Specific Risk Assessments at Hazardous Waste Combustion Facilities

Section 4 and References

4.0 DIOXIN AND FURAN EMISSIONS

This section summarizes specific operating and waste feed parameters to be considered for collection of D/F emissions data to support human health and ecological SSRAs. COPC emission rates are dependent on several operating parameters, most of which are monitored during DRE and SRE tests. Operating parameters may also vary between types of HWC facilities (HWIs, boilers, cement kilns, and LWAKs). Separate subsections are included to further discuss the relevance of the operating parameters as they relate to each type of HWC facility. The MACT database (EPA 1996a, 1996b, 1996c, 1996d, 1996e, 1997a, and 1997l) is used as a reference to describe operations and APCD performance in HWIs, cement kilns, and LWAKs. MACT data on boilers are limited and are not considered fully representative of the entire boiler universe within the United States.

This guidance relies on available research and emissions databases to draw general conclusions and provide recommendations. However, it is important to note that this guidance cannot encompass every potential situation. Permit writers should always evaluate facility-specific operating trends and information against the underlying principles of the recommendations in this document.

The subject of D/F formation is both complex and extensive, and this section starts with general information and becomes progressively more specific. Formation mechanisms are discussed in Section 4.1, key operating and waste feed parameters are reviewed and summarized in Section 4.2, and the relevance of the parameters for each industry category are discussed in Sections 4.3 through 4.6. Finally, Tables 4-1 and 4-2 summarize the recommendations by industry category.

4.1 DIOXIN AND FURAN FORMATION MECHANISMS

D/F formation mechanisms, emission rates, and potential control measures in combustion systems have been studied since the late 1970s with increased efforts in the United States over the past 10 years. D/Fs are formed as the result of many complex side reactions that occur in a combustion system (Townsend and others 1995). These side reactions occur primarily in the post-furnace (downstream) regions of the HWC facility. D/Fs can result from a combination of formation mechanisms depending on combustion conditions, the type of APCD, and waste feed characteristics.

D/F formation in HWC facilities is believed to include three possible mechanisms. Depending on waste feed, design, APCD, and operating characteristics, one or more of the following mechanisms may predominate:

1. Homogeneous gas-phase formation was one of the earliest D/F formation mechanisms observed in combustion systems (Sidhu and others 1994). However, gas phase formation is believed to play a relatively minor role in D/F formation in HWC facilities.
2. The term *de novo* synthesis is commonly used for heterogeneous, surface-catalyzed D/F formation from flyash-based organic material coupled with flyash-based metal catalysts (such as copper). This mechanism is likely to occur in HWC facilities.
3. Heterogeneous D/F formation from gas-phase precursors and flyash-based metal catalysts is also considered a likely formation mechanism in HWC facilities.

Gas-phase D/F formation from trichlorinated phenols was observed to occur at temperatures of 570 to 1,475 °F by Sidhu and others (1994). Their data indicated that the kinetic model developed by Shaub and Tsang (1983) underestimated potential D/F emissions by a factor of approximately 50. The model developed by Sidhu and others (1994) is dependent on the presence of halogenated phenols which are recognized as D/F precursors. Sidhu and others (1994) concluded that pure gas-phase formation of D/Fs in combustion systems is possible given the presence of halogenated hydrocarbons that form halophenols.

The kinetic model for gas-phase formation developed by Shaub and Tsang (1983) failed to account for all the D/F emissions from a municipal waste incinerator, and subsequent work focused more on heterogeneous, surface-catalyzed reactions. Subsequently, over the past 15 years, research has focused on *de novo* synthesis of D/Fs and synthesis from gas-phase precursors.

Early studies on municipal waste incinerators indicated that organic compounds in the gas coupled with high flyash concentrations promote chlorination reactions and subsequent synthesis of D/Fs (Bruce 1993; Townsend and others 1995). Bruce (1993) and Griffin (1986) theorized that this synthesis involves the Deacon reaction:

$2HCl + \frac{1}{2} O_2 \Longleftrightarrow Cl_2 + H_2O$, with copper or other metals serving as catalysts (Equation 1)

where:

HCl = hydrogen chloride
O_2 = oxygen
Cl_2 = chlorine
H_2O = water

The free chlorine formed by the reaction then chlorinates D/F precursors, including halogenated aromatics, through substitution reactions. Sulfur has been shown to interfere with the Deacon reaction, and thereby decreases D/F formation (Griffin 1986; Bruce 1993; Raghunathan and Gullet 1994). Researchers have theorized that sulfur may affect these results by (1) reducing the Cl_2 to HCl (Equation 2), and (2) altering the copper in the Deacon reaction (Equation 3) (Bruce 1993):

$$Cl_2 + SO_2 + H_2O \Longleftrightarrow 2HCl + SO_3 \qquad \text{(Equation 2)}$$

where:

Cl_2 = chlorine
SO_2 = sulfur dioxide
H_2O = water
HCl = hydrogen chloride
SO_3 = sulfur trioxide

and:

$$CuO + SO_2 + \frac{1}{2} O_2 \Longleftrightarrow CuSO_4 \qquad \text{(Equation 3)}$$

where:

CuO = cupric oxide
SO_2 = sulfur dioxide
H_2O = water
$CuSO_4$ = cupric sulfate

De novo synthesis of D/Fs involves many complex reactions that can occur at several stages in the combustion process. However, all *de novo* formation mechanisms appear to depend on solid phase chemistry (Townsend and others 1995). Historically, D/F emissions were believed to be controlled by ensuring good combustion and by controlling temperature, oxygen, and PM (carbon monoxide concentration has been used as a surrogate for good combustion). Recent studies indicate that even in systems achieving good combustion (with low carbon monoxide concentrations), D/F reformation may occur in cooler zones downstream of combustion chambers (Santoleri 1995). Critical operating parameters related to D/F formation in downstream zones include (1) presence of particulates, which allow for solid-phase, metal-catalyzed reactions, (2) appropriate temperature window (approximately 400 to 750 °F), (3) presence of Cl_2 and other precursors, including chlorinated aromatics, and (4) particulate residence time. Poor combustion can increase D/F formation through increased PM (which serves as the reaction site for D/F formation), increased formation of PICs (which could serve as D/F precursors), and increased gas-phase formation of D/Fs.

Santoleri (1995) summarizes several operating conditions and parameters that are relevant to D/F formation and control as follows:

- Combustion temperatures lower than approximately 1,800 °F or higher than 2,250 °F can lead to higher free Cl_2 emissions and subsequent D/F formation. A rapid quench is recommended to quickly lower the temperature and improve the conversion of Cl_2 to HCl.
- Sulfur and sulfur dioxide have been observed to be effective in reducing Cl_2 to HCl, thereby reducing D/F emissions.
- Downstream zones that potentially collect PM (including boiler tubes, ESP plates, and fabric filters) provide reaction sites that promote D/F formation. More rapid cycling of cleaning processes can shorten the residence time for D/F formation, and decrease D/F emissions.

Overall, researchers have concluded that D/F formation mechanisms in HWC facilities are extremely complex and cannot be predicted accurately with kinetic models or surrogate monitoring parameters such as carbon monoxide or total hydrocarbons (Santoleri 1995). Almost any combination of carbon, hydrogen, oxygen, and chlorine can yield some D/Fs, given the proper time and temperature (Altwicker and others 1990; Santoleri 1995). Factors such as non-detect levels of chlorine in feed streams, lack of dry APCD systems, presence of D/F inhibitors (such as sulfur), lack of D/F catalysts (such as copper), and lack of D/F precursors (such as chlorinated phenols) may lead to reduced or low emissions of D/Fs. However, because mechanisms of D/F formation are extremely complex and are not well understood, it is not possible to predict with certainty whether or not a given HWC facility will have significant D/F emissions. Therefore, it is anticipated that all HWC facilities will need to test for D/Fs. The remainder of this section discusses key operating parameters that should be considered for D/F testing.

4.1.1 Particulate Hold-Up Temperatures

Several studies have demonstrated the importance of identifying critical operating parameters associated with D/F emissions. Data described in Altwicker and others (1990), Harris and others (1994), Lanier and others (1996), and EPA (1994a, 1996a, 1997a) indicate the importance of inlet temperatures for HWC units equipped with dry APCDs (such as ESPs, fabric filters, or possibly high efficiency particulate air [HEPA] filters). In general, these data indicate that, within the D/F formation window of approximately 400 to 750 °F, D/F formation can increase exponentially with increases in temperature. Thus, dry APCD inlet temperature is a critical operating parameter. The lower temperature of 400 °F, versus 450 °F as prescribed by the current BIF regulations, has been emphasized in evaluations conducted for the MACT standards (EPA 1996a, 1997a).

Additional data indicate that any particulate holdup areas (including boiler tubes and long runs of ductwork) can serve as reaction sites for D/F formation if the temperature profile falls within the D/F formation window. Santoleri (1995), citing numerous studies in Germany and the United States, notes that facilities with heat recovery boilers have been found to have higher emissions of D/Fs than facilities without heat recovery. The proposed mechanism is a result of boiler tube corrosion as the tubes trap ash and form deposits. As HCl gas passes over these deposits, the deposits and iron within the tubes react to form Cl_2 and iron chlorides, resulting in conditions conducive for D/F formation. The D/F emissions trend for waste heat recovery boilers is further supported by EPA (1997a), who found that incinerators equipped with recovery boilers have significantly higher D/F emissions than other incinerators. EPA (1997a) noted that the heat recovery boilers preclude rapid temperature quench of combustion gases to a temperature of less than 400 °F. Acharya and others (1991) hypothesized that D/Fs in a boiler could be minimized by only cooling combustion gases to about 800 °F. Although energy recovery might be reduced, this would keep the gases outside of the 400 to 750 °F range.

EPA (1997a) also found elevated D/F emission rates at some LWAKs where formation apparently occurred in extensive runs of ductwork connecting the kilns to the fabric filters. EPA noted that reductions of D/F emission rates could likely be achieved simply by rapidly quenching gases at the exit of the kiln to less than 400 °F and insulating the ductwork to maintain gas temperatures above the dewpoint prior to the fabric filter.

Results of these studies indicate that, for D/F testing, the relatively low temperature (approximately 400 to 750 °F) areas of particulate holdup downstream of the combustion zone should be emphasized. These areas are conducive to surface-catalyzed D/F formation through mechanisms such as *de novo* synthesis. Available data indicate that PM provides the substrate to act as a chemical reactor, given the appropriate temperature, time, and presence of Cl_2. Thus, any particulate holdup area (including fabric filters, ESPs, HEPA filters, heat recovery boilers, and extensive runs of ductwork) can serve as a reactor for D/F formation.

Particulate holdup temperatures should be considered very carefully in determining the appropriate test condition for D/F testing. Unless the temperature fluctuation across the PM holdup device is negligible, D/F testing should not be performed at normal or average holdup temperatures. D/F formation has been observed to increase exponentially with increases in temperature over the range of approximately 400 to 750 °F (EPA 1994a, 1996a; Lanier and others 1996). Thus, a long-term average temperature limit will not necessarily ensure that D/Fs remain below the levels observed during a normal temperature test (i.e., the D/F emissions from one minute of operation at 100 °F above normal could not be offset by one minute of operation at 100 °F below normal). Unless a facility can provide a monitoring scheme that will reliably ensure that D/Fs can be maintained below the levels observed during testing at average holdup temperatures, then D/F emissions data should be collected while the facility is operating under maximum particulate holdup temperatures.

4.1.2 Rapid and Partial Liquid Quench Systems

Ullrich and others (1996) describe the reduction of D/F emissions through the use of a rapid liquid quench, which decreases residence time in the D/F formation window. A liquid quench involves rapid quenching (on the order of milliseconds) from combustion temperatures to saturation temperatures of approximately 170 to 185 °F. HWC facilities that provide for rapid flue gas quenching to below saturation temperatures generally have low D/F emissions. However, this may not necessarily be the case for facilities that perform only a partial quench. Waterland and Ghorishi (1997) observed significant increases in D/F levels in the flue gas as post-partial-quench temperatures increased from 711 to 795 °F (prior to the full quench). The observed residence time between the partial quench and full quench chamber was approximately 0.5 seconds. This phenomenon, termed rapid high-temperature D/F formation, appears to be active in a post-partial-quench temperature range of 570 to 800 °F.

Based on this information, it appears that operating limits on rapid quench systems are unnecessary for the control of D/Fs. However, limits on post-quench temperatures from partial-quench systems are potentially important.

4.1.3 Combustion Conditions

This section provides general information regarding the impact of combustion conditions on D//F emissions. Further industry-specific discussion is provided in Sections 4.3 through 4.6. These discussions are based on the underlying assumption that HWC facilities must operate under combustion conditions that meet or exceed 99.99 percent DRE.

Combustion conditions and associated quality can play a key role in minimizing the formation of D/F precursors, and thus, in potentially minimizing D/F emissions (EPA 1994a, 1996a). Berger and others (1996) describe an increase in D/F, carbon monoxide, and total hydrocarbon emissions through poor combustion in HWIs. High D/F emissions were observed only during the same incineration processes that included high total hydrocarbon emissions. Gullett and Raghunathan (1997) observed substantial increases in D/F emissions under conditions of poor combustion and carbon monoxide levels greater than 2,000 parts per million (ppm).

In order to assure combustion quality, EPA (1996a) has indicated that the following combustion parameters should be demonstrated during D/F testing and controlled (during facility operation) to minimize D/F precursors:

- Minimum PCC and SCC combustion temperatures
- Maximum combustion gas velocity
- Maximum waste feed rates
- For batch feeds,
    - maximum feeding frequency
    - maximum batch size
    - minimum oxygen concentration
- Maximum carbon monoxide
- Maximum total hydrocarbons

Unfortunately, it is often difficult to determine a direct correlation between an individual combustion parameter and D/F emissions. Combustion processes involve complex physical and chemical interactions. A change in a single independent variable can simultaneously impact several dependent variables. These changes may or may not impact D/F emissions, and the most influential combustion parameters may not always be the ones listed above. These points are demonstrated by the following two examples.

The first example involves minimum combustion temperature. Operating conditions associated with DRE testing, including minimum combustion temperature, are generally believed to result in higher PIC formation (and thus, potentially higher D/F emissions). This should be the case for most systems. However, the opposite has been shown for incinerators feeding containerized wastes. For these units, pilot testing shows that PIC emissions can be minimized by operating at *lower* PCC temperatures (Lemieux and others 1990). Higher PCC temperatures and higher kiln rotation speeds result in rapid heating and rupturing of the containers. Evolution of waste gases from the containers can exceed the rate at which the stoichiometric amount of oxygen can be supplied, resulting in increased organic emissions rates. Lower temperatures may lead to more gradual rupture of waste containers, and less disruptive transients. (The term "transient" refers to frequent changes in combustion conditions. These changes may be indicated by recurring temperature, carbon monoxide, or total hydrocarbon spikes, or by frequent changes in combustion pressure.) The impact of this phenomenon on D/F emissions has been confirmed during at least one trial burn at a HWC facility burning containerized wastes. At this facility, dioxin yields were higher at maximum PCC temperatures than at minimum temperatures (EPA 1998c).

The second example involves oxygen concentration. Oxygen concentration is not specifically addressed during many trial burns. In fact, it often varies considerably between test conditions when excess air is used to simultaneously achieve minimum combustion temperature and maximum combustion gas velocity. However, D/F emission rates may be impacted by oxygen levels. Gullett and Lemieux (1994) performed a pilot study to investigate the impact of oxygen concentrations (as well as several downstream parameters) on dioxin yields. Intermediate levels of oxygen (4.7 percent) were found to produce greater dioxin yields than extreme levels (1.7 and 8.9 percent). In addition, oxygen significantly affected the partitioning between dioxins and furans. Increases in oxygen favored formation of dioxins over furans.

These examples illustrate that the relationship between individual combustion parameters and D/F emissions is not necessarily intuitive or readily demonstrated. Key parameters are likely to vary by facility, and the facility-specific key parameters may or may not be those identified in EPA (1996a). Because of these uncertainties, it is recommended that D/F emissions be determined during all of the planned test conditions (e.g., DRE and SRE) at a HWC facility whenever possible. By characterizing D/Fs over the entire range of combustion conditions, a facility can minimize the possibility of inadvertently omitting combustion situations that may play a key role in D/F formation. In addition, the data collected during multiple conditions can be analyzed for trends to determine the combustion parameters that should be limited in the RCRA permit to control D/F emissions.

The recommendation for D/F sampling during all test conditions is a general guideline. However, some facilities and permit writers may be faced with situations that are not addressed by this general guideline. For example, DRE and SRE testing may have been conducted in advance of the sampling effort to collect SSRA data, or stack sampling ports may not accommodate all of the necessary sampling trains for consolidated testing. These and other situations call for decisions regarding the specific combustion conditions to be demonstrated. Therefore, this guidance recommends that the following combustion situations (if applicable) be preferentially targeted for D/F testing:

- Transient conditions
- Combustion of containerized or batch wastes

- Operation at high carbon monoxide levels, for units with carbon monoxide limits above 100 ppm

As appropriate, permit conditions for the combustion parameters listed in Tables 4-1 and 4-2 should be established based on testing under the conditions indicated above. In addition, a facility-specific review of trial burn and historical operating data should be performed to determine whether transient operations correlate with other operating or feed parameters. If so, then the correlating parameters may be limited in the permit in addition to, or in lieu of, the specific parameters listed in Tables 4-1 and 4-2.

Some HWC units do not operate under the scenarios identified above. For example, a liquid injection incinerator feeding a single high-British thermal unit (Btu) waste stream may sustain very constant temperatures and extremely low carbon monoxide concentrations. Ideally, D/F testing performed in conjunction with the DRE test will demonstrate the combustion parameters indicated in Tables 4-1 and 4-2. However, if this is not possible then historical operating data for the appropriate combustion parameters should be reviewed. Demonstration of absolute maximum or minimum values for combustion parameters during D/F testing may be less critical if the review indicates steady-state operations with very few fluctuations. For this situation, consideration may be given to testing under normal combustion conditions. Periodic reporting to confirm continued absence of transients may be appropriate in lieu of specific permit limits for the parameters listed in Table 4-1. When D/F testing is not performed in conjunction with the DRE test, caution should be exercised to ensure that combustion parameters are not substantially different from levels demonstrated during the DRE test.

The remainder of this section provides additional information on transient conditions, combustion of containerized or batch wastes, and operating at high carbon monoxide levels for units with carbon monoxide limits above 100 ppm.

4.1.3.1 Transient Conditions

The permit writer should review historical operating data to determine whether a facility experiences routine transients, and, if so, the waste feed or operating conditions that cause the spikes should be determined. The feeds or operating conditions causing transients represent candidate conditions for D/F testing. Particular attention should be given to data indicating transients for combustion temperatures, combustion chamber pressure, carbon monoxide, and total hydrocarbons. Instantaneous data may be more useful in defining transients than rolling average data, which inherently dampen spikes.

During D/F testing, the facility should treat difficult-to-burn wastes under operating extremes that may challenge combustion quality. Actual wastes (and not surrogate wastes synthesized from pure compounds) should be used whenever possible. Candidate wastes should be selected based upon a review of the wastes handled at a particular facility. Special consideration should be given to those wastes burned at commercial facilities due to their variation and complexity. Examples of wastes that can cause transients include:

- Stratified or highly viscous liquids and sludges
- Aqueous or low heating value liquids
- Liquids with a high percentage of solids
- Highly chlorinated wastes
- Low heating value solids and sludges
- Wastes with a high moisture content
- Batch feeds with high moisture, volatility, or instantaneous oxygen demand

4.1.3.2 Containerized or Batch Wastes

Transient operations due to batch waste feeds are fairly common. D/F testing during batch feed conditions should be performed regardless of carbon monoxide concentrations (which are generally measured downstream of the SCC and which may or may not reflect the transients experienced in the PCC). Based upon EPA (1996a) and Lemieux and others (1990), the following batch feed parameters should be demonstrated during D/F testing:

- Maximum feeding frequency
- Maximum batch size
- Maximum PCC combustion temperature
- Maximum kiln rotation speed
- Minimum oxygen concentration

A trial burn plan for a batch-fed facility should include a description of the procedures used to maintain adequate oxygen while feeding batch or containerized wastes. Unless the oxygen demand from the batch waste is insignificant compared to the oxygen demand of other fuels (e.g., 1-gallon containers fed to the hot end of a cement kiln), EPA (1996a) suggests establishing a minimum oxygen limit at the end of the combustion chamber into which the batch is fed, at the time the batch is fed. Implementation of minimum oxygen limits at the exit of the PCC on rotary kilns can sometimes be difficult, due to potentially significant gas-phase stratification (Cundy and others 1991). If this is a problem, alternate monitoring locations may need to be considered. Minimum oxygen limits for HWC facilities other than batch-fed units are generally not necessary because emission limits for carbon monoxide will ensure that wastes are not fed to the unit while excess air is at too low a level. However, if a HWC facility operates at conditions that frequently exceed the carbon monoxide limits, the permit writer may consider establishing either a minimum oxygen limit from the trial burn, or requiring an automatic control system to maintain fuel-to-air ratios. Carbon monoxide may not always be a good indicator of combustion efficiency for cement kilns, as discussed later in Section 4.5.

The physical and chemical composition of the batch waste is also important. Key characteristics include volatility, instantaneous oxygen demand, moisture content, and heating value. Historical information on operating trends and AWFCS events should be reviewed in an effort to determine which batch characteristics are most likely to cause transients for a particular HWC facility. Some batch-charged and containerized wastes can volatilize rapidly, causing an instantaneous release of heat and gases that completely consume the available oxygen. This results in a momentary oxygen-deficient condition that can result in poor combustion. Conversely, if too large a batch of aqueous waste or wet soil is fed, there is danger that the batch can instantaneously quench temperature.

4.1.3.3 High Carbon Monoxide

Units with carbon monoxide limits above 100 ppm should perform D/F emissions testing while carbon monoxide levels are maximized. EPA (1994a) evaluated D/F emissions data by normalizing the data for APCD inlet temperature and carbon monoxide. Low carbon monoxide levels (less than 100 ppm) were associated with very low D/F emissions (less than 1 nanogram per dry standard cubic meter [ng/dscm] on a total basis). For carbon monoxide levels greater than 100 ppm, temperature-normalized dioxin emissions were significantly higher (in the range of 10 to 100 ng/dscm on a total basis).

4.1.4 Feed Composition

In addition to the physical waste characteristics that can cause poor combustion, there are several chemical characteristics that can potentially influence D/F emissions. These include chlorine concentration, the presence of metals (such as copper, iron, and nickel) that can act as catalysts in D/F production mechanisms, the presence of D/F precursors (such as chlorobenzenes and chlorophenols), and the presence of D/F inhibitors (such as sulfur and ammonia). Each of these is discussed below.

4.1.4.1 Chlorine

While the presence of chlorine is necessary for the formation of D/Fs, there does not appear to be a direct correlation between the level of chlorine in the feed and the level of D/Fs in the flue gas in full-scale HWC facilities. The American Society of Mechanical Engineers (ASME) (Rigo and others 1995) analyzed over 1,700 test results with chlorine feed concentrations ranging from less than 0.1 percent up to 80 percent, and found no statistically significant relationship between D/F emission rates and chlorine concentration. Obviously, no D/Fs could be formed without the presence of chlorine. However, other parameters, such as APCD inlet temperature, are more statistically significant and any potential effect of chlorine feed input is effectively masked.

EPA (1996a) is not proposing to limit the amount of chlorine fed to the HWC facility to ensure compliance with the proposed D/F MACT standards. For D/F testing, chlorine feed rates should be maintained at normal levels (i.e., chlorine should not be biased low). For purposes of this guidance, the term chlorine feed rate refers to total chlorine from all sources, including both organic and inorganic forms. Chlorinated wastes are preferred over non-chlorinated wastes, where the choice exists. However, specific HRA limits on total chlorine are not anticipated based upon the D/F testing.

4.1.4.2 Metal Catalysts

Abundant pilot-scale and fundamental research has shown that certain metals, such as copper, may catalyze the formation of D/Fs. This phenomenon has not been observed during full-scale testing (Lanier and others 1996); however, the testing may have been conducted in a system that was influenced by other, more dominant factors. EPA (1996a) is not proposing to limit the amount of catalytic metals to ensure compliance with the future D/F MACT standards. Wastes or other feed materials containing copper are preferred over feeds without copper during the D/F testing, where the choice exists. However, specific limits on copper (or other catalytic metals) are not anticipated based upon the D/F testing.

4.1.4.3 D/F Precursors

Some HWIs that burn D/F precursors, including chlorobenzenes, chlorophenols, and PCBs, have been shown to have high D/F emissions. EPA (1996a) compared a limited number of facilities that feed known D/F precursors to those that do not feed D/F precursors. This limited study suggested no strong correlation between the level of precursors and D/F formation; however, the issue has not been examined in detail. If a facility burns wastes with significant quantities of D/F precursors, these wastes are preferred over wastes without precursors for D/F testing. Although specific permit limits on D/F precursors are not anticipated, the permit writer may require waste profile tracking to determine whether increased quantities of precursor wastes warrant retesting.

4.1.4.4 D/F Inhibitors

D/F inhibitors, such as sulfur, have been commercially marketed as feed stream additives to control D/F emissions. These same compounds may naturally be present in fossil fuels (such as coal) or hazardous waste fuels. Raghunathan and Gullett (1994) and Raghunathan and others (1997) conducted bench and pilot-scale tests of municipal solid waste combustion facilities and concluded that co-firing with coal can effectively reduce D/F emission rates. Significant decreases in D/F emission rates were observed at a sulfur to chlorine ratio of 0.64 (Raghunathan and Gullett 1994). Depletion of active chlorine by sulfur dioxide through a gas-phase reaction appears to be a significant inhibition mechanism, in addition to sulfur dioxide deactivation of copper catalysts. In reviewing the D/F test protocol, the permit writer should ensure that the facility will not burn a high sulfur waste or fuel in greater quantities than during normal operation. The permit writer may require waste and fossil fuel tracking to determine whether burning decreased quantities of sulfur warrant retesting.

4.1.4.5 Other Factors

Other waste feed components may also potentially affect D/F emissions. The presence of bromine, in particular, has been found to affect emissions of chlorinated organic PICs and D/Fs in pilot-scale experiments (Lemieux and Ryan 1998; Lemieux and Ryan in press). Although the effects of the presence of bromine has not been clearly established during full-scale testing, permit writers should be aware of its potential when selecting waste feeds for trial burns, particularly if the facility burns brominated waste during normal operations.

4.1.5 D/F Control Technologies

Some facilities may install specific D/F control technologies. These include carbon injection, carbon beds, catalytic oxidizers, and D/F inhibitor technologies. If a facility uses one of these technologies, then permit limits on key operating parameters should be established during D/F testing. Relevant operating parameters are identified in EPA (1996a, 1996d).

4.2 OPERATING PARAMETERS ASSOCIATED WITH D/F PRODUCTION

Based on a review of existing information, this guidance prioritizes operating parameters and conditions associated with D/F formation as primary, secondary, or tertiary. These hierarchial designations should not be considered absolute, but are intended to emphasize the relative importance of demonstrating various operating parameters during D/F testing and limiting those parameters in the final RCRA permit. Parameters related to combustion conditions are categorized as primary; however, this designation should be tempered by the previous discussion for steady-state systems. A description of primary, secondary, and tertiary operating parameters follows:

- Primary operating parameters are those that have shown the highest correlation with D/F emission rates during full-scale testing, and are expected to dominate D/F formation. These parameters should always be demonstrated during the D/F test, and should be limited in the permit by specific quantitative limits. These operating parameters relate to either surface-catalyzed D/F formation, or the use of specific D/F control technologies and include:
    - Inlet temperature to dry APCDs
    - Temperature profiles over particulate holdup areas (including long runs of ductwork, economizers, and boiler tubes)
    - Key operating parameters for specific D/F control technologies
    - Combustion parameters listed in Tables 4-1 and 4-2
- Secondary operating parameters are those that may influence D/F emissions under certain circumstances. However, there is less information indicating a direct correlation between these parameters and D/F emission rates. These parameters may or may not need to be demonstrated during the D/F test and limited in the permit, depending on the significance of these parameters for a given system configuration and the presence or absence of dominant primary parameters. Secondary parameters include:
    - Conditions other than combustion quality that could lead to the formation of organic precursors (such as organics from raw materials in cement kilns and LWAKs)
    - Flue gas temperatures due to partial quenching
- Tertiary operating parameters are those that relate to feed composition. These operating parameters have been the subject of fundamental and pilot-scale research on D/F

formation, but have not routinely been correlated with D/F emissions during full-scale testing. These parameters may influence the selection of feeds for D/F testing and subsequent waste profile tracking, but are not expected to be limited in the permit by specific feed rate limits. Tertiary parameters include:

- Chlorine feed rates
- Presence of D/F catalysts (such as copper)
- Presence of D/F precursors (such as chlorinated aromatics)
- Presence of naturally-occurring D/F inhibitors (such as sulfur)

The following subsections discuss critical D/F operating parameters in more detail as they relate to specific types of HWC facilities.

4.3 D/F EMISSIONS FROM HWIS

HWIs include rotary kiln, liquid injection, fluidized bed, and fixed hearth designs. Commercial HWIs typically accept hazardous waste from generators throughout the United States. Waste feeds to these units can be highly variable, for example waste feed material may include low- and high-Btu liquids, as well as solids from laboratory packs and soils contaminated with low levels of RCRA hazardous wastes. Large chemical complexes may operate captive HWIs that treat waste feeds generated on site and from corporate affiliates off site. These wastes may also be highly variable, especially if the facility burns a number of wastes from different production operations and does not have the capability to blend the wastes to a consistent specification. Small chemical companies may generate only one or two waste streams. These wastes are typically more predictable and homogeneous.

HWIs are generally associated with two-stage APCDs (EPA 1996a) that first cool hot flue gases and then remove PM, metals, and organics. Most HWIs use wet APCDs (three were cited that use dry scrubbers). Typical APCDs include (1) packed towers, spray dryers, or dry scrubbers for temperature reduction and acid gas control and (2) venturi scrubbers, wet or dry ESPs, or fabric filters for PM, metal, and organics control. Some new technologies are being developed, and several facilities are injecting activated carbon in the spray dryers for control of D/Fs, non-D/F organics, and mercury (EPA 1996a). Some HWIs may have heat recovery boilers that affect D/F emissions.

The level of D/F emissions from HWIs may be dependent on incinerator design, APCD type, particulate hold-up temperatures, type of quench or presence of a heat recovery unit, combustion conditions, and feed composition. In summary, all of the considerations discussed previously in Section 4.1 apply to HWIs.

Table 4-1 summarizes operating parameters associated with D/F emissions from HWIs. Recommended averaging periods are discussed further in Section 8.0. Depending on the system configuration, demonstration of operating parameters associated with D/F formation may coincide with both the DRE and SRE test conditions. If dry APCD equipment or heat recovery devices are present in the HWI system, the temperature profile across these systems is recognized as a primary operating parameter directly related to D/F formation. Therefore, for these systems, D/F data collection may be performed in conjunction with SRE testing (unless the facility can adjust inlet temperature to obtain the requisite temperature profiles during DRE testing). Demonstration of operating parameters affecting combustion efficiency (especially for transient operations, units burning containerized wastes, or high carbon monoxide situations) will most likely coincide with the DRE test condition.

Facilities with more predictable, homogeneous waste feeds, few operating fluctuations, and no particulate holdup devices may opt to collect D/F emissions data during a risk burn conducted under normal operating conditions. Waste feed selection is based on a representative waste stream, with a preference for D/F precursors such as chlorophenols and minimal amounts of D/F inhibitors (such as sulfur).

4.4 D/F EMISSIONS FROM BOILERS

General boiler designs are discussed by EPA (1994a), and requirements for boilers burning hazardous waste are defined in 40 CFR Part 266.100 et seq. Boilers recover the heat from hazardous waste combustion to pressurize water. The three most common boiler designs used for treating hazardous waste include firetube boilers, watertube boilers, and stoker-fired boilers. Most boilers treating hazardous waste are on-site units at chemical production facilities. Most boilers do not have APCDs. Historically, emissions tests from boilers have focused on metals and PM, and the database for D/F emissions from boilers is not as extensive as it is for D/F emissions from HWIs and cement kilns.

D/F emissions from boilers are expected to be dependent on boiler design, APCD type, particulate hold-up temperatures, combustion conditions, and feed composition. Table 4-1 summarizes operating parameters associated with D/F and other organic emissions from boilers. Recommended averaging periods are discussed further in Section 8.0. Depending on the system configuration, demonstration of operating parameters associated with D/F formation in boilers may coincide with both the DRE and SRE test conditions.

TABLE 4-1

OPERATING PARAMETERS ASSOCIATED WITH D/F EMISSIONS FROM HWIS AND BOILERS

	Operating Parameters	Most Likely Achieved During	Parameter Type/Suggested Averaging Periods*	How Limit is Established	Other Considerations
PRIMARY OPERATING PARAMETERS					
Surface-Catalyzed Formation: (Dry APCD) Surface-catalyzed formation is a predominant D/F formation mechanism for post-combustion dry APCD particulate holdup areas operating at temperatures between 400-750 °F.	Maximum dry ESP inlet temperature	SRE test, unless a variable quench is used	Group A: Dual 10 minute/1 hour	Average of three maximum 10-minute RAs/Average of three maximum HRAs	Particulate loading should not be biased low during the test, based upon a review of: - ash feed rate - combustion gas velocity - APCD operation Ongoing PM control is assured by limits on APCD operating parameters established during the PM test.
	Maximum FF inlet temperature				
	Maximum HEPA filter inlet temperature				
	Boiler exit temperature	Any test that achieves the critical temperature window	Group A: Dual 10 minute/1 hour	Average of three minimum or maximum 10-minute RAs/Average of three minimum or maximum HRAs (depending on which edge of the boiler operating range is in the critical temperature window)	
D/F-Specific Control Technology: D/F-specific control technologies include carbon injection, carbon bed, and inhibitor technologies.	If a specific control technology is used to limit D/F emissions, operating limits should be established per EPA (1996a, 1996d).				

TABLE 4-1

OPERATING PARAMETERS ASSOCIATED WITH D/F EMISSIONS FROM HWIS AND BOILERS (Continued)

	Operating Parameters	Most Likely Achieved During	Parameter Type/Suggested Averaging Periods*	How Limit is Established	Other Considerations
PRIMARY OPERATING PARAMETERS (Continued)					
Combustion Conditions Related to Formation of D/F Precursors: (*These parameters should also be limited to control non-D/F organics, as discussed in Section 5.1*) Operating parameters to limit D/F precursors from poor combustion are most critical for transient operations. Transient operations may be identified by frequent temperature, carbon monoxide, oxygen, or total hydrocarbon spikes. Operating parameters related to good combustion may be less critical for steady-state operations. Although demonstration of these operating parameters during DRE conditions is preferred whenever possible, D/F testing at normal combustion conditions may be considered for some steady-state units. Record keeping and periodic reporting to confirm continued absence of transients may be considered in lieu of HRAs or 10-minute averages.	Minimum combustion temperature, each chamber Exception: Maximum PCC temperatures should be demonstrated for units burning containerized wastes	DRE	Group A: Dual 10-minute/1 hour	Average of three minimum 10-minute RAs/Average of three minimum HRAs	
	Maximum combustion gas velocity	DRE/ SRE	Group A: 1 hour	Average of three maximum HRAs	
	Maximum waste feed rate, each location	DRE	Group A: 1 hour	Average of three maximum HRAs	Limits should be established for: - maximum organic liquids to PCC - maximum aqueous liquids to PCC - maximum sludges to PCC - maximum solids to PCC - maximum organic liquids to SCC - maximum aqueous liquids to SCC

TABLE 4-1

OPERATING PARAMETERS ASSOCIATED WITH D/F EMISSIONS FROM HWIS AND BOILERS (Continued)

	Operating Parameters	Most Likely Achieved During	Parameter Type/Suggested Averaging Periods*	How Limit is Established	Other Considerations
PRIMARY OPERATING PARAMETERS (Continued)					
Combustion Conditions Related to Formation of D/F Precursors: (Continued):	Waste variability that could cause transients	DRE	This is not a continuously monitored parameter, but pertains to selection of wastes for testing. Conditions for waste profile tracking may be specified by the permit writer.		Wastes with physical properties that can cause combustion transients (as discussed in Section 4.1) should be selected.
	Batch feed conditions: - batch size - batch frequency - minimum oxygen level	DRE	<u>Group B</u>: Per batch	Batch: - size demonstrated during test - frequency demonstrated during test - oxygen level demonstrated during test	Test wastes with high volatility and oxygen demand.
	- maximum PCC temperature - maximum kiln rotation speed		<u>Group A</u>: 1 hour	Average of three maximum HRAs	
	Maximum carbon monoxide and total hydrocarbons	DRE	<u>Group A</u>: 1 hour	Average of three maximum HRAs, or 100 ppm carbon monoxide, whichever is higher	None

TABLE 4-1

OPERATING PARAMETERS ASSOCIATED WITH D/F EMISSIONS FROM HWIS AND BOILERS (Continued)

	Operating Parameters	Most Likely Achieved During	Parameter Type/Suggested Averaging Periods*	How Limit is Established	Other Considerations
SECONDARY OPERATING PARAMETERS					
Rapid High Temperature Formation: (Wet APCD) May be a concern for partial quench situations with post-partial quench gas temperatures between 570-800 °F. Not a concern for rapid wet quench systems that cool gases to saturation temperatures within milliseconds.	Maximum post-partial quench gas temperature	Any test condition that achieves the critical temperature window for D/F formation	Group A: Dual 10-minute/1 hour	Average of three maximum 10-minute RAs/Average of three maximum HRAs	None
TERTIARY OPERATING PARAMETERS					
Feed Composition: Wastes should be chosen based on consideration of chlorine and D/F precursors, catalysts, and inhibitors.	Total Chlorine D/F Precursors D/F Catalysts D/F Inhibitors	These are not continuously monitored parameters, but pertain to selection of wastes and fuels for testing. Conditions for waste profile tracking may be specified by the permit writer.			Considerations are discussed in Section 4.1.

Notes: APCD = air pollution control device
D/F = dioxins and furans
DRE = destruction and removal efficiency
EPA = U.S. Environmental Protection Agency
ESP = electrostatic precipitator
FF = fabric filter
HEPA = high efficiency particulate air
HRA = hourly rolling average
PCC = primary combustion chamber
PM = particulate matter
RA = rolling average
SCC = secondary combustion chamber
SRE = system removal efficiency
* = Hourly and 10-minute rolling averages are specified as examples, but other averaging periods and techniques may be considered. When establishing permit limits that are based on the average of the three highest (or lowest) rolling averages, it is important to ensure that the test is conducted in a manner that only allows for normal variability about a central value. For example, it would not be acceptable to conduct the test at 15 minutes of artificially high carbon monoxide concentrations, with the remainder of the test at normal levels. One way to avoid this is to establish the permit limit as the time-weighted average over all runs. Averaging periods are also discussed in Section 8.0

As explained in Section 4.1, boiler tubes may serve as particulate holdup areas and lead to D/F emissions. D/Fs may form when boiler flue gases are within the D/F formation temperature window. Because boilers typically have no rapid quench, the time and temperature window for D/F formation may be large. Therefore, boiler exit temperature (which can include temperatures at heat exchangers and economizers) is considered a primary operating parameter for D/F formation and control. Collection of D/F emissions data for boilers is recommended during conditions that achieve boiler exit temperatures in the upper end of (but well within) the 400 to 750 °F range. For example, for a facility with boiler exit temperatures ranging from 350 to 550 °F, D/F testing at the boiler exit temperature of 550 °F would be preferred over testing at the exit temperature of 350 °F. Boiler exit temperatures may fall in the upper end of the D/F formation window during either DRE or SRE conditions, depending on the facility-specific operating envelope.

Demonstration of parameters related to combustion quality can also be a consideration, especially for boilers that burn wastes resulting in combustion transients. Some boilers at chemical facilities burn different production run wastes in campaigns. These conditions should be evaluated by the permit writer prior to trial burn to determine the potential for transients. Demonstration of operating parameters affecting combustion efficiency will most likely coincide with the DRE test condition.

Demonstrating key operating parameters related to combustion quality can sometimes be problematic for boilers based on potential test condition conflicts (Schofield and others 1997). For example, a facility with a fixed combustion air flow rate burning a single high-Btu waste stream will not be able to demonstrate minimum combustion temperature and maximum feed rate simultaneously. Thus, two test conditions may be needed to demonstrate all of the key control parameters related to combustion. However, if combustion air can be controlled, then temperature could be minimized and feed rate could be maximized simultaneously by adjusting the amount of combustion air.

In some cases, D/F testing during the DRE condition may not be possible for reasons discussed in Section 4.1 (e.g., because of sampling port limitations, or because the risk testing is being performed separately from performance testing). In these situations, a facility with predictable, homogeneous waste feeds and few combustion transients may opt to test during a test condition that represents normal combustion conditions. The facility would still need to demonstrate boiler exit temperatures in the upper end of the 400 to 750 °F range.

In general, facilities with highly variable operations should collect D/F emission samples during DRE conditions and any other condition that is necessary to achieve boiler exit temperatures in the upper end of the 400 to 750 °F window. This could result in multiple test conditions. Facilities with more predictable, homogeneous waste feeds and few combustion transients may need to test only during the test condition achieving the requisite boiler exit temperatures.

Permit writers should also be aware of soot blowing practices at boilers because high particulate loading due to this practice could affect D/F emissions. The permit writer should determine normal sootblowing procedures from the facility's operating record. Sootblowing should be performed during D/F testing to capture the potential impact of higher particulate loading on D/F emissions. However, sootblowing should not be performed on a more rapid cycle than normal, because this could potentially shorten the residence time for D/F formation, and decrease D/F emissions (Santoleri 1995). EPA (1992b) provides guidance on structuring test runs to reflect sootblowing practices.

4.5 D/F EMISSIONS FROM CEMENT KILNS

Background information on potential D/F emissions from cement kilns is summarized by EPA (1994a, 1996a). Cement kilns may use hazardous waste as a supplementary fuel while producing a salable product. In general, the operating envelope of cement kilns is dictated in large part by the American Society for Testing and Materials (ASTM) requirements for their final product. Cement kilns also have regions that operate at high temperatures approaching 3,000 °F. Based on these characteristics, issues related to good combustion and minimum combustion temperatures are less relevant, as compared to HWIs and boilers. Also, because of the chemical composition of the raw materials, carbon monoxide and total hydrocarbon concentrations may not always serve as indicators of good combustion. According to EPA (1996a) all hazardous waste burning cement kilns use either fabric filters or ESPs as APCDs.

Table 4-2 summarizes operating parameters associated with D/F and other organic emissions from cement kilns and LWAKs. Data presented by Harris and others (1994) and Lanier and others (1996) demonstrate that D/F emissions from cement kilns increase exponentially with increases in inlet temperatures to the dry APCD while within the D/F formation window (400 to 750 °F). Given these conditions, maximum inlet temperature to the dry APCD system is the primary operating parameter related to D/F emissions for cement kilns. Collection of D/F emission data should occur during conditions that achieve maximum APCD inlet temperatures. These conditions may coincide with the SRE test if the APCD inlet temperature cannot be independently controlled from combustion temperature.

TABLE 4-2

OPERATING PARAMETERS ASSOCIATED WITH D/F EMISSIONS FROM CEMENT KILNS AND LWAKS

	Operating Parameters	Most Likely Achieved During	Parameter Type/Suggested Averaging Periods*	How Limit is Established	Other Considerations
PRIMARY OPERATING PARAMETERS					
Surface-Catalyzed Formation: (Dry APCD) Surface-catalyzed formation is a predominant mechanism for post-combustion dry particulate holdup areas operating at temperatures between 400-750 °F.	Maximum dry ESP inlet temperature	SRE	Group A: Dual 10 minute/ 1 hour	Average of three maximum 10-minute RAs/Average of three maximum HRAs	Ongoing PM control is assured by limits on APCD operating parameters established during the PM test.
	Maximum FF inlet temperature				
	LWAKS: Maximum inlet temperature to extensive runs of ductwork	SRE	Group A: Dual 10 minute/ 1 hour	Average of three maximum 10-minute RAs/Average of three maximum HRAs	
D/F-Specific Control Technology: D/F-specific control technologies include carbon injection, carbon bed, and inhibitor technologies.	If a specific control technology is used to limit D/F emissions, operating limits should be established per EPA (1996a and 1996d).				

EQC November 18-19, 1999
Attachment E, Page E-37

TABLE 4-2

OPERATING PARAMETERS ASSOCIATED WITH D/F EMISSIONS FROM CEMENT KILNS AND LWAKS (Continued)

	Operating Parameters	Most Likely Achieved During	Parameter Type/Suggested Averaging Periods*	How Limit is Established	Other Considerations
SECONDARY OPERATING PARAMETERS					
Good Combustion to Control D/F Precursors: *Note: These parameters should also be limited to control non-D/F organics, as discussed in Section 5.2* Applicable only to kilns that feed wastes at locations other than the hot end of the kiln.	Batch feed conditions: - batch size - batch frequency - feed location - minimum oxygen - maximum temperature at feed location	Any test	<u>Group B</u>: Per batch	Batch: - size demonstrated in test - frequency demonstrated in test - location demonstrated in test - oxygen level demonstrated in test - temperature demonstrated in test	Test wastes with high volatility/oxygen demand. Kiln rotation speed is generally limited by the production process and need not be limited for cement kilns.
Control of Precursors from Raw Material Organics: *Note: These parameters should also be limited to control non-D/F organics, as discussed in Section 5.2* Total hydrocarbons originating from raw materials may lead to formation of chlorinated organics that could potentially serve as D/F precursors.	Maximum total hydrocarbons, as measured at both the main and bypass stacks, not to exceed 20 ppmv per BIF	SRE	<u>Group A</u>: 1 hour	20 ppmv, regulatory limit, at the monitoring location used for BIF compliance. Limits for other locations will be considered based on the results of the SSRA.	Temporary total hydrocarbon monitors may be needed if the facility does not normally measure total hydrocarbons.

TABLE 4-2

OPERATING PARAMETERS ASSOCIATED WITH D/F EMISSIONS FROM CEMENT KILNS AND LWAKS (Continued)

	Operating Parameters	Most Likely Achieved During	Parameter Type/Suggested Averaging Periods*	How Limit is Established	Other Considerations
TERTIARY OPERATING PARAMETERS					
Feed Composition: Total chlorine and the presence of D/F inhibitors such as sulfur in coal should be considered during selection of wastes and other fuels.	Total Chlorine	These are not continuously monitored parameters, but pertain to selection of wastes and fuels for the testing. Conditions for waste profile tracking may be specified by the permit writer.			Normal to high levels of total chlorine should be maintained during the D/F testing.
	D/F Inhibitors				Coal should not be fed at higher than normal rates during the D/F testing, and low-sulfur coal is preferable if the facility uses coal with varying sulfur content.

Notes: APCD = air pollution control device
BIF = boiler and industrial fur
D/F = dioxins and furans
EPA = U.S. Environmental Protection Agency
ESP = electrostatic precipitator
FF = fabric filter
HRA = hourly rolling average
PM = particulate matter
ppmv = parts per million volume
RA = rolling average
SRE = system removal efficiency

* = Hourly and 10-minute rolling averages are specified as examples, but other averaging periods and techniques may be considered. When establishing permit limits that are based on the average of the three highest (or lowest) rolling averages, it is important to ensure that the test is conducted in a manner that only allows for normal variability about a central value. For example, it would not be acceptable to conduct the test at 15 minutes of artificially high carbon monoxide concentrations, with the remainder of the test at normal levels. One way to avoid this is to establish the permit limit as the time-weighted average over all runs. Averaging periods are also discussed in Section 8.0.

The operating parameters in Table 4-2 related to combustion conditions are limited to situations where kilns feed hazardous waste at locations other than the hot end of the kiln. Controls on waste charging rate and kiln oxygen concentration are recommended because wastes injected at mid- or feed-end locations may not experience the same elevated temperatures and long residence times as those wastes injected at the hot end. In a worst-case scenario, volatile compounds may be released from the charge so rapidly that they are not able to mix with oxygen and ignite before they cool below a critical temperature forming PICs (Dellinger and others 1993).

Table 4-2 does not establish control parameters related to combustion of hazardous wastes introduced to the hot end of kilns. Results from both kinetic modeling and field studies suggest that organics are efficiently destroyed when fed at the hot end of cement kilns (Dellinger and others 1993). DRE failures at cement kilns are extremely limited, and can generally be explained by high blank or baseline (non-hazardous waste) levels of POHCs. In one instance, DRE failure has been attributed to poor atomizer design. However, facility-specific DRE testing should be sufficient to reveal design problems.

In cement kilns, main stack emissions of total hydrocarbons are dominated by organics that are volatilized from the raw materials prior to entering the high temperature regions of the kiln. The chlorination of these hydrocarbons is a potential source of chlorinated hydrocarbon emissions, including D/F precursors such as monochlorobenzene (Dellinger and others 1993). Therefore, D/F testing should be performed at the upper end of the operating range for total hydrocarbons, as measured in both the main and bypass stacks, not to exceed 20 parts-per-million volume (ppmv) at the monitoring location used for BIF compliance. Although the operating conditions necessary for achieving high total hydrocarbon emissions may vary by facility, maximum total hydrocarbon levels are likely to be achieved by some combination of high production rate, high gas temperatures at the raw material feed end of the kiln, and low oxygen at the raw material feed end of the kiln. Dellinger and others (1993) observed an inverse relationship between total hydrocarbons and stack oxygen concentrations. The organic content of the raw material can also significantly influence hydrocarbon levels, but the raw materials are not easily controlled for the purpose of testing. If total hydrocarbon levels increase substantially due to changes in raw materials, then re-testing may be necessary. Organic emissions from LWAKs are generally expected to be less than those from cement kilns. This is because the feed material is usually shale or slate with low organic carbon content. However, the objectives for maximizing total hydrocarbons still apply, consistent with those provided for cement kilns.

In the context of D/F and other organic testing, total hydrocarbons are used as an operating parameter indicating levels of organics within raw materials that may be chlorinated from the hazardous waste fuel. In this case, total hydrocarbons are not being used as an indicator of good combustion or combustion efficiency. The SSRA quantifies risks from organic emissions from the HWC facility, regardless of source. Therefore, facilities that only monitor carbon monoxide under the BIF regulations (some LWAKs), or cement kilns that only monitor carbon monoxide or total hydrocarbons in a bypass stack, may need to install temporary total hydrocarbon monitors on the main stack prior to and during the D/F and other organic tests to ensure that total hydrocarbon emissions are being maximized. The need for permanent total hydrocarbon monitoring is assessed by the permit writer after the SSRA is completed and potential risks are compared to target risk levels. Carbon monoxide may not always be a good indicator of organic emissions from cement kilns. Carbon monoxide is generated during the calcining of calcium carbonate, and may also be formed at the kiln exit where some of the total hydrocarbons from the raw materials are oxidized.

Normal levels of chlorine in wastes should be maintained during D/F and other organic emissions testing. It has been proposed that the highly alkaline environment in a cement kiln scavenges available chlorine, making it unavailable for chlorination of organics. However, equilibrium calculations show lower chlorine capture at high temperatures and conversion of HCl to Cl_2. Thus, even a highly basic chemical species such as calcium hydroxide would not be expected to effectively control chlorinated hydrocarbon formation (including D/Fs) at temperatures above 400 °F (Dellinger and others 1993).

Naturally occurring D/F inhibitors, such as sulfur, are expected to be present in the coal used for co-firing a cement kiln. During the D/F testing, coal should not be fed at higher-than-normal rates, and low sulfur coal is preferred if a facility uses several coal suppliers. Other potential D/F inhibitors, such as calcium, are already present in the raw materials.

Metal catalysts in the waste are not expected to be relevant to D/F testing at cement kilns. Spiking wastes with copper were not observed to affect D/F emission rates during full-scale testing of a cement kiln (Lanier and others 1996). Also, other metals that have been studied as D/F catalysts (iron and aluminum) are major ingredients in cement kiln raw materials.

D/F precursors at cement kilns are expected to be dominated by precursors in the raw material, and not by precursors in the waste. However, if a facility burns wastes with significant quantities of D/F precursors, these would be preferred over wastes without the precursors.

4.6 D/F EMISSIONS FROM LWAKS

The operation of LWAKs is similar to cement kilns in that (1) the operating temperature range is dictated by ASTM consideration of the final product and (2) temperature at the hot end varies from 2,050 to 2,300 °F (EPA 1996a). Combustion gas exit temperatures vary from 300 to 1,200 °F depending on the feed and system design. LWAKs typically burn only high-Btu, liquid fuel, and do not burn wastes at locations other than the hot end. According to EPA (1996a), all LWAKs using hazardous waste as a fuel use fabric filters for PM control.

Table 4-2 summarizes operating parameters associated with D/F and other organic emissions. As with cement kilns, dry APCD inlet temperature is the primary operating parameter related to D/F formation. The need to demonstrate combustion parameters should be evaluated on a case-by-case basis. As appropriate, permit writers may also wish to consider combustion parameters as permit conditions. LWAKs do not operate at combustion temperatures as high as those in cement kilns. However, the potential for combustion transients may be minimized because LWAKs typically only burn high-Btu, liquid wastes in the flame zone.

An additional concern for some LWAKs is the use of long runs of duct work (between the kiln, fabric filter, and stack) that can lead to particle entrainment and high D/F emissions. This particulate holdup area should be evaluated as a primary issue related to D/F formation. D/F emission data collection is most appropriate during the upper end of the temperature operating envelope (SRE) due to the importance of the inlet temperature to the dry APCD and duct work.

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ATTACHMENT F

Documents related to the Pollution Abatement System Carbon Filter System Class 2 Permit Modification Request [UMCDF-97-005-PAS(2TA)]

Conditional Approval Letter for Permit Modification Request
November 17, 1998
(DEQ Item No. 98-0938)

Request for Further Information
August 24, 1999
(DEQ Item No. 99-1398)

Notice of Decision
November 24, 1998
(DEQ Item No. 98-0991)

Response to Comments
November 24, 1998
(DEQ Item No. 98-0989)

FILE

98-0938

18

Oregon
John A. Kitzhaber, M.D., Governor

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November 17, 1998

Lieutenant Colonel Martin Jacoby
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Sent By Certified Mail No. Z 700 336 182 (copy hand-delivered)

Mr. Raj Malhotra
UMCDF Site Project Manager
Program Manager for Chemical Demilitarization
78072 Ordnance Road
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Sent By Certified Mail No. Z 700 336 183 (copy hand-delivered)

Re: Class 2 Permit Modification
Pollution Abatement System
Carbon Filter System (PFS)
UMCDF-97-005-PAS (2TA)
DEQ Item No. 98-0938

Dear LTC Jacoby and Mr. Malhotra:

The Department of Environmental Quality (Department) acknowledges receipt of the Permittee's response to the September 2, 1998 Notice of Deficiency (NOD) (DEQ Item No. 98-0614) for the Class 2 Permit Request of the Pollution Abatement System Carbon Filter System (PFS). The Department has reviewed the response and has determined that the Permittee has addressed the issues identified in the NOD.

In accordance with 40 CFR 270.42 the Department approves this Permit Modification Request [UMCDF-97-005-PAS (2TA)] subject to the following conditions:

1. In accordance with Permit Condition VI.A.5 the Permittee must submit Trial Burn Plans 180 days prior to thermal shakedown. The Trial Burn Plans must include the items that are called-out in the response to NOD Item Nos. 3 and 26.

2. In response to NOD Item No. 3, and in accordance with Permit Condition VI.A.5.iii.c, the Permittee must perform sampling for total organic carbon using EPA-600-R-96-036. EPA-600-R-96-036 requires the use of a bag sample (EPA Method 0040-non-isokinetic) and a semivolatile train (EPA 0010 dedicated only to total organic carbon-isokinetic train). Further, the Department recommends the Permittee add an isokinetic sample train for Hexavalent Chrome (EPA Method 0061) and a semivolatile train separate from the train for semivolatiles for dioxins and PCB's. These requirements and recommendations should also be included in the Trial Burn Plans.

3. In response to NOD Item No. 7 the Department requires that the Permittee provide for a high-high alarm and associated waste feed cutoff at 170°F (measured as a one-hour rolling average). The AWFCO Tables should be revised to reflect this change and be submitted to the Department within 30 days of the date of this letter.

4. Based on the response to NOD Item No. 15, the Permittee must update the permit instrument and process tables to accurately reflect the devices to be used for measuring and reporting moisture in the gas, with the expected range and revised instrument calibration paragraph. The revised tables must be submitted to the Department within 30 days of the date of this letter.
5. As stated in NOD Item Nos. 38 and 39 a Permit Modification Request for the RCRA Tank Assessment will be submitted addressing outstanding issues in these NOD Items. The Tank Assessment permit modification must be submitted within 90 days from the date of this letter.
6. The changes to Specification 13202 as stated in NOD Item No. 38 must be addressed in a permit modification request and be submitted to the Department within 90 days of the date of this letter.
7. The Department will revise the Hazardous Waste Storage and Treatment Permit definition section to include a definition of "Workshift."

The approval of this Permit Modification Request results in revisions to some Permit Conditions and sections of the RCRA Part B Application. The Department will issue the required changes to the facility Permit and RCRA Part B Application under separate cover.

If you have any questions or comments concerning this matter, please contact Wayne C. Thomas at (541) 567-8297 extension 22.

Sincerely,

Stephanie Hallock

Stephanie Hallock
Administrator
Eastern Region

C.f. Wayne C. Thomas, DEQ Hermiston
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August 24, 1999

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Re: PFS Carbon Filter System
Permit Modification Request
Response to Other Information
UMCDF-97-005-PAS(2TA)
Umatilla Chemical Agent Disposal Facility
ORQ 000 009 431
DEQ Item No. 99-1398 (18)

Dear LTC Woloszyn, Mr. Malhotra and Mr. Bluestein:

MAY 25

The Department of Environmental Quality (Department) has reviewed the Permittee's response (PMCSD ENV-99-0165) to the Department's letter of May 5, 1999 (DEQ Item No. 99-0859, "PFS Carbon Filter System Permit Modification Request, Other Information"). The Department requests further clarification of some of the responses.

- Bullet Item No. 1: The Department believes that the information concerning the removal of the emergency induction draft (ID) blowers for the Deactivation Furnace System (DFS) and Metal Parts Furnace (MPF) Pollution Abatement Systems (PAS) should have been included in the original PFS Permit Modification Request. Please provide an estimated date for the submittal of the Permit Modification Request that will include the removal of the PAS blowers. This information could be significant to the Department's preparation of recommendations concerning the PFS that will be presented to the Environmental Quality Commission on November 18, 1999.

- Bullet Item No. 2: The Department acknowledges the response concerning the incorrect reference in the Mitretek report, but no response has been provided to the second paragraph of the Department's comments: "The Mitretek Risk Assessment report seems to arrive at its conclusion that the PFS is "risk neutral" by correcting assumptions used in the HHRA to reflect more "realistic" parameters. A valid comparison of health risk assessment results "with" and "without" the PFS requires that only those factors directly related to the presence of the PFS be changed in the applicable calculations. Although the results indicate that health risks related to chronic exposures might still be within regulatory requirements, an analysis of acute exposure risks due to a catastrophic release should also be included. The catastrophic release scenarios are clearly defined in the SAIC QRA."

- Bullet Item No. 3: The Department accepts this response, but remains concerned that PMCD and USACHPPM do not have a process in place to keep the regulatory community informed of developments concerning revisions to agent toxicity values. The Department recommends that information concerning revisions to toxicity values be disseminated through the National Chemical Demilitarization Workgroup as soon as it is available.

- Bullet Item No. 4: The Permittee's response supplied the Department with a table that had DMMP breakthrough data at 130°F and 180°F that was presented by ERDEC in 1995. The ERDEC laboratory bench scale test results supplied to the Department in the PFS Permit Modification Request (supplemental submittal) contained carbon breakthrough data for temperatures of 120°F and 170°F. The Department requests that the Permittee provide a complete copy of the ERDEC study "An Experimental Study of DMMP and DIMP Filtration at High Temperature and High Dewpoint Using Activated Carbon" so that the adsorption data can be reviewed in context.

- Bullet Item No. 5: The Department expects updates and timely reporting on ANCDF's progress on the pre-filter and HEPA filter feasibility study issues. The Permittee should provide a schedule of activities related to the filter feasibility study issues. This information could be significant to the Department's preparation of recommendations concerning the PFS that will be presented to the Environmental Quality Commission on November 18, 1999.

- Final Comment: The Department concurs with the Permittee's new approach to the review of relevant documents and the review of the "SIGACTS" List. The Department would like to be informed of the location of the review reports and have access to the review reports upon request.

In accordance with Permit Condition I.W., the Permittee must provide the additional information requested above by September 23, 1999. The Department will evaluate the responses as part of the Department's PFS Staff Report being prepared for the November meeting of the EQC.

If you have any questions or comments concerning this matter, please call me at (541) 567-8297, ext. 22 or Ken Chapin of my staff at ext. 27.

Sincerely,

Sue Oliver

for Wayne C. Thomas
Program Manager
Umatilla Chemical Agent Disposal Program

Cf: Ken Chapin, DEQ Hermiston
Ms. Megan Proctor, SAIC

98-0991

NOTICE OF DECISION

UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

PERMIT MODIFICATION UMCDF-97-005 PAS (2TA)
(Pollution Abatement System Carbon Filter System)
PERMIT NUMBER: OR6 213 820 917

WHAT WAS DECIDED?

On November 17, 1998, the Department of Environmental Quality (DEQ) issued a conditional approval of a Class 2 Permit Modification Request related to the construction and operating parameters of the Pollution Abatement System Carbon Filter Systems (PFS).

The revision to the HW Permit describes the configuration, components and the operating parameters of the PFS.

WHY DID THE PERMIT NEED TO BE MODIFIED?

The HW Permit for UMCDF was originally issued in February 1997. The Permittee proposed several changes to the PFS that affected numerous permit conditions. Changes to the conditions required the Permittee to submit a Class 2 Permit Modification Request to address how the Umatilla Chemical Depot and UMCDF will configure and operate the PFS.

WHERE CAN I GET MORE INFORMATION?

If you sent comments to the DEQ about the proposed modification any time during the public comment periods (November 18, 1997 to January 20, 1998 and May 12, 1998 to July 13, 1998), you will be sent a "Response to Comments" from the DEQ.

If you did not provide any comments to the DEQ, but you would still like to receive a copy of the Response to Comments, or a copy of the revised HW Permit condition, please call Sue Oliver in the Hermiston DEQ office at (541) 567-8297 extension 26 (or toll-free 1-800-452-4011). Copies of this Notice, the Response to Comments, and the revised HW Permit Condition will also be placed in each of the information repositories listed on the following page.

INFORMATION REPOSITORIES

DEQ–Hermiston Office
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Hermiston, OR 97838
(541) 567-8297

DEQ–Bend Office
2146 N.E. Fourth Street, Suite 104
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(541) 388-6146

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[Appeals to this Decision must be in accordance with the requirements of ORS 183.484 for an Order In Other Than A Contested Case, and no administrative appeal of this Permit Modification shall be provided to the applicant or third parties.]

COPY

RESPONSE TO COMMENTS

UMATILLA CHEMICAL DISPOSAL FACILITY

PERMIT MODIFICATION UMCDF-97-005-PAS (2TA)
(Pollution Abatement System Carbon Filter System)
PERMIT NUMBER: OR6 213 820 917
November 24, 1998

On November 17, 1998, the Oregon Department of Environmental Quality (DEQ) issued a conditional approval of a Class 2 Permit Modification request related to the construction and operating parameters of the Pollution Abatement System Carbon Filter System (PFS) for the Umatilla Chemical Agent Disposal Facility (UMCDF).

The HW Permit for UMCDF was originally issued in February 1997. The Permittee proposed several changes to the PFS that affected numerous permit conditions. Changes to the conditions required the Permittee to submit a Class 2 Permit Modification request to address how the Umatilla Chemical Depot and UMCDF will configure and operate the PFS. The Department received two comments during the public comment periods. The public comment periods were open from November 18, 1997 to January 20, 1998 and May 12, 1998 to July 13, 1998. This "Response to Comments" has been prepared in accordance with the requirements of the Resource Conservation and Recovery Act regulations [40 CFR 270.42(b)(6)(vi), as adopted by OAR 340-100-002] that cover hazardous waste treatment facilities.

The revision to the HW Permit describes the configuration, components and the operating parameters of the PFS.

A copy of this Response to Comments has been provided to each person who provided comment during the public comment period. Associated documents with this Response include the Notice of Decision. Copies of the Notice of Decision, the Response to Comments will also be placed in each of the information repositories listed in the Notice of Decision. If you have any questions please call Sue Oliver in the Hermiston DEQ office at (541) 567-8297, extension 26.

Umatilla Chemical Agent Disposal Facility
Permit for the Storage and Treatment of Hazardous Waste
I.D. No.: OR6 213 820 917

RESPONSE TO COMENTS
RELATED TO
PERMIT MODIFICATION UMCDF-97-005-PAS (2TA)
(Class 2 Permit Modification to address the Pollution Abatement System Carbon Filter System)

COMMENTER	ISSUE	DEPARTMENT RESPONSE
G.A.S.P. January 20, 1998 (G.A.S.P. – Susan Jones, Karyn Jones, Stuart Dick, Merle Jones, Mark Jones, Debra McCoy-Burns, and Melanie Beltane)	"The filters may actually increase the production of PICs."	Products of Incomplete Combustion (PICs) are a by-product of the incineration process and are formed at the point of incineration (LIC, DFS, and MPF). The Pollution Abatement System Carbon Filters System (PFS) carbon filters are downstream of the incinerators and at temperatures that cannot support combustion. Therefore, the PFS carbon filters will not produce or increase PICs.
	"The filters create a fire hazard within the stacks and a quenching system must be designed and tested."	The PFS carbon filters are upstream of the common stack. Automatic waste feed cut offs (AWFCOs) and filter bypass are at specified temperatures (≤180°F) below the temperatures needed for ignition (>400°F) of the carbon filters. Therefore, the PFS carbon filters do not create a fire hazard.

RESPONSE TO COMMENTS
RELATED TO
PERMIT MODIFICATION UMCDF-97-005-PAS (2TA)
(Continued)

COMMENTER	ISSUE	DEPARTMENT RESPONSE
G.A.S.P. January 20, 1998 (continued)	"The filters have not been tested at JACADS. The filters are not being used at TOCDF."	The PFS carbon filters are an enhancement to the Pollution Abatement Systems (PAS) at Umatilla and are required by the State of Oregon Environmental Quality Commission (EQC). Carbon filtration is a proven technology and the PFS carbon filters will operate similarly to the HVAC carbon filters that are in operation at both Johnston Atoll (JACADS) and Tooele, Utah (TOCDF).
	"The Filters will be highly contaminated and will create a significant disposal problem."	The PFS carbon filters will see minor, if any at all, amounts of agent. The filter material (carbon) was to be disposed of in the DUN Incinerator; however, the Permittee has advised the Department that the DUN incinerator will probably not be installed at Umatilla. The DUN removal will be processed as a Class 3 Permit Modification and will include the issue of spent carbon and other secondary waste disposal. The public will have an additional opportunity to comment on the carbon disposal issue during the public comment period of the forthcoming DUN Incinerator Class 3 Permit Modification.
	"The filters create a potential explosion problem."	The filters will be upstream of the induced draft fans and will be under negative pressure. Automatic waste feed cut offs (AWFCOs) and filter bypass are at specified temperatures (≤180°F) below the temperatures needed for ignition (>400°F) of the carbon filters.
G.A.S.P. July 13, 1998 (Karyn Jones, Susan Jones, and Debra McCoy-urns)	"The carbon filtration system being proposed has not been through operational verification testing."	Carbon filtration is a proven technology. The PFS carbon filters will operate similarly to the HVAC carbon filters that are in operation at both JACADS and TOCDF. Performance testing of the PFS carbon filters will be conducted during the Trial Burns.
	"A fire potential has not been considered and no fire suppression system has been designed."	Automatic waste feed cut offs (AWFCOs) and filter bypass are at specified temperatures (≤180°F) below the temperatures needed for ignition (>400°F) of the carbon filters.

RESPONSE TO COMENTS
RELATED TO
PERMIT MODIFICATION UMCDF-97-005-PAS (2TA)
(Continued)

COMMENTER	ISSUE	DEPARTMENT RESPONSE
G.A.S.P. July 13, 1998 (continued)	"The filters are potentially going to be contaminated with agent, dioxins, and a variety of PIC's. During upset conditions the potential for contamination will increase. How will this be addressed? How will the filters be disposed? How will it be determined when it is time to change the filters?"	The carbon filter change out schedule has been submitted and is found in the Class 2 Modification Request (UMCDF 97-005-PAS (2TA)) and in the Response to the Notices of Deficiency (NOD). The filter material (carbon) was to be disposed of in the DUN Incinerator; however, the Permittee has advised the Department that the DUN incinerator will probably not be installed at Umatilla. The DUN removal will be processed as a Class 3 Permit Modification and will include the issues of spent carbon and other secondary waste disposal. The public will have an additional opportunity to comment on the carbon disposal issue during the public comment period of the forthcoming DUN Incinerator Class 3 Permit Modification.
	"The carbon filters will slow down the effluent emission rate, which will lower the temperature. A lower temperature will increase the stack production of dioxins and PICs."	The Permittee has accounted for the differences in flow rates with the carbon filter system in place. The temperatures of incineration are not affected.
	"The filters may cause back pressure within the stack which may cause an explosion."	The filters are upstream of the induced draft fans and the common stack. The flue gas exhaust is at a negative pressure until the point of the induced draft fan, after the induced draft fan the exhaust is vented to atmosphere through the common stack. Therefore, the carbon filters will not cause an explosion.

ATTACHMENT G

Executive Summary
"Carbon Filtration for Reducing Emissions
from Chemical Agent Incineration"
(DEQ Item No. 99-1410)

and

"Frequently Asked Questions" about the National Research Council

National Research Council
1999

CARBON FILTRATION FOR REDUCING EMISSIONS FROM CHEMICAL AGENT INCINERATION

Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program
Board on Army Science and Technology
Commission on Engineering and Technical Systems
National Research Council

National Academy Press
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NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competencies and with regard for appropriate balance.

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COMMITTEE ON REVIEW AND EVALUATION OF THE ARMY CHEMICAL STOCKPILE DISPOSAL PROGRAM

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Executive Summary

The Committee on Review and Evaluation of the Army Chemical Stockpile Disposal Program (Stockpile Committee) of the National Research Council has endorsed incineration (with comprehensive air pollution control systems) as a safe and effective procedure for destroying chemical agents and munitions. Recognizing, however, that some public opposition to incineration (based primarily on substances of potential concern [SOPCs] that could escape into the atmosphere with the combustion gas) has always existed, the committee also recommended that the Army study the addition of a carbon filtration system to improve the existing pollution abatement system. This recommendation reflected the committee's belief that (1) reductions in emissions resulting from carbon filtration systems, however small, could increase public confidence, and (2) a carbon filter would virtually eliminate the possibility of an accidental release of a chemical agent through the stack.

When the first recommendations were made in 1991 and 1992, carbon filters were being introduced in Europe. Since then, the Army has evaluated the European experience and decided to add carbon filters to the baseline incineration systems for the disposal of chemical weapons stockpiles at Anniston, Alabama; Umatilla, Oregon; and Pine Bluff, Arkansas. Carbon filters are called for in the Resource Conservation and Recovery Act (RCRA) permits for the Anniston, Umatilla, and Pine Bluff sites, where construction of the disposal facilities is already under way.

Since these decisions were made, data from trial burns conducted at the operating Tooele Chemical Agent Disposal Facility (TOCDF) near Tooele, Utah, have become available. Although this facility does not have a carbon filtration system, the data show very low emitted concentrations of SOPCs, including dioxins and metals. The concentrations measured at the TOCDF were either the lowest or among the lowest emitted concentrations in the Environmental Protection Agency's (EPA's) Hazardous Waste Combustor Emissions Database. Chemical agent, if present at all, was below the detection limit, which is also below the levels generally believed to have deleterious environmental or health effects. Nevertheless, an Army study modeling the performance of carbon filters concluded that they would reduce many SOPCs to even lower levels. The committee concurs with this judgment.

The carbon filter system, including associated gas conditioning equipment designs, had not been finalized at the time this report was prepared. Suggested design alternatives were available, however, and the committee concluded that an effective pollution abatement system carbon filter system (PFS) design could be implemented.

The Utah Department of Environmental Quality's Division of Solid and Hazardous Waste, which conducted the health risk assessment (HRA) for the Tooele facility, determined that the health risk to the public posed by the incinerator stack gas emissions was below the level of regulatory concern. HRAs have also been conducted by Army contractors for the Anniston and Umatilla facilities in which the effects of adding carbon filters to the baseline incineration system pollution abatement systems were considered, but only in terms of changes in the exhaust gas flow rate and temperature, not reduction in emissions of SOPCs. These studies did not quantitatively evaluate the potential benefits of the PFS, but even without carbon filtration systems, emissions are expected to be below the levels of regulatory concern.

Based on quantitative risk assessments (QRAs) (estimates of the probability and consequences of accident scenarios that could lead to a release of agent) completed at Tooele and under way at Anniston and Umatilla, the increased risk to the public from an accidental release of agent associated with carbon filters was found to be negligible (i.e., orders of magnitude below the risks people face every day). This was not so for worker risk. In the Anniston QRA analysis carried out using the Phase 2 QRA from the TOCDF, modified for the presence of a PFS, the only type of upset condition that would increase the risk of agent release was blockage of the exhaust gas flow by the PFS coupled with loss of the induced draft (which maintains the pressure drop for the exhaust gas flow). The risk of an explosion of agent vapor caused by blockage of the PFS represents 3 percent of the total worker risk. Individual worker fatality risk from agent over the facility life attributable to upsets in the pollution abatement system are estimated at 3.3×10^{-5} with the PFS and 1.1×10^{-5} without the PFS. This is in contrast to total worker risk from agent over the facility life of 4.1×10^{-4} as estimated for TOCDF. These findings also can be compared with the worker accidental death rates of 3×10^{-5} *per year* for manufacturing and 1.5×10^{-4} *per year* for construction industries during 1996. The increased risk at the TOCDF is within the range of the uncertainty of worker risk analysis at the facility but significant enough to warrant further evaluation.

The QRAs assess the risk of accidental releases of chemical agent, but they do not address "normal" industrial risk to workers. Hazards to workers from operating and maintaining an industrial facility (hazards not related to agent) will be evaluated during design and prior to commissioning, as part of the health, safety, and environmental evaluations for baseline facilities. If carbon filters are used, they will be included in these evaluations and the risk management and safety programs of each facility. Two risks that are frequently mentioned in this connection are risks associated with potential fires and risks during disposal of the carbon. PFS design and monitoring plans substantially mitigate the risk of potential carbon fires. The amount of potentially contaminated carbon from the PFS that will require disposal is small in comparison to the amount of agent-contaminated carbon that will require disposal from the treatment of the ventilation air for the facility.

The QRAs for three sites (Tooele, Anniston, and Umatilla) to date all confirm the committee's previous observations: (1) the major hazard to the public is from the stored agent and munitions in the stockpile itself; and (2) the risk introduced by stockpile disposal processing is relatively small (less than 1 percent of the stockpile storage risk). Major changes in a RCRA permit may engender a considerable delay that would increase the overall risk to the public. However, the magnitude of the increased storage risk depends on the length of the delay (which is uncertain). The increased risk from prolonged stockpile storage has been estimated on a *per year of storage* basis. For the population 2 to 5 km from the Anniston Chemical Agent Disposal Facility, the individual public fatality risk is 1.4×10^{-5} per year, and the societal public fatality risk is 2.6×10^{-2} per year. This risk is in contrast to the disposal processing risks for the same population of 3.8×10^{-8} per year (individual public fatality risk) and 1.8×10^{-5} (societal public fatality risk). Thus, the *per year* risk from storage is at least three orders of magnitude higher than the risk from disposal processing. Hence, very short delays would increase public risks more than the total public risk from disposal. A delay of approximately one year would result in increased individual public risks of the same order of magnitude as the estimated increase attributable to the PFS in individual worker fatality risk over the *entire* period of disposal processing. Consequently, public risk will be minimized by the expeditious safe destruction of the stockpile.

Conceptually, the committee agrees with the Army's decision to proceed with the current designs at Anniston and Umatilla and not to alter the operating configurations of JACADS and the TOCDF. Removing or adding carbon filters at this point is likely to cause delays that will increase the risk to workers and the public. However, potential increases in worker risk from the carbon filters, which were initially estimated to be small, require further evaluation. To mitigate the potential adverse consequences of adding carbon filters at Anniston and Umatilla, worker risk should be evaluated quickly and managed effectively, including changing the PFS design, if necessary.

The Army's initial attempts at public outreach using its change management process (CMP) in PFS decision making did not elicit meaningful public involvement or comment during the decision process, and several shortcomings of the CMP have now become apparent. First, public involvement must be initiated much earlier in the process of evaluating change. For example, public involvement could have helped the

Army formulate the questions to be answered during the PFS risk evaluation. Second, public involvement should allow for public input prior to making decisions on major process changes, even if initial assessments indicate that no change is preferred. Third, for the CMP public involvement process to be credible and engender public trust, the Army must provide clear guidelines for initiating the CMP, which should not be circumvented by executive decision.

The Army's decisions not to change the configurations at Tooele, Anniston, and Umatilla were made in the context that the original intent of the PFS was to reduce risk and increase public confidence. These goals were to be achieved by adding another air pollution control system component to polish the effluent and curb whatever pollutants would have been emitted without the PFS. However, the results of the Army's analysis showed that changes to risk would be small, that these changes could be improvements or degradations depending on the population considered and the uncertainty analysis, and that the risks could be different for the public and workers. In addition, the Army's presentation of the risk evaluations was difficult to understand and was not issued in a self-contained document delineating (1) comparisons of each risk component with and without the PFS and (2) the Army's rationale for making no changes to the current site configurations. These crucial lapses all but precluded the public from following the process or influencing the results.

FINDINGS AND RECOMMENDATIONS

The estimated concentrations and emission rates of SOPCs from chemical agent incinerator operations developed during the permitting processes for the Anniston Chemical Agent Disposal Facility and the Umatilla Chemical Agent Disposal Facility were below the thresholds of regulatory concern, whether or not a passive carbon filtration system (like the PFS) was included in the facility design. Therefore, the committee considers PFS to be risk neutral to off-site populations.

The addition of a PFS to the PAS would probably reduce the already low emissions of some SOPCs during normal, transient, and upset operating conditions. However, a PFS would also increase worker risk by making the facility more complex and by introducing new scenarios for potential facility upsets and failures. The extent of the increase in worker risk is not clear because all of the applicable risk evaluations (e.g., Phase 2 QRAs and health, safety, and environmental evaluations) and resulting risk mitigation measures have not yet been completed. Preliminary assessments, however, indicate that the increase in worker risk would be small.

Significant changes in permitted facility designs require permit modifications, which could cause substantial delays. Because risk analyses consistently indicate that the storage risk to the public and workers is much greater than the processing risk, changing the permitted configuration at any stockpile site is likely to increase the overall risk by delaying destruction of the stockpile.

Finding 1a. The reported emitted concentrations of SOPCs measured during trial burns at the JACADS and TOCDF incinerators are among the lowest reported to the EPA. TOCDF emissions are the lowest, or at least one of the lowest, in dioxins, mercury, cadmium, lead, arsenic, beryllium, and chromium. The reported emissions of some SOPCs were based on the analytical detection limit for the constituent, which means the actual concentration could be much lower than the reported concentration. Maximum emitted concentrations from JACADS were used for the HRAs for other baseline facilities to ensure that estimates of risks would be conservative.

Finding 1b. In 1992 and 1994, the NRC recommended that the Army investigate using carbon filters for two purposes: (1) to contain transient stack emissions or accidental releases of agent and (2) to increase public confidence in incineration. Activated carbon filters in use at several large incinerators in Europe meet very stringent regulations on emissions of chlorinated dioxins/furans and are considered to be the state-of-the-art technology for this purpose. Based on preliminary design evaluations, activated carbon in the PFS of the Army's baseline incineration system is likely to have sufficient adsorption capacity to reduce emitted concentrations of dioxins, furans, HD, VX, and GB for more than a year of normal operations before the activated carbon would have to be replaced. The activated carbon would also have the capacity to adsorb a chemical agent in case of a major upset; however, a major upset would necessitate the immediate replacement of the activated carbon.

The addition of carbon filters to a baseline incineration PAS does not appear to reduce the health risk to the surrounding population substantially because the health risk is already small (see Finding 1a). Nevertheless, reinforcing public and worker confidence is an important goal.

Recommendation 1. The Army should only consider removing the carbon filtration system from the permitted designs of the Anniston, Umatilla, or Pine Bluff facilities if, after a thorough implementation of the change management process to ensure meaningful public involvement, the public supports that decision.

Finding 2. Based on the evaluation of preliminary PFS design alternatives, an effective design for the PFS is feasible. Operating facilities in several countries now have significant experience in the design and operation of activated carbon filters.

Recommendation 2. The Army should take advantage of the experience of other users of carbon filters through appropriate consultation.

Finding 3. The Army has evaluated the implications of adding or removing passive carbon filter systems to the baseline incineration systems at the Tooele, Anniston, and Umatilla disposal facilities. Some of the impacts on risk to public health from stack emissions were evaluated by comparing the HRAs for the existing baseline facilities to estimates of the upper bound of public health risk posed by the addition of the PFS. However, the potential reductions in public health risk were not estimated, and the evaluations of impacts to off-site populations were incomplete.

An estimate of the impact on risk of accidents leading to agent-related public fatalities was made by expanding the Anniston and Umatilla Phase 1 QRAs to consider the addition of the PFS. The impact of the PFS on worker risk, which is not evaluated in the Anniston and Umatilla Phase 1 QRAs, was estimated by extrapolating the Tooele Phase 2 QRA results (which does include worker risk) to these other facilities. The Phase 1 QRAs for the Anniston and Umatilla facilities were also used to estimate increases in risk to the public from extended storage of the stockpile due to the PFS. Thus, the QRA evaluations completed to date are initial estimates of the magnitude of increased risk to the public from accidental releases of agent resulting from the addition of the PFS, but they are not complete evaluations of worker risk. Moreover, the range of potential delays to stockpile destruction caused by permit modifications and physical changes to the current site-specific baseline incineration configurations has not been defined.

Based on these estimates, the Army concluded that "[the] current plan to install and operate the PFS at the ANCDF [Anniston] and the UMCDF [Umatilla] remains the best course of action for maximizing human health and environmental protection," and that the TOCDF should continue to operate without a PFS. The decision to continue with the current configurations at permitted facilities eliminates increases in risks to the public and workers from potential delays in stockpile destruction caused by facility modifications or permit changes. Although worker risk from current PFS configurations is uncertain, based on the available risk estimates and projected schedules, the committee concurs with the Army's conclusion.

Recommendation 3. To minimize increased risks to off-site populations and on-site workers from delays in stockpile destruction, the Army should proceed with the current configurations, which include carbon filtration systems at Anniston and Umatilla, and should continue operations at Tooele, which does not have a carbon filtration system.

Finding 4. Only the Phase 1 Anniston and Umatilla QRAs have been completed. The risk of acute hazards to workers, probably the receptors at greatest risk from a mishap involving the PFS, has not been adequately characterized. Early initiation of the Phase 2 QRAs could identify these risks while facility design and construction are in progress and give the Army greater flexibility to modify facility designs and operating procedures, if necessary.

Recommendation 4a. The site-specific Phase 2 QRAs for Anniston, Umatilla, and Pine Bluff, which would identify and analyze specific failure modes, should include a complete evaluation of worker risk associated with the addition of the pollution abatement system filter system. The Phase 2 QRAs for each site should be initiated as soon as possible and should be completed and reviewed by independent technical experts before systemization of the facilities at Anniston, Umatilla, and Pine Bluff is completed.

Recommendation 4b. A risk management plan should be developed to minimize worker risk during the operation and maintenance of the pollution abatement system filter systems. The evaluation of operating and maintenance risks should include the operational experience of similar systems. If the increased risk to on-site workers is found to be substantial, the Army should consider making modifications, as long as they do not substantially increase overall worker or public risk from prolonged storage.

Finding 5. If increased worker risks and hazards are identified, it is not clear what steps the Army would take to mitigate them. Nor does the Army have a clear decision basis for balancing reductions in public risk and increases in worker risk.

Recommendation 5. The Army should clarify to the public and facility workers the risk management actions that would be taken if increased worker risks are identified. The Army should also clarify the decision basis for balancing reductions in public risk against increases in worker risk while fulfilling its mandate to protect both workers and the public.

Finding 6. The PFS was assumed to have no effect on concentrations of SOPCs in the HRA calculations for Anniston and Umatilla. The effects of SOPCs emitted from the stacks at these facilities have been estimated to be below the thresholds of regulatory concern without the benefit of the PFS. However, changes from installing a PFS have not been determined in a way that facilitates quantitative comparisons.

Recommendation 6. Future health risk assessments should include estimates of emitted and ambient concentrations of SOPCs, with and without the PFS, for all substances that contribute significantly to the overall risk. Because PFS performance cannot be based on actual measurements, the analysis should consider the implications of reducing emissions to both the method detection limit and the levels indicated by engineering calculations, including quantitative evaluations of the uncertainties associated with each risk estimate. The results, including the acute and latent risks, should be reviewed by independent technical experts. The results should then be presented in a way that facilitates public input to decision making.

Finding 7. Because of the length of time required to complete the preliminary PFS risk assessment, the fact that this evaluation is still incomplete, and the status of construction activities at Anniston and Umatilla, meaningful public involvement in the decision to include the PFS at these sites is no longer possible. The CMP Plan and the CMP Public Involvement Outreach Plan were not effectively implemented during the Army's analysis of the PFS. The lack of public involvement in this process represents a lost opportunity for the Army to develop its CMP and to implement the CMP public outreach process.

Recommendation 7a. The health risk assessment and quantitative risk assessment for Pine Bluff should be completed as quickly as possible and communicated to the public in a timely manner so that there can be meaningful public involvement in the decision process to retain or remove the carbon filter system. The risk assessments should be subject to independent expert review and the findings incorporated into the decision-making process.

Recommendation 7b. The Army should continue to refine its change management process and the change management process public involvement plan. Public involvement should be an integral part of future evaluations of the pollution abatement system filter system, especially at Pine Bluff. The committee repeats its recommendation that the Army involve the public meaningfully in the Chemical Stockpile Disposal Program as a whole.

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Organization of the National Academies
The Associated Organizations
The National Research Council
The National Research Council Process
General Questions

The National Research Council

Q. What is the National Research Council?

The National Research Council is the working arm of the National Academy of Sciences and the National Academy of Engineering, carrying out most of the studies done in their names. The Research Council is not a membership organization. It was organized in 1916 in response to the increased need for scientific and technical services caused by World War I. The Research Council is administered jointly by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine, and its work is overseen by a Governing Board and an Executive Committee. The president of the National Academy of Sciences is the chair of both the Governing Board and Executive Committee; the president of the National Academy of Engineering is vice chair.

As indicated on the Program Organizational Diagram, the National Research Council consists of the following units, which direct most of its programs:

- Commission on Behavioral and Social Sciences and Education
- Commission on Engineering and Technical Systems
- Commission on Geosciences, Environment, and Resources
- Commission on Life Sciences
- Commission on Physical Sciences, Mathematics, and Applications
- Office of International Affairs
- Office of Scientific and Engineering Personnel
- Board on Agriculture and Natural Resources
- Center for Science, Mathematics and Engineering Education
- Policy Division
- Transportation Research Board

Q. What is the basic mission of the National Research Council?

The basic mission of the National Research Council is to provide most of the services to governmental agencies and the Congress that are undertaken by the National Academy of Sciences and the National Academy of Engineering in their role as advisers to the federal government. The Research Council does this primarily through its committee structure, calling upon a wide cross section of the nation's leading scientists, engineers, and other professionals, who serve on its committees without pay.

Q. Who requests and supports the work of the National Research Council?

Most of the requests for Research Council studies come from governmental agencies or from the Congress; some are initiated internally; and a few are proposed by other external sources. About 85 percent of the funding comes from the federal government through contracts and grants from agencies and 15 percent from state governments, private foundations, industrial organizations, and funds provided by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine for internally generated projects of a critical nature.

Q. Does the Research Council originate and fund any of its work on its own?

Yes, although only limited resources are available for self-initiated work. The Academics and the Institute of Medicine have devoted much effort in recent years to building up their endowments in order to be able to expand the capacity to pursue self-initiated activities. However, such undertakings always will remain a small part of the institution's overall operations.

Q. Does the Research Council solicit funds or accept donations?

Yes, it does solicit funds and accept donations from non-governmental sources. However, all funds, regardless of their source, are accepted by the Research Council with very stringent conditions in order to ensure that the acceptance of any funds does not influence the objectivity, scope, method of study, or membership of a study group.

Q. What is the Research Council's tax status?

The National Research Council functions under the National Academy of Sciences, which is a nonprofit organization. The National Academy of Sciences is exempt from federal income taxes under section 501(c)(3) of the Internal Revenue Code.

Q. How many active Research Council and Institute of Medicine committees are there?

In a typical year, there are a total of more than 1,000 committees with approximately 10,000 professionals volunteering their time to serve on them.

Q. Does the Research Council do research? Fund research?

The Research Council has no research laboratories. Rather than conducting its own research, it generally evaluates and compiles research done by others. However, in a few cases and increasingly so in recent years, the institution has been funding research in areas such as transportation, medical care, highways, and international scientific and technical programs in developing countries.

Q. What kind of projects do the Research Council and the Institute of Medicine undertake?

For the federal government, the Research Council examines scientific and technological questions in any of the scientific and engineering disciplines referred to it by government agencies. However, discussions with an agency are sometimes necessary in order to ensure that questions are formulated in such a way that they can be answered as clearly and unequivocally as possible.

The Institute of Medicine, operating through procedures of the National Research Council, responds to questions relating to public health policy, care, research, and education.

Proposals received from non-federal sources to investigate scientific and technological questions are considered on their merits and in light of their application to national concerns. All new projects from all sources are considered first by the Research Council commission, office, or board, or Institute of Medicine unit under whose aegis they would be undertaken before they are referred either to the Research Council's Executive Committee or Governing Board for review and approval.

Q. Who selects topics for Research Council and Institute of Medicine projects?

Suggestions of topics are received from many different sources: Congress, governmental agencies, state agencies, foundations, universities, industry, Academy and Institute members, and units in the National Academies.

As noted above, topics are evaluated initially by the Research Council commission, office, or board, or Institute of Medicine unit that would be responsible for them. If found acceptable, proposals for these projects are presented to the Research Council's Executive Committee or Governing Board for review and approval.

Q. Can private organizations, including foundations and corporations, sponsor Research Council studies?

Yes, they can, but as noted previously, industry sponsors cannot provide more than 50 percent of the support for a project. As with all studies, the subject first must be evaluated by the major unit of the Research Council that would undertake it and then be approved by the Research Council's Executive Committee or Governing Board. Funding contributed for such a study is accepted with the same stringent conditions placed on the acceptance of all funds, namely, that acceptance does not influence the study in any way.

Q. Does the institution confine its activities to domestic issues or does it undertake international assignments?

Although most of its activities have been related to domestic issues, the institution's interests now encompass a broad range of international concerns such as scientific cooperation and exchanges, the impact of international competition on U.S. industries, the reduction of friction among industrialized nations, and scientific and technical programs in developing countries.

Q. What proportion of committee members are members of the National Academy of Sciences, the National Academy of Engineering, or the Institute of Medicine?

The percentages vary from year to year. In fiscal year 1990, the number of National Academy of Sciences members serving on Research Council and Institute of Medicine committees was approximately 24 percent of the membership of the Academy, which amounted to 6 percent of the total number of professionals serving on Research Council committees. For the National Academy of Engineering, the figures were 24 percent and 6 percent. For the Institute of Medicine, they were 39 percent and 6 percent.

ATTACHMENT H

Review of the NRC report: *Carbon Filtration for Reducing Emissions from Chemical Agent Incineration*

Technical Memorandum
Ecology and Environment, Inc.
October 7, 1999
(DEQ Item No. 99-1678)

99-1678

ecology and environment, inc.
International Specialists in the Environment
1500 First Interstate Center, 999 Third Avenue
Seattle, Washington 98104
Tel: (206) 624-9537, Fax: (206) 621-9832

TECHNICAL MEMORANDUM

Date: 10/7/99
To: Wayne Thomas, DEQ Hermiston
From: Gordon Randall, E&E GR
cc: Julie Wroble, E&E; Project File
RE: Review of "Carbon Filtration for Reducing Emissions from Chemical Agent Incineration"

E&E has completed a review of the National Research Council (NRC) document "Carbon Filtration for Reducing Emissions from Chemical Agent Incineration". Although the document is generally well written and accurate, there are a few specific points and recommendations that could use clarification or may not directly apply to the Umatilla facility. These include the following:

The NRC based a number of statements and conclusions about health risks on documents that were not evaluated by DEQ or the EQC. The risk assessments cited as the sources of their data were the Mitretek PFS risk assessment documents prepared for the Army; the Mitretek report for the UMCDF was not considered or reviewed by DEQ. The Umatilla pre-trial burn risk assessment was not even included in the references of the NRC document; neither, for that matter, was CHPPM's pre-trial burn risk assessment for Anniston. While the Mitretek reports evaluated by the NRC may not have been "wrong" per se, the NRC is not in a position to review these documents from the perspective of how they meet the requirements of DEQ.

For example, the NRC report makes some possibly inappropriate statements about the emissions being "below the thresholds of regulatory concern." The language actually in the report is milder than that used in the EQC meeting, so this may mostly amount to a poor (or poorly-remembered) choice of words. However, it is worth repeating that DEQ and the EQC are responsible for determining the levels of "regulatory concern" for the UMCDF; neither the NRC nor the Army are legitimately able to make statements about what is or is not "of concern" in Oregon.

Also, the authors of the NRC report do not appear to clearly understand the purpose of conducting a risk assessment for a proposed combustion facility. There is a significant conceptual difference between a traditional Superfund-style risk assessment and a combustion facility risk assessment designed to determine if a set of permit conditions are adequate. (Or, as written in the EPA combustion human health risk assessment protocol, "performance of a site-specific risk assessment can provide the information necessary to determine what, if any

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additional permit conditions are necessary for each situation to ensure that operation of the combustion unit is protective of human health and the environment.") Because of this apparent lack of understanding, the NRC document includes statements and recommendations about levels of emissions that are not appropriate for the risk assessment.

In particular, one recommendation that may be unfeasible is the recommendation that future risk assessments should take the PFS into account through engineering estimates of emission reductions. However, this information is probably not relevant to the purpose of a risk assessment that verifies the protectiveness of permit conditions. Current trial burn data (from TOCDF) indicate that the majority of organic constituents, including most dioxins and furans, are not present in stack emissions above the analytical detection limit. Use of the detection limit in the risk assessment demonstrates that the facility will not pose an unacceptable risk to human health or the environment if these chemicals continue to not be detected (or are detected at only very low concentrations). Using engineering estimates of emission rates in the risk assessment that are below concentrations that could not be demonstrated through any tests could result in permit conditions that could not conceivably be met (or at least shown to be met) and are needlessly over-conservative.

Despite the above statement about the role of the PFS in a risk assessment, the view that the PFS is "risk-neutral to off-site populations" is arguable, and based on a definition of "neutral" that may not be shared by DEQ or the EQC. Many of the factors used to estimate emissions in the risk assessment are somewhat arbitrary conservative multipliers, such as the multipliers to account for potential upset conditions. Changing these factors may increase or lower the calculated risks, but in reality what comes out of the stack will be exactly the same. The PFS, on the other hand, will affect the real risks rather than the paper risks. While it may have little quantitative effect on the risk assessment, it will nevertheless reduce the very small amount of emissions from the facility to an even smaller amount of emissions. Furthermore, while facility risks are currently believed to be very low, future changes to risk assessment methodology or some of the parameters could conceivably indicate that there are some problems. It would be unfortunate to discover after removing the carbon filters from the design that they are actually necessary to keep emissions below benchmark levels.

Finally, the recommendation that all of the risk assessments should be "reviewed by independent technical experts" seems out of place considering the degree of review that some of these documents have already had. The Umatilla pre-trial burn risk assessment was very extensively reviewed, as was CHPPM's risk assessment for Anniston. While it is true that the Mitretek's PFS risk assessment has undergone little or no review, as noted above, this document has not been used by DEQ for decision-making purposes.

Overall, although the NRC report is generally accurate and should help answer some of the outstanding issues regarding the use of carbon filters, we would caution DEQ and the EQC to draw their own conclusions about the risks to human health and the environment from the carbon filter system.

ATTACHMENT I

"OTHER REFERENCE DOCUMENTS"

(Reference Documents Related to the Class 2 Permit Modification Request UMCDF-97-005-PAS(2TA) and other technical documents reviewed by the Department concerning the use of carbon filtration technology)

Reference Documents Related to the Class 2 Permit Modification Request UMCDF-97-005-PAS(2TA) and other technical documents reviewed by the Department concerning the use of carbon filtration technology.

"*Request for a Class 2 Permit Modification and Temporary Authorization to Revise the Umatilla Chemical Agent Disposal Facility Pollution Abatement System Carbon Filter System UMCDF-97-005-PAS(2TA),*" Program Manager for Chemical Demilitarization, November 17, 1997, DEQ Item No. 2812.

"*Approval of Temporary Authorization Request to Commence Construction Activities on the PAS Carbon Filter System and Removal of Acid Wash System,* " Department of Environmental Quality, November 24, 1997, DEQ Item No. 2835.

"*Notice of Supplemental Information Submittal for the Class 2 Permit Modification Request for Revision of the Pollution Abatement System (PAS) Carbon Filters UMCDF-97-005-PAS(2TA)* ", Program Manager for Chemical Demilitarization, February 5, 1998, DEQ Item No. 98-0086.

"*Notice of Deficiency on Pollution Abatement System Carbon Filter System UMCDF-97-005-PAS(2TA),*" Department of Environmental Quality, March 3, 1998, DEQ Item No. 98-0106.

"*Supplemental Information on Class 2 Permit Modification Request UMCDF-97-005-PAS(2TA) and Request for an extension of the Temporary Authorization,* " Program Manager for Chemical Demilitarization, May 12, 1998, DEQ Item No. 98-0249.

"*Extension of Temporary Authorization, Umatilla Chemical Agent Disposal Facility,* " Department of Environmental Quality, May 15, 1998, DEQ Item No. 98-0256.

"*Clarification and Additional Changes to the Supplemental Information on the Class 2 Permit Modification Request for the Revision to the Pollution Abatement System Carbon Filter System (PFS),* " Program Manager For Chemical Demilitarization letter, May 26, 1998, DEQ Item No. 98-0279.

"*Outstanding Items on the Supplemental Information for the Class 2 Permit Modification Request UMCDF-97-005-PAS(2TA)* " Program Manager For Chemical Demilitarization letter, June 22, 1998, DEQ Item Nos. 98-0345 and 98-0349.

"*Response to the April 23 1998 Notice of Deficiency on the Class 2 Permit Modification Request No. UMCDF 97-005-PAS(2TA) PAS Carbon Filter-System,* " Program Manager For Chemical Demilitarization, July 16, 1998, DEQ Item Nos. 98-0492 and 98-0493.

"*Outstanding Items on the April 23 1998, Notice of Deficiency on the Class 2 Permit Modification Request No. UMCDF 97-005-PAS(2TA) PAS Carbon Filter System,* " Program Manager For Chemical Demilitarization, August 5, 1998, DEQ Item Nos. 98-0557 and 98-0558.

"Notice of Deficiency on Pollution Abatement System Carbon Filter System UMCDF-97-005-PAS(2TA)," Department of Environmental Quality, September 2, 1998, DEQ Item Nos. 98-0613 and 98-0614.

"Response to the September 2, 1998 Notice of Deficiency on the Class 2 Permit Modification on the Improvements to the PFS UMCDF 97-005-PAS(2TA)," Program Manager For Chemical Demilitarization, October 15, 1998, DEQ Item No. 98-0796.

"Umatilla Chemical Agent Disposal Facility Pollution Abatement Filter System Summary of Risk Assessment Results," Letter Report from the Program Manager For Chemical Demilitarization, October 19, 1998, DEQ Item No. 98-1416.

"Outstanding Items on the September 2, 1998 Notice of Deficiency on the Class 2 Permit Modification Request on Improvements to the PFS UMCDF 97-005-PAS(2TA)," Program Manager For Chemical Demilitarization, October 29, 1998, DEQ Item Nos. 98-0844, 98-0845, 98-0846, 98-0847, 98-0848, and 98-0849.

Conditional Approval Letter for Permit Modification Request Pollution Abatement System Carbon Filter System UMCDF 97-005-PAS(2TA), Department of Environmental Quality, November 17, 1998, DEQ Item No. 98-0938. (A copy of this item is included in Attachment F of this staff report.)

"Conditional Items from the Approval of the Class 2 Permit Modification Request on the Pollution Abatement System Carbon Filter System UMCDF-97-005-PAS(2TA)," Program Manager for Chemical Demilitarization, December 17, 1998, DEQ Item No. 98-1148.

"Conditional Items from the Approval of the Class 2 Permit Modification Request on the Pollution Abatement System Carbon Filter System UMCDF-97-005-PAS(2TA)," Program Manager for Chemical Demilitarization, December 29, 1998, DEQ Item No. 98-1199.

"Reports, Documents and Memorandums Concerning the PFS Carbon Filter System Permit Modification Request," Department of Environmental Quality, January 22, 1999, DEQ Item No. 99-0104.

"PFS Carbon Filter System Permit Modification Request, Other Information," Department of Environmental Quality, May 25, 1999, DEQ Item No. 99-0859.

"Response to Department's May 25, 1999 Letter," Program Manager for Chemical Demilitarization, July 7, 1999, DEQ Item No. 99-1207.

"PFS Carbon Filter System Permit Modification Request, Response to Other Information UMCDF-97-005-PAS(2TA)", Department of Environmental Quality, August 24, 1999, DEQ Item No. 99-1398. (A copy of this item is included in Attachment F of this staff report.)

"PFS Carbon Filter System Permit Modification Request," Response to DEQ Item No. 1398, Program Manager for Chemical Demilitarization, September 21, 1999, DEQ Item Nos. 99-1576 and 99-1577.

"Assessment of Carbon Filter System Performance," Mitretek Technical Report, MTR-93W0000034, September 1993, DEQ Item No. 536.

"U.S. Army's Alternative Demilitarization Technology Report for Congress," Department of the Army, February 11, 1994, DEQ Item No. 1428.

"Risk Assessment of the Pollution Abatement Filter System for the Umatilla Chemical Agent Disposal Facility," Mitretek Technical Report MTR 1997-60, September 1998, DEQ Item No. 99-0066.

"Value Engineering Report PFS Alternative Configuration Study," Ralph M. Parsons Report, September 1995, DEQ Item No. 99-0189.

"UMCDF Alternative PFS Concepts," Ralph M. Parsons, December, 1996, DEQ Item No. 99-0223.

"PFS Systems Analysis," Science Applications International Corporation, Report SAF-452-96-0046, 1997, DEQ Item No. 99-0225.

"Development of a Simulation Model for a Pollution Abatement Carbon Filter System," Mitretek Technical Report MTR 1998-3, October 1998, DEQ Item No. 99-0226.

"Evaluation the Pollution Abatement Filter System for Chemical Agent Disposal Facilities; Methodology for Evaluating Risks," Mitretek Technical Report MTR-1996-3, January 1998, DEQ Item No. 99-0227.

"Feasibility Study for the Control of Particulate Emissions at the Umatilla Chemical Disposal Facility," International Technology Corporation Report, July 1998, DEQ Item No. 99-0239.

Response to *"Request for Information from the Umatilla Chemical Depot for the Oregon Department of Environmental Quality on the Adsorption of GB, VX and HD on Activated Carbon,"* Memorandum from Edgewood Research, Development and Engineering Center, August 5, 1999, DEQ Item No. 99-1389.

"Summary Report On Agent Offgassing from Activated Carbon Filters," Edgewood Research, Development and Engineering Center, August 1998, DEQ Item No. 99-1390.

"Effect of Temperature on the Desorption and Decomposition of GB on Activated Carbon" Draft Copy, Research and Technology Directorate and George W. Wagner, Geo-Centers Inc., 1999, DEQ Item No. 99-1391.

"Effect of Temperature on the Desorption and Decomposition of HD from Activated Carbon" Draft Copy, Research and Technology Directorate and George W. Wagner, Geo-Centers Inc., 1998, DEQ Item No. 99-1392.

"Evaluation of Post-Treatment Filter, Part 1: Experimental Study of DMMP and DIMP Filtration at High Temperature And High Dew Point Using Activated Carbon," Edgewood Research Development and Engineering Center (ERDEC-TR-317), August 1996, DEQ Item No. 99-1578.

"Evaluation of Post-Treatment Filter, Part 2: Modeling Laboratory-Scale Filter Breakthrough Data," Edgewood Research Development and Engineering Center (ERDEC-TR-317), November 1996, DEQ Item No. 99-1579.

"Evaluation of a Post-Treatment Filter, Part 3: Experimental Study of Multicomponent Adsorption Breakthrough," Edgewood Research Development and Engineering Center (ERDEC-TR-317), August 1997, DEQ Item No. 99-1580.

"Evaluation of a Post-Treatment Filter, Part 4: Predicted Stack Gas Filtration," Edgewood Research Development and Engineering Center (ERDEC-TR-317), August 1997, DEQ Item No. 99-1581.

State of Oregon
Department of Environmental Quality

Memorandum

To: Carol Whipple
Melinda Eden
Tony Van Vliet
Linda McMahon
Mark Reeve
Langdon Marsh
Stephanie Hallock
Larry Edelman
Larry Knudsen
Steve Bushong

From: Ken Chapin
DEQ Hermiston

Date: September 24, 1999

State of Oregon
Department of Environmental Quality
Received
SEP 27 1999
OFFICE OF THE DIRECTOR

Re: Public Comments received in response to the Umatilla Chemical Agent Disposal Facility "Carbon Filtration Technology" open comment period of June 2, 1999 to September 20, 1999
DEQ Item No. 99-1584 (92.92)

Enclosed is a copy of the public comments the Department received in response to the "Chance to Comment" period on carbon filtration technology. The comment period opened on June 2, 1999 and closed on September 20, 1999. Two comments were received from Mr. Jeff Hockett, one comment was sent in anonymously, and G.A.S.P. et al. sent in comments with references. Please find below a list of the comments the Department received.

Commenter	DEQ Item No.	Title	Subject
Jeff Hockett	99-1365	Untitled	Plasma Arc as Best Available Technology
Jeff Hockett	99-1483	Untitled	Addition to previous comments, build a mobile plasma arc incinerator
Anonymously	99-1296	Untitled	Carbon filters are needed for safe operation
GASP, OWF, Sierra Club, et al	99-1539	Comments on Carbon Filter Technology for UMCDF and Request for Revocation or Suspension	The NRC report on carbon filters raises more questions than it answers. Request for revocation or suspension of the Permit
Oregon Clearinghouse for Pollution Reduction	99-1541 and Attachments 1,1-A, 1-B, 2, 3, 4-A, 4-B, 5, 5-A, 5-B, 5-D, 6-A, 6-B, 7, 8, Second Attachment 7 (QRA Report form SAIC September 1996), Newspaper clipping and letters from Senators, EPA Document No. EPA-600/R-98-076	In Response to the "Chance to comment on Carbon Filtration Technology at the Umatilla Chemical Agent Disposal Facility"	Comments on SAIC QRA and other issues

If you have any questions please call me at (541) 567-8297 extension 27.

FILE

99-1296 92[illegible]2

CARBON FILTER is Needed FOR SAFETY
Please put it on the stack.
What happened to the FOAM that
Would dilute the GAS? BURNING Would
Not be NECESSARY — ?

92.92

99-1365

FILE

8-10-99

Wayne Thomas
Umatilla Program Manager
DEQ Hermiston Office
256 E. Hurlburt Ave.
Suite 105
Hermiston, OR 97383

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
AUG 13 1999
HERMISTON OFFICE

Dear Mr. Thomas,

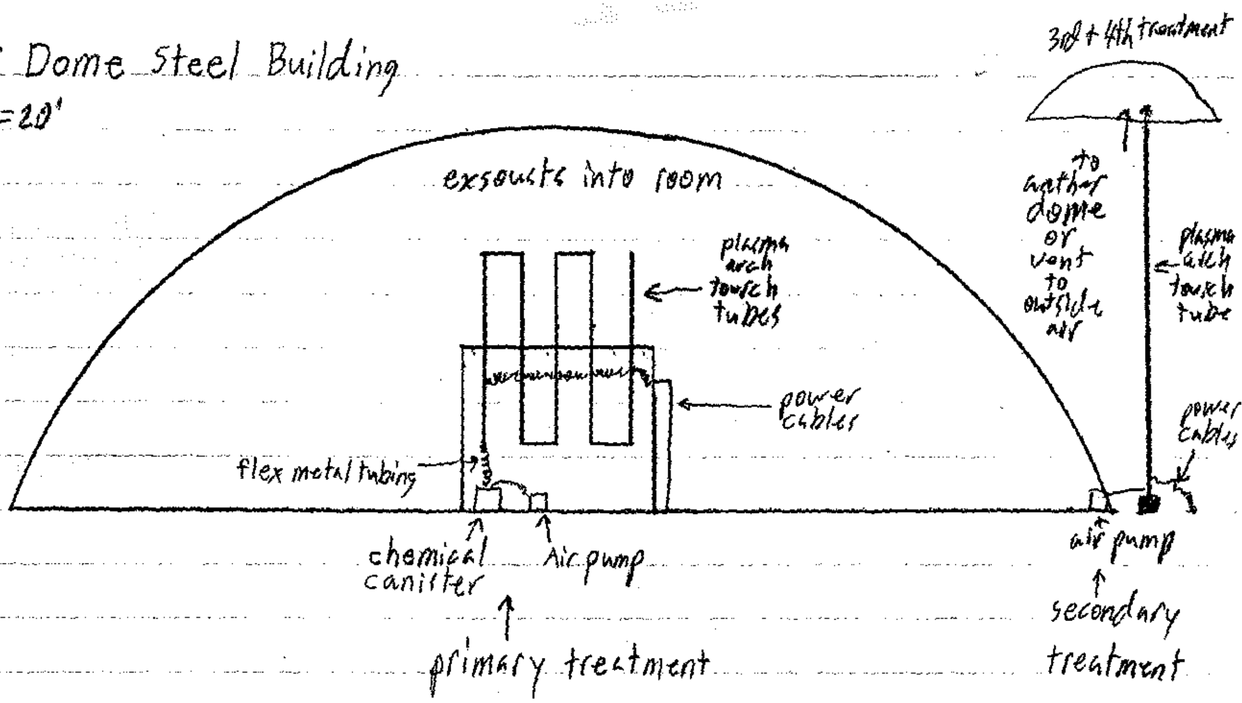
I would like to propose a possible improvement to the chemical incinerator in Hermiston. With federal law stating that only the "Best Demonstrated Available Technolgy" shall be used to treat and reduce hazardous waste, I believe that only a plasma arc torch should be used to handle the chemical weapons problem.

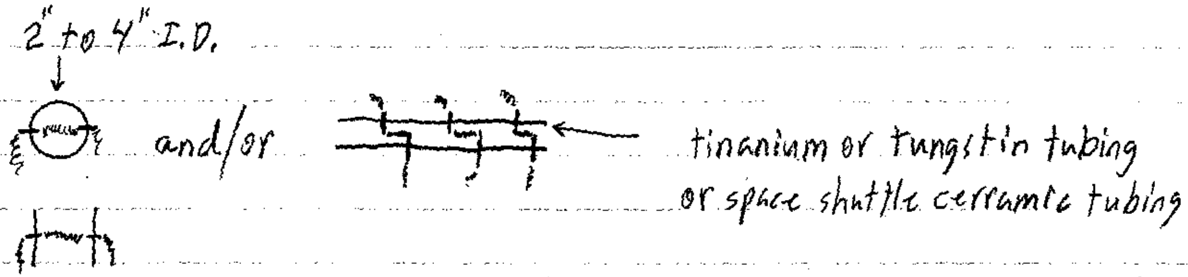
The following diagrams will show what I believe to be the best way to treat the chemical weapons. Because of the extremely high temptures of the plasma ach torch, most of the hazardous chemicals will be destroyed.

Sincerely,

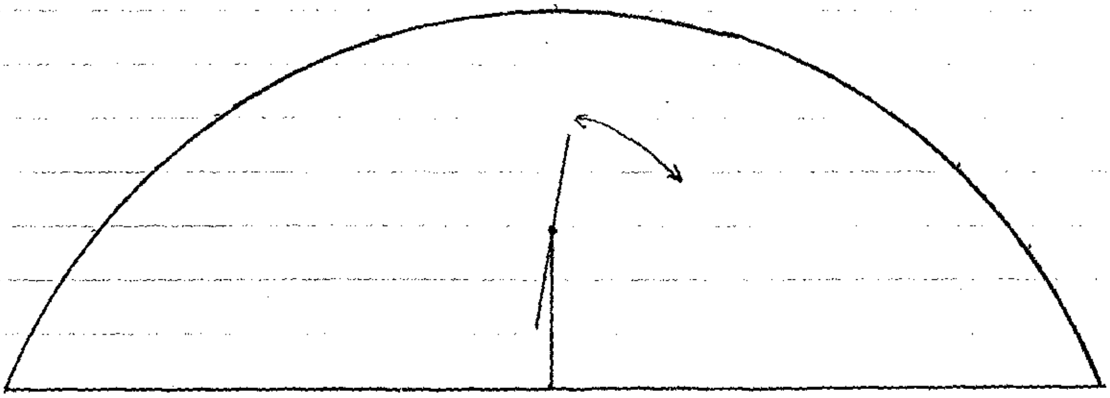
Jeff Hockett
E.O.C.I. 10674971
2500 Westgate Rd
Pendleton, OR 97801

1/3 Dome Steel Building
1" = 20'





If all works well, no carbon filters will be needed.
If roof gets to hot, water can be sprayed on the roof.



Tilts to see if gravity has any effect on proccess

Please add to last lett dated 8/10/99

92.92

3/28/99

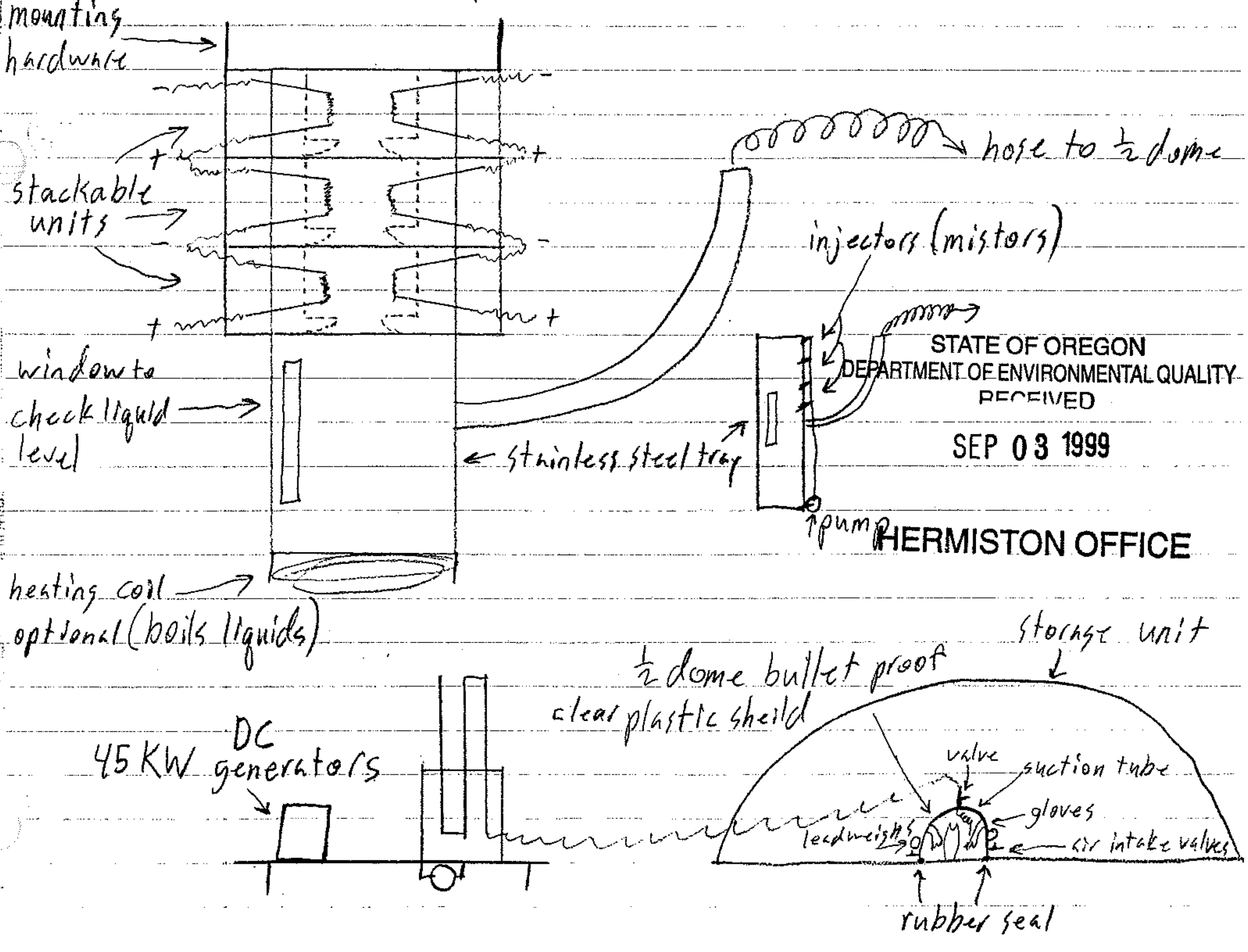
FILE

99-1483

Bring the disposal unit to the chemical weapons, would be a safer option.

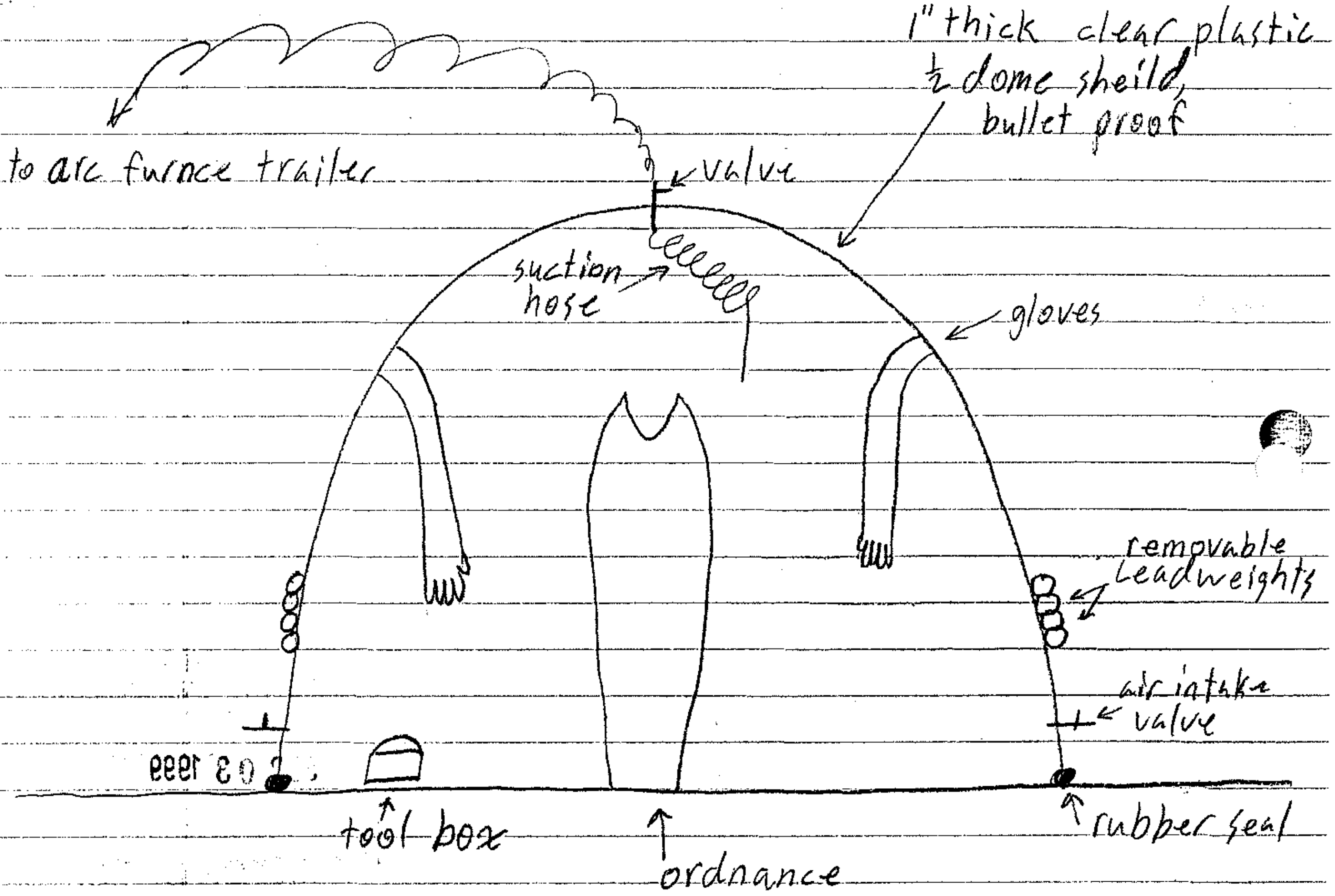
Build a trailer with an arc furnce, and park it next to the chemical weapons storage site.

This would save on construction and demolition costs; less workers needed to complete the job, can be easily exported to other contries, and dozens of portable units could be built to speed up the process of chemical treatment.



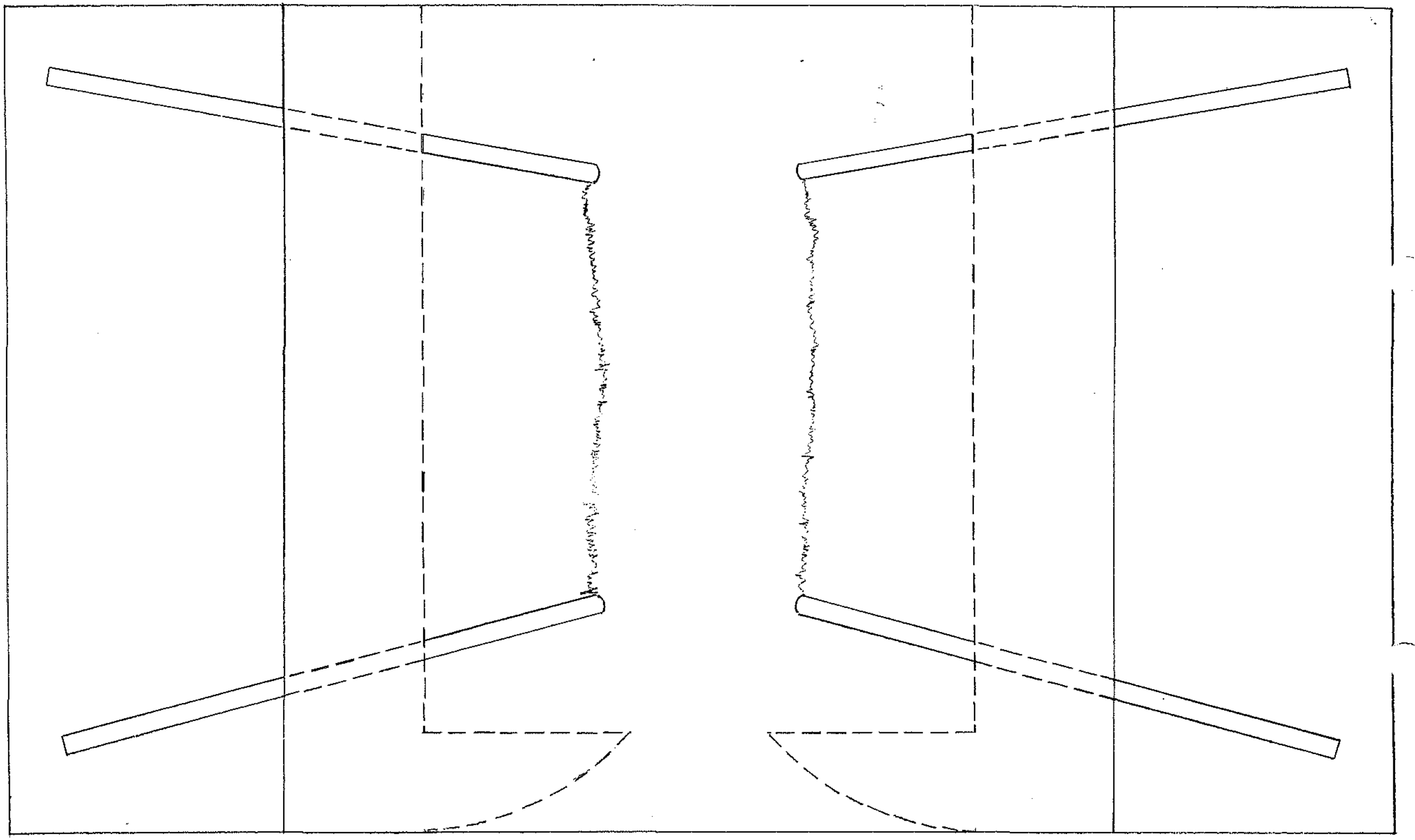
STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
SEP 03 1999
HERMISTON OFFICE

When the arc furnce is started, it will cause a strong vaccum to pull any and all liquids/gasses out of the ordnance



Jeff Hockett
E.O.C.I. 10674971
2500 Westgate Rd.
Pendleton, OR 97801

top



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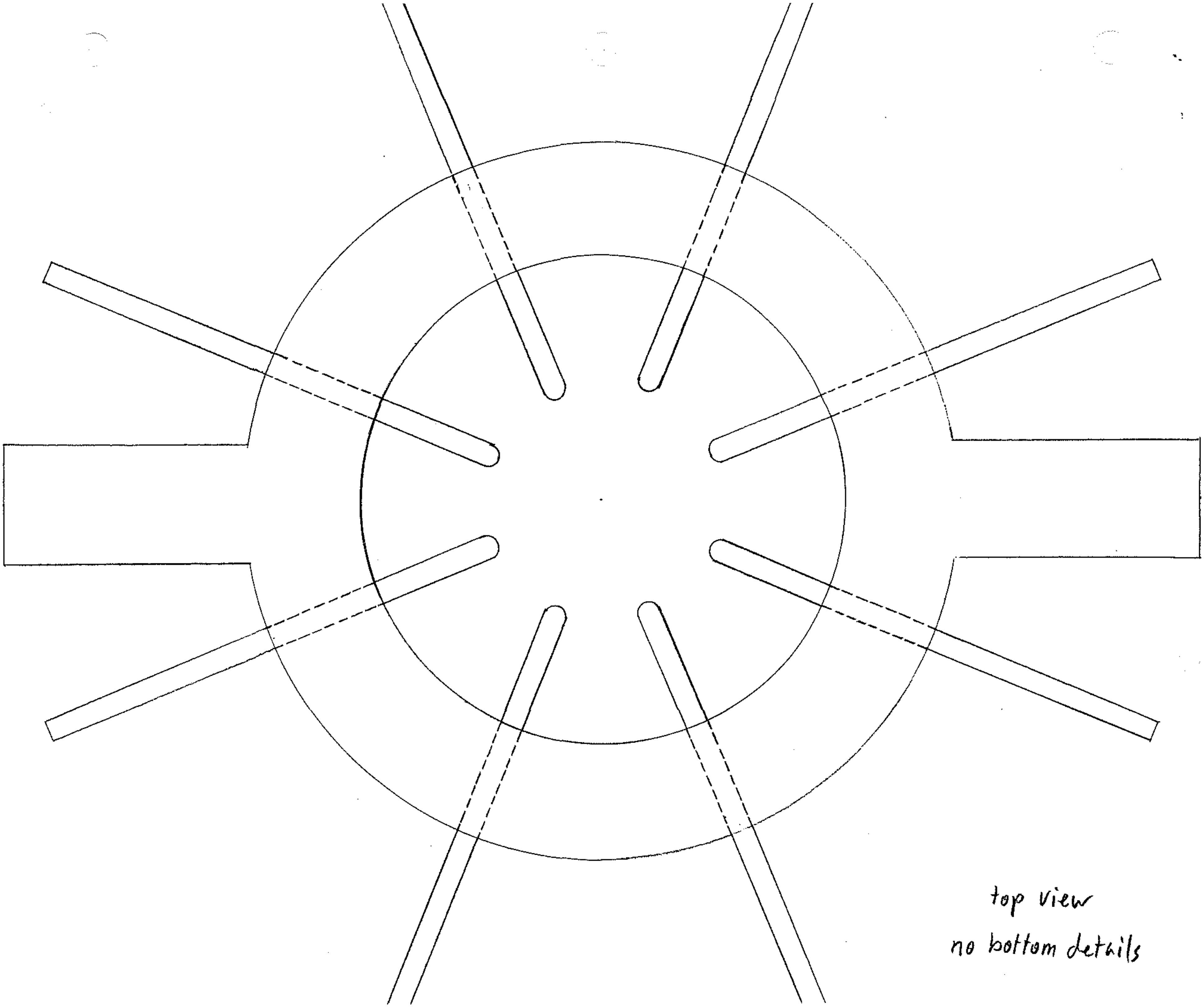

top view
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OrCPR *The Oregon Clearinghouse for Pollution Reduction*
Protecting public health and the environment from toxic substances that disrupt natural systems including improper use, manufacture, transport, storage, release and disposal.

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STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY
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September 18, 1999

Wayne Thomas, Umatilla Program Manager
DEQ - Hermiston Office
256 Hurlburt, Suite 105
Hermiston, OR 97838

In Response to the "Chance to Comment on Carbon Filtration Technology at the Umatilla Chemical Agent Disposal Facility"

In responding to the "Chance to Comment", this commentary responds to the major issues raised in the NRC Report on Carbon Filtration, and August 18 testimony by the NRC committee and the army. In the report, the NRC committee emphasizes that the risks of delaying processing are so great that the existing permit to incinerate should not be modified even though the permitted pollution control technology will have little effect on emission reduction and create major safety problems. The report cynically suggests that the carbon bed filter system be built but not used.

To narrowly respond to the EQC's chance to comment, would be to avoid the real question -- a question about whether emissions from the proposed incinerator can be contained during normal, upset, or accident conditions; and that is the question that we address. The NRC report and commentary has clearly demonstrated that the carbon bed filters are NOT the best available control technology. No commercial industrial facility processing material as lethal and hazardous as chemical agent would really install a useless and dangerous component to their pollution abatement system.

Because the NRC and the army have stated in the report and in testimony that any delay in proceeding with the incineration plan will be potentially disastrous, we respond to these assertions with evidence that the contrary is the case. There is time to reconsider the disposal plan in order to avoid the mistakes at Utah. A change to advanced technology can avert potential disasters **and** allow for timely disposal of the chemical weapons stockpile.

Because linear discussions such as the NRC report have obfuscated critical points due to the level of detail required to support them and because so many issues are interrelated, this document contains assertions in the form of brief commentary along with appended documentation and/or references with full citations. We assume that the DEQ has copies of all relevant EPA and NRC reports, studies and previously submitted testimony such as our critique of the Iisa carbon filter report and therefore do not include them in full with this testimony.

Regards,

Lisa P Brenner

Lisa P Brenner, PhD

INTRODUCTION

"Accidents are the tail that wags this dog."
"Chernobyl was safe, most of the time."
"The risk assessments for Chernobyl and the Challenger were low by 100x."
"Of what use to wise decisions are risk estimates with uncertainties of 100X or more?"
Dr. Halstead Harrison

"In the dark ages, witches were burned, and we still think of burning as a way of dealing with our worst problems."
Jane Williams, Sierra Club

"In the Wizard of Oz, Dorothy pours water on the witch and she melts; maybe we are developing the capacity to believe in safer ways of disposing of our worst problems."
Chip Ward, Utah Resident

At the time for public comments on the risk assessments, the public raised critical questions and presented important information and critiques that were never answered and have been now confirmed by the August NRC report and events at the Utah incinerator. Notwithstanding the accumulated record, new information contained in court documents and information included in this document, again strongly speak to the need for a permit change to require advanced technology for disposal of the chemical weapons stockpile at Umatilla.

It is time for the EQC to fully act on the facts and implications of the following:

1) Releases of intact chemical agent to the atmosphere is the major danger in incineration of chemical weapons. The claimed processing risks seem low and the claimed storage risks seem high. (Attachments 1-A, 1-B)

- The first of these concerns is explained by Dr. Harrison in attachment 1-A. The attachment starts off by giving the assumptions that SAIC generates. It goes on to compare the incineration process with routine industrial accidents and other well quantified risks. His analysis demonstrates that SAIC has somehow concluded that the incineration process is remarkably **four** times safer than general industrial processes despite the presence of explosives and highly toxic chemicals. He goes on to select risk values from the list that SAIC used to determine the overall risks. He finds many that are fairly high, as would be expected. From this he determines that **SAIC must have underestimated the risk of the incineration process by about 300 fold!**

- Dr. Harrison, in attachment 1-B examines the storage risk. SAIC determined that the risk was mostly due to risk of seismic events and aircraft mishaps and was about 3×10^{-3} fatalities/person/year. This number is compared to other risks that are fairly routine and somehow ends up being high, despite the fact that aircraft crashes and earthquakes in Eastern Oregon are much less common than highway fatalities. He again raises the question of systematic error in the SAIC analysis. This error is further suggested by the fact that accidents and sabotage, both of which happen with more regularity than aircraft crashes and earthquakes when subjected to the same analysis, result in lower risk than that claimed by SAIC for seismic/aircraft events. Dr. Harrison's analysis points out that the importance of dioxin in the short-term risk is over shadowed by the high lethality of the chemical agents to be processed at Umatilla.

2) No existing pollution abatement system will contain emissions from a major accident/explosion of an incinerator burning large amounts of chemical agent. (Attachment 2)

3) Carbon Filtration systems (Attachment 3) (Also see Attachments 2 & 6-A)

- Carbon bed filters, the primary component of the inadequate Umatilla pollution control system create back pressure in upset/accident conditions that will both exacerbate explosions within the incinerator, furthering the likelihood of breaching the containment system. In addition the carbon bed filters themselves can explode.

- Carbon injection systems, one of five to eight critical components of contemporary hazardous waste incineration pollution abatement systems, will not stop explosive chemical agents in an accident.

4) EPA MACT standards will tighten standards for hazardous waste incinerators in the near future, but will still be inappropriate as standards for chemical agent disposal. Recent EPA research has found these standards are inadequate to address the 90% of previously undetected, undefined, actual emissions from hazardous waste incinerators. (Attachments 4-A, 4-B, 4-C, 4-D)

5) The Utah incineration program is not working (Attachments 5-A, 5-B, 5-C)

- Utah chemical weapons incineration lessons demonstrate that in operational settings the permitted incineration plan doesn't work and is extremely accident prone. Two of the Utah systems have been abandoned by the army, the metal parts incinerator has had a release of agent 800 times the permitted level of GB, and the two liquid agent incinerators **have had two $6 million dollar replacements of brick lining during the first year of operation,** and are incapable of processing the highly acidic agent found in some of the tons.

- Virtually all the GB rockets remaining at Utah have been found to have jelled and thus will not drain. The best that the current incineration plan can do is to explode agent filled rockets assumed to still contain more than 5% of their original GB in the dunnage incinerator, two to five per day, with a permitted limit as of July 1999 of one every 63 minutes.

- At the rate that Utah is currently processing GB rockets because of jelling and subsequent overloading of the metal parts incinerator, processing of rockets in Oregon would take more than thirty years to complete.

6) The PMCD program has not been honest or accountable about safe storage and money available to test advanced technology; and has thereby unnecessarily sacrificed public safety in the name of haste to burn. (Attachments 6-A, 6-B)

7) There IS time to secure the stockpile, reconsider the system design, and dispose of the stockpile with the safest possible technology. (Attachment 7)

8) Advanced technology has been demonstrated to effectively and safely deal with Umatilla chemical weapons stockpile components. Neutralization of the stockpile with water is now a viable way to quickly eliminate the danger of accidents because secondary treatment methods have been approved which eliminate the large volume of water previously needed for neutralization. (Attachment 8 – expected under separate cover by another party.)

Conclusion

"We both warn you not to take mathematical models too seriously. Surprising consequences are fine, but consequences so surprising that they don't make any sense are almost certainly based on false assumptions. Don't be impressed by mathematics just because you don't understand it."

Jack Cohen & Ian Stewart
The Collapse of Chaos, 1994

ATTACHMENT 1-A

SAIC QRC Internal Inconsistencies

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On the SAIC Report No. SAIC-96-2601

"Umatilla Chemical Agent Disposal Facility
Phase 1 Quantitative Risk Assessment"
Sept, 1996

Prepared for the US Army Program Manager for Chemical
Demilitarization, Edgewood, MD 21010, under contract
DAAA15-91-D-0005

The SAIC QRA attempts a quantitative estimate of public health risks associated with the proposed incineration of toxic chemical warfare agents at the at the US Army's Umatilla Chemical Depot in northeastern Oregon. The report is summarized in figures S-1 and S-2 [repeated later as figures 16-1 through 16-3], Table 16-1, and several pie-charts of chapter 16, that **together may be abstracted as asserting that:**

1. The 20 year storage risks exceed 3 year processing risks by a factor of 2E+3 [2,000].

2. The storage risk is dominated by earthquakes, and is estimated to be 3E-3 [0.003] "Average Acute Fatality Risk (/year)".

3. The processing and incineration risks for destroying these weapons are estimated as about 1E-5 [0.00001], in the same units, over a campaign of 3 years.

The units of risk cited by SAIC are somewhat ambiguous, but I assume from comparison with other risks listed in the table below that they are equivalent to fatalities/capita/yr [f/c/yr]:

Table I

Fatalities/million/yr	Fatalities/Capita/Yr	Comment
3,000	3E-3 [0.003]	Estimated storage risk at Umatilla Depot
100	1E-4 [0.0001]	US Highway Deaths
60	6E-5 [0.00006]	US Murder Rate
40	4E-5 [0.00004]	Industrial accidents [UK]
10	1E-5 [0.00001]	Estimated processing risk at Umatilla Depot

The alternative interpretation, that the risks estimated by SAIC are cumulative [total fatalities per year], would result in the last entry of the Table I being of order 1E-7 [0.0000001], which I take to be unreasonably small.

Thus it appears that SAIC estimates the yearly, per capita exposure to processing risks of the proposed incineration to be 4X safer than diverse industrial accidents in the United Kingdom [as cited by SAIC in Table 2-1, page 2-19], and 10X safer than the fatality risks for the general population living among highways and cars in the US.

Table II re-emphasizes the distinction between per-capita and cumulative risks, assuming risk exposure to 100 shift workers, only, in the immediate vicinity of the chemical weapons disposal depot.

Table II
Cumulative "Acute Fatalities"

Persons at Risk	Years @ risk	Risk Rate [f/c/yr]	Total Deaths	Comment
100	3	1E-5	3E-3	processing risks at Depot
100	20	3E-3	6	storage risks at Depot

As the SAIC report emphasizes, the entries in the 4th column should be understood as reflecting a greatest probability of no deaths at all, but some lesser probability of accidents involving more than one death.

Higher casualty estimates would of course result from assuming larger numbers of persons at risk. If for example the same per-capita risk rate were applied to the roughly 10,000 persons in the nearby cities of Hermiston and Umatilla, then the total, ensemble averaged, expected deaths would be estimated as 0.3 and 600, respectively. In these cases it would seem less likely that with good luck there would be no casualties.

In my opinion, the processing risks estimated by SAIC are improbably low. Is it reasonable that the serial risks of transporting [fork lifts, trucks, and cranes], defusing, propellant separation, and incineration of chemical agents in aging rockets, shells, mines, bombs, and "ton" canisters are really 10X safer than normal, day-to-day living .. as all Americans do .. among highways and cars? Or 4X safer than the average of manufacturing accidents in a diversely industrial community in England?

I note in support of this doubt that Table 4-1, of the SAIC report, page 4-23, lists estimated frequencies [with two significant digits!] of a variety of accident-initiating events. I have culled these for those listing "explosions", "agent spills", and "agent release", finding several numbers as large as 3E-4 [0.0003] per munition. If [my guesses] the fatality rate per event were 0.01, and 1,000 munitions were to be processed per year, then the expected fatality risk rate from these accidents, only, would be about 3E-3 f/c/yr, which is 300X greater than SAIC estimates for **all** processing accidents [1E-5 f/c/yr]. **The factor of 300X appears large enough, in my judgment, to suggest internal inconsistencies within the SAIC report.**

I note further in support of my doubt an historical bias in "forward" risk estimates of this type, with the egregious examples of the Challenger and Chernobyl tragedies. Both estimates were low by 100X. The common thread of this bias appears to be neglect of "pilot error". We assume that we are rational, and that others are too. Neither optimism is justified.

I am less able to form an independent estimate of the storage risks. It is surprising to me that earthquakes are assumed to be limiting, followed by aircraft crashes. I would naively have thought that problems of container corrosion, operator errors, and sabotage would be more likely. I would have thought the storage risks to be relatively low at first, then rising rapidly with container age and operator complacency. It is a deficiency of the SAIC report that these risk factors were not better discussed. Omitted also were any mention of "non-acute" deaths and "sub-acute" injuries and illness.

I remark that the "extra deaths" of any of the numbers in Table II greatly exceed EPA's tacitly assumed but discretely non-stated tolerance of 1E-5 [1 in 100,000] total extra deaths within an affected community, over a lifetime exposure, for industrial toxic waste incineration. It appears that risk tolerance accommodates to other imperatives.

ATTACHMENT 1-B

Sabotage and other accidents are the greatest real danger

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U.S. Lethal Incident Rates

The US population experiences something less than 30,000 highway deaths per year, among a population near 280 million, for an average rate of about 1E-4 [0.0001] deaths per capita per year.

The US armed services employ something near 2 million enlisted and officer personnel, who experience "operational accidents" near 100 deaths a year, for an average rate of about 5E-5 [0.00005] deaths per person per year. "Non-operational" accidents among service personnel exceed this rate.

The US Postal Service employs about 200,000 people, among whom we have recently experienced about one incident a year of employee assaults ["going postal"] involving 2-5 very publicized deaths, for an average rate for lethal employee sabotage of about 1E-5 [0.00001] deaths/cap/yr.

Similarly, the murder rate among US urban citizens is about 6E-5 [0.00006]/cap/yr.

Lethal Incident Rate 0.01 near-site fatalities per year from accidents and sabotage.

If, very roughly, these rates are averaged into a "lethal incident" rate a bit less than 1E-4 [0.0001]/cap/yr, then with about 100 employees at the Umatilla facility, we can not unreasonably expect about 0.01 near-site fatalities per year from accidents and sabotage.

To compare with this, formal risk estimates for dioxin modulated cancers at Umatilla are estimated to be about 1E-6 [0.000001]/cap/"lifetime" exposure among a nearby population. When you look at the fine print, a "lifetime" in this context is taken to be close to 10 years [not 70], under the not-unreasonable assumptions that people move in and out of a community, and that the facility will not operate for "a lifetime". Thus the annualized fatal risk rate from this path is assumed to be about 1E-7 [0.0000001]/cap/yr, or 0.001 dioxin modulated cancer deaths per year among the roughly 10,000 people living near the Umatilla Facility.

Now, for reasons discussed in my letter to Carol Browner (Attachment 4-B), I believe the formal, mostly-dioxin-driven risk estimates that we have been reviewing are likely low, perhaps by 10X, and that the uncertainty associated with them is very large, perhaps by 100X.

Balancing this it is my very subjective judgment that owing to the extremely hazardous and unstable nature of the incinerator feedstocks, and to the population from which many of the facility's employees are drawn, both the accident and sabotage rates that I have used above are also likely low by 10X or more. Particularly worrying is the potential for accidents with poison-gas agents escaping the incineration process entirely, into the surrounding community.

Thus, I argue with these very rough numbers that:

At the Umatilla facility, and in the surrounding community, the expected risks from accidents and sabotage likely exceed those from dioxin modulated cancers, by an order of magnitude.

ATTACHMENT 2

Pollution Abatement Systems and Chemical agent Destruction

Lisa Brenner
Oregon Clearinghouse for Pollution Reduction
Portland, Oregon 97232

> "As risk-assessment guidelines for toxic-waste incineration have evolved through successive directives from the EPA, the perceived risk-factors have become centered upon cancers, and the controlling risk-agents upon the dioxins. This model is inappropriate for the incineration of nerve and mustard gases, whose intrinsic toxicities are orders-of-magnitude greater than those of the feedstocks of ordinary "toxic-waste" incinerators. "
>
> Dr. Halstead Harrison

No incinerator's pollution abatement system contains emissions during upsets or accidents, which are allowed up to 10% of the time by EPA, and some emissions are allowed to escape during "normal" operations.

For ordinary, medical or hazardous waste, accidents resulting in uncontrolled emissions do not result in the destruction of all living things within the plume. Unlike other waste streams, this is exactly what chemical agents are designed to do.

> "The problem here .. it seems to me .. is not dioxins, or of residual chemical agents that may pass through incineration and carbon-bed filtration, but of the potential for accidents that
> directly release toxic agents that are exquisitely lethal at very low doses. Accidents are the tail that wags this dog." Dr. Halstead Harrison

Oregon's laws require not just that a hazardous waste incinerator meet current EPA standards, but that no major risk to health and the environment are found. The army and DEQ's fallacious clinging to EPA standards for ordinary hazardous waste cannot in reality apply to chemical agent.

However a chemical agent accident in which a pinpoint of the material, when volatilized, would kill a person, is in a completely different ballpark. A chemical agent accident will mean certain death for large numbers of workers and residents.

Today in the commercial arena, the ballpark in which death is not immediate and widespread, we would find mass waste, medical waste, hazardous waste and special waste incinerators. Although constantly used in comparisons and most recently in the NRC carbon filter report, by content mass waste incinerators do not qualify for comparison because they are not permitted to dispose of large quantities of dangerous materials. Medical Waste Incinerators would come closer because of the toxicity of their emissions, and Hazardous Waste Incinerators the closest within the commercial realm and the different ballpark. The content of even hazardous waste incinerators are so far removed from levels of toxicity of chemical agent that they cannot be considered equivalent waste. Special incinerators exist for processing small quantities of extremely hazardous waste, but the volume of substance present at Umatilla depot makes comparisons inappropriate.

Unfortunately, both the Army, in their presentations, the DEQ consultant, Kristiina Iisa (Umatilla Chemical Depot Testimony, CD 3B, Document #2559, pp130-140) and the NRC failed to select like to compare to like in their promotion of carbon filter bed technology as BACT for a chemical agent incinerator. If DEQ really had no alternative for disposal but incineration and they selected a pollution control system that was the best available, they would have looked at a five stage system typical of commercial hazardous waste incinerators (ref) for controlling emissions.

ATTACHMENT 3

The most recent, August 1999 NRC report and its comments about risk

Dr. Halstead Harrison

I disagree emphatically with the report's assurance in the Executive Summary,(p 1) that "a carbon filter would virtually eliminate the possibility of an accidental release of a chemical agent through the stack"

I have commented elsewhere (Letter to Carol Browner, Attachment 4-B) on the very large uncertainties associated with numerical risk estimates, and their consequent inutility in assisting wise decisions. I wish further to emphasize, however, that the numbers quoted in the Executive Summary (p 2, c 2) must be strongly qualified as appropriate only [if at all] to the normal, design-center operation of the Umatilla Facility. They are not conservative, as asserted.

The potential for accidents is the tail that wags this dog.

In "Finding 1a" (p 3, c2) it is remarked that test emissions of "dioxins, mercury, cadmium, lead, arsenic, beryllium, and chromium" are among the lowest that have been reported to the EPA. Good. But irrelevant. **What we are concerned about is the potential for accidents that release GB, VX, and HD.** ["Sarin", "nerve gas", and "Mustard".]

In "Finding 1b" it is asserted that "the activated carbon would also have the capacity to absorb a chemical agent in case of a major upset". Filter-bed channeling and other operational defects may vitiate this optimism. More to the point, other safety factors may necessitate by-passing the filters during major upsets. **The filters will have real value in containing lesser upsets.**

Findings 4 and 5 express concerns about acute hazards to workers, their identification and analysis, and steps that may be taken in mitigation. You bet. **A crucial part of this should be a critical study of the histories of off-design operations at Johnston Island and Tooele. What have we learned? What steps have been taken to avoid repeats?**

And what about sub-acute exposures? What is the incidence of workers at Johnston and Tooele complaining of chronic fatigue? "flaming nightmares"? Of anxiety attacks? Of digital numbness? Of serious autoimmune diseases?

I am bemused by the statement "Properly operated, the incineration system produces mostly relatively harmless products." (p 7, c1) **Chernobyl was safe, most of the time.** My point is serious: our highest concern should be with off-design operations, and what to do about them.

The NRC document reports no above-threshold measurements of GB, VX, and HD in the exit gas stream, with detection limits of 1.8, 115, and 1.8 ng/dsm^3 [nanograms per dry standard cubic meter [page 18, col. 1]. This is good. Gas-phase measurements at this level [about 0.001 - 0.1 ppbv] are hard. The techniques reported in these studies, and I presume projected to become routine at Umatilla, require pre-concentration on charcoal and "tenax" adsorption substrates, followed by desorption into gas chromatographs and ultimate detection by mass spectrometry, a process requiring several minutes.

I am concerned about this delay, as it may affect prompt discovery of off-design operations, and prompt remediation to limit them. Other physical measurements of the plant's operating conditions, such a pressures, temperatures, and flow velocities, are more prompt: bells can ring and sirens wail, but the foreman may not appreciate that the system is in real trouble until after serious exposures to bad stuff. I recommend directly sampled, molecular beam mass-spectrometry, which has the capability of detecting sub-ppbv gas concentrations of molecules such as GB, VX, and HD with response times near 10 seconds. **These devices are commercially available.**

"The Army has reported that puffs have been relatively infrequent, (e.g. one per week)."(p 21) "Puffs", in this context refers to excursions of trappable-gases emitted from the deactivation furnace system, I presume at Johnston Island or Tooele. **These are serious, and we should know more about them.**

"Because agent levels in remote processing areas can be relatively high ..." (p 38) How high? How often? What are the measurements? **This is serious.**

On page 43, both columns include further numerical risk assessments, about which my judgments are already expressed.

What, for example, are we doing to protect the site from employee ["postal"] sabotage? From extra-national terrorism? From Aryan Nationalists rumbling down from Idaho in their SUVs? One little bang from a home-made fertilizer/diesel casserole can spoil a whole afternoon.

The point is serious: Is the risk of terrorism really negligible with respect to the formal estimates near 1E-6 that float around so irresponsibly on page 43? If not, what are we doing about it, more than a cyclone fence?

ATTACHMENT 4-A

Current Standards are not Protective

Compiled by Lisa Brenner
Oregon Clearing House for Pollution Reduction

Toxic compounds produced by the incineration process are not well documented or understood or measurable. Every new piece of scientific evidence shows how little we actually know about emissions and the products of incomplete combustion from incinerators and how much more toxic they are then we ever guessed.

A recent research report on the emissions of hazardous waste incinerators (USEPA -600/R-98-076 July 1998. Research and Development. Development of a Hazardous Waste Incinerator Target Analyte List of Products of Incomplete Combustion. Prepared for: Office of Solid Waste. Prepared by: National Risk Management Research Laboratory Research Triangle Park, NC 27711) concludes:

> "It can be concluded from these experiments that the current sampling and analytical schemes for characterizing HWC emissions are inadequate and provide an incomplete picture of the emission profile. This is primarily due to the presence of an extremely complex mixture of organic compounds in the HWC emission samples.... the number of compounds suspected to be present in incinerator **emissions may be an order of magnitude greater** than initially suspected." (p4-1)

A report referenced in the *Defense Environment Alert* of July 27, 1999 notes that an NRC panel found that Army derived oral reference dose (not inhalation) for VX and the slope factor for HD were too high and not protective of human health (p-7). This reference is included with the attachments to 6-B.

United States
Environmental Protection
Agency

EPA-600/R-98-076
July1998

Research and Development

Development of a Hazardous Waste Incinerator Target Analyte List of Products of Incomplete Combustion

Prepared for:

Office of Solid Waste

Prepared by:

National Risk Management Research Laboratory
Research Triangle Park, NC 27711

FOREWORD

The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory is the Agency's center for investigation of technological and management approaches for reducing risks from threats to human health and the environment. The focus of the Laboratory's research program is on methods for the prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites and groundwater; and prevention and control of indoor air pollution. The goal of this research effort is to catalyze development and implementation of innovative, cost-effective environmental technologies; develop scientific and engineering information needed by EPA to support regulatory and policy decisions; and provide technical support and information transfer to ensure effective implementation of environmental regulations and strategies.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

E. Timothy Oppelt, Director
National Risk Management Research Laboratory

EPA REVIEW NOTICE

This report has been peer and administratively reviewed by the U.S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

DEVELOPMENT OF A HAZARDOUS WASTE INCINERATOR TARGET ANALYTE LIST OF PRODUCTS OF INCOMPLETE COMBUSTION

FINAL REPORT

Prepared by:

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U.S. Environmental Protection Agency
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ABSTRACT

Pilot-scale incineration experiments were performed to develop a comprehensive list of products of incomplete combustion (PICs) from hazardous waste combustion (HWC) systems. The goals of this project were: 1) to develop an expanded list of HWC target analytes for EPA's Office of Solid Waste (OSW) to use as a basis for a PIC-based regulatory approach; 2) to identify the total mass of organic compounds sufficiently to estimate the toxicity of the complex mixture; and 3) to enable OSW to assess the relative importance of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs) to other PICs.

These tests were performed under varied combustion conditions feeding a mixed surrogate waste, resulting in the generation of numerous PICs. While many of these PICs were identified as target analytes using standardized sampling and analytical methods, the majority of PICs present in the incineration emissions were not target analytes. Although a substantial number of PICs have been tentatively identified, a considerably larger number have not been identified at this time. It can be concluded from these experiments that the current sampling and analytical schemes for characterizing HWC emissions provide an incomplete picture of the emission profile.

Innovative analytical techniques, such as multi-dimensional gas chromatography (MDGC) appear to show great promise for identifying the unknown compounds present in the stack gases. In many cases, "clean" chromatographic peaks were not able to be identified via mass spectral search algorithms because what appeared to be a single peak was really many compounds co-eluting off the column. When these types of peaks were analyzed using the MDGC system, the co-eluting compounds were resolved and identified.

As a result of these experiments, an expanded list of PIC target analytes has been developed. This list is by no means complete or comprehensive. This list should be viewed in context with this particular set of experiments; i.e., waste mix. The PICs generated from the incineration of other mixed waste streams have not been evaluated.

The PICs identified fall into several chemical classes. A wide variety of chloro, bromo, and mixed bromochloro alkanes, alkenes, alkynes, aromatics, and polyaromatics were detected. In addition, nonhalogenated hydrocarbon homologues along with oxygenated, nitrogenated, and sulfonated organics were detected. Analytical methods specifically suited to identify these chemical classes are needed to enhance PIC characterizations. Of the non-target semivolatile organic compounds that were detected but not identified, the vast majority were large alkanes (with more than 10 carbons), esters of high molecular weight carboxylic acids, and phthalates. The authors believe that improved analytical methodologies emphasizing validation and quantification of these compounds would provide the greatest opportunity to reduce uncertainty in risk assessment calculations.

Other secondary goals of this project were also realized. It was observed that increases in feed bromine concentration could dramatically impact emissions of many chlorinated organics, including PCDDs/PCDFs. It was also observed that concentrations of chlorinated alkenes dropped as residence time in the secondary combustion chamber increased, while ring growth reactions were observed in-flight in moderate temperature regions prior to gas quenching. Finally, evidence has been found to support the use of certain easily measured volatile organic PICs as surrogates for PCDD/PCDF emissions.

Some goals of this project were not attained. A mass balance between identified PICs and total hydrocarbon (THC) measurements was not established. THC concentrations were in the very low ppm range, within the analytical accuracy of the instruments. Attempts to measure non-chlorinated alkanes, alkenes, and alkynes via bag sampling did not detect measurable levels of those compounds.

ACKNOWLEDGMENTS

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1.0 INTRODUCTION

1.1 - Focus

Assessing the risk posed by combustor emissions requires sampling and analysis of what is leaving the stack. The chemical analysis must be compound specific in order to consider the toxicity of each compound. Efficient and cost effective sampling and analysis for routine regulatory control requires a target analyte list to focus the effort. A list of Products of Incomplete Combustion (PICs) suitable for focusing this effort is not well developed. The primary goal of this project is to develop such a list. This list will help serve as a basis for EPA's Office of Solid Waste (OSW) to pursue a PIC-based regulatory approach.

In the past, the Appendix VIII[1] list of hazardous compounds has become the *de facto* list for hazardous waste combustor (HWC) investigations. The Appendix VIII list was generated by appending lists of chemicals that were previously regulated by other government agencies (U.S. Department of Transportation (DOT) shipping labels, etc.). And, as such, it is not a list of compounds well focused to HWC stack emissions. Moreover, this list focuses on compounds possessing hazardous characteristics that are most often the Primary Organic Hazardous Constituents (POHCs). As a result, existing required analytical methodologies focus on measuring the POHC. Very few PICs that are formed are targeted by current analytical methodologies. Analytical methodologies capable of identifying and quantifying PICs are required. This effort avoids the focus provided by Appendix VIII by approaching the task with an open mind in order to establish a list of compounds of importance to HWC emissions.

As a starting point, this study used existing trial burn data, laboratory-scale research literature, and, where relevant, target analyte lists based on Appendix VIII and the hazardous air pollutant (HAP) list from the 1990 Clean Air Act Amendments[2]. It must be stressed, though, that this was only a starting point. The vast majority of the effort for this study was consumed in identification and quantification of unknown compounds.

1.2 - Regulatory Basis

HWCs have been regulated by the Resource Conservation and Recovery Act (RCRA),[3] based on the destruction and removal efficiency (DRE) of POHCs as defined in a trial burn. This approach used the initial decomposition of the POHC, the first step in converting the organic POHC molecule to carbon dioxide (CO_2) and water (H_2O), as a surrogate for the extent of complete conversion to CO_2 and H_2O. The goal of reducing the toxicity of the hazardous constituents requires many reactions (chlorobenzene has 12 bonds to break and 18 new bonds to make) to completely react to CO_2 and H_2O. If the reaction sequence goes to completion, the toxicity is reduced completely (i.e., CO_2 and H_2O are not toxic). However, partial destruction can mute the reduction in toxicity, and reformation reactions can occur that cause molecular size growth; these can also mute the reduction in toxicity or, in some cases, increase the toxicity from that of the original organic molecule being incinerated[4]. Additionally, chlorine from the hazardous waste, released in the form of hydrochloric acid (HCl) or diatomic chlorine (Cl_2), can react with naturally occurring hydrocarbons in the cool end of some incineration facilities (e.g., cement kilns) and generate potentially toxic hazardous organic compounds[5]. A new PIC-based approach can potentially avoid these problems associated with the POHC DRE approach.

Current regulatory approaches use carbon monoxide (CO) as a surrogate for PICs. This approach is based on the assumption that the oxidation of CO to CO_2 is the final step in the long chain of complex combustion reactions. Minimization of CO thus is assumed to minimize PICs. Unfortunately, this assumption does not hold up well when polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs), which are generally formed in the cooler regions of the incinerator, are taken into account. In the case where PCDDs and PCDFs constitute a significant component of the organics-based toxicity of the mixture, the "CO-as-a-PIC-surrogate" approach breaks down. CO appears to be a viable surrogate to distinguish between "poor" combustion and "good" combustion, but as emissions limits get lower and lower, CO is not a reliable surrogate to distinguish between "good" combustion and "great" combustion. At that point, other parameters have a much more significant influence on the emissions of PCDDs/PCDFs, such as the temperature at which the particulate control device operates.[6] In other words, minimization of CO is a necessary, but not sufficient condition for PIC minimization.

1.3 - Surrogate Indicators

A surrogate incinerator performance indicator is an easily measured parameter, compound, or group of compounds whose variance can account for the variance in the measurements of a more difficult-to-measure compound, such as PCDDs/PCDFs. Although this work will not be used directly to develop surrogate indicators of performance, it will lay ground work for that purpose. The task of choosing a surrogate indicator of performance implies that a significant PIC of concern (one that can significantly influence the results of a risk assessment) is known. PCDDs/PCDFs have gained notoriety as being potentially significant PICs in many cases, although some critics have suggested that PCDDs/PCDFs are the most important PICs simply because they are the class of PICs most frequently investigated. The problem that exists is that PCDDs/PCDFs are present at the low parts-per-trillion (ppt) levels in the stacks of a well-operated combustion facility. Sampling and analytical procedures to measure PCDDs/PCDFs are expensive and time consuming. If an easily measured surrogate were available that gave a strong correlation with PCDDs/PCDFs, routine compliance tests could potentially be replaced by continuous or semi-continuous monitoring of that surrogate. In addition, the process could be optimized based on continuous measurements of that surrogate.

1.4 - Emission Characterization

An additional issue this work may help to address is that of "what fraction of the emissions are toxic and what fraction are low or non-toxic?" By attempting to quantify as large a percentage of the mass of organic emissions as possible (in a research level effort) it may be possible to get a better handle on the question. The public has been quick to assume that the unidentified compounds are hazardous; since they have not been identified it is not possible to assure the public that they are of low toxicological significance. This research effort and the Omnibus regulatory effort intend to identify and quantify both the toxic and low/non-toxic compounds to the extent possible. It is expected that the bulk of the emissions will be low molecular weight low/non-toxic compounds.

Although PCDDs/PCDFs, due to their high toxicity[7], are likely to be the most toxic organic hazard in the HWC stack, they are typically present in minute quantities. In addition, there may be entire classes of PICs that are not even being measured, some of which could potentially influence the risk assessment calculations. The conservative nature of risk assessment assumes that unknown compounds are toxic. Because of this, risk assessment uncertainties can be influenced not only by not detecting PICs that are important from a toxicological point of view, but also by not detecting harmless compounds that potentially comprise much of the mass of stack emissions. Sampling and analytical methodologies may not be sufficiently developed to generate reliable emissions data. Compounds that fall into this category are the brominated and bromochloro analogs to PCDDs/PCDFs (the polybrominated dibenzo-p-dioxins and polybrominated dibenzofurans [PBDDs/PBDFs] and mixed bromochloro dibenzo-p-dioxins and mixed bromochloro dibenzofurans [PXDDs/PXDFs]), and polycyclic aromatic hydrocarbons (PAHs) substituted with various species (oxygen, chlorine, sulfur)[8]. Another issue is the measurement of compounds such as phthalates, which are frequently detected in HWC emissions, but may be artifacts of sampling and analytical treatments.

1.5 - Limitations

The experiments were performed on EPA's rotary kiln incinerator simulator (RKIS) located in Research Triangle Park, NC. Exact quantification of concentrations was not a primary goal for this study. A more important goal was to derive a detailed list of target compounds that can be found at levels above the detection limits. The existing database of PIC data from bench, laboratory, pilot, and full-scale was used as a starting point for development of this list.

It is critical to understand that all quantified PICs generated in this study are based on the pilot-scale RKIS, burning the chosen waste mix, at the given conditions, prior to any flue gas cleaning equipment. The RKIS is a small pilot-scale kiln, and many of the fluid mechanical features of full-scale kilns that can produce excess emissions are not present in the RKIS. As such, the system sometimes needs to be operated slightly outside what would constitute normal incinerator operating conditions in order to properly quantify important emission trends and measure subtle phenomena. It is believed that this system generates qualitatively applicable data, although emissions results from the RKIS should not be quantitatively compared to full-scale systems.

2.0 EXPERIMENTAL APPROACH

2.1 - Focus

The emphasis of this effort was placed on analytical operations rather than sampling operations. The sampling methods selected were appropriate for the quantitative capture of volatile, semivolatile, and non-volatile organics. The issue was how to retrieve and analyze the organic compounds captured by these methods. Both standard and non-routine approaches were used. Methods development/validation was not within the scope of this project. It must be reiterated that the emphasis of this project was to identify PICs that are not routinely identified by conventional methodologies. Once these PICs have been identified and their relative toxicological importance evaluated, emphasis can more appropriately be placed on method development and validation.

Certain samples, such as those collected using SW-846 Draft Method 0040[9] (Tedlar bags) or Method 0030[10] (VOST), must be analyzed soon after the samples have been taken. These analyses were performed within 24 hours. Other samples, though, such as Method 0010[11] (MM5) or Method 23[12], can be stored for a longer time after extraction of the sampling media. In addition, since this effort was directed at identification of the multitude of unknowns in the semivolatile and non-volatile fraction, the majority of the effort was directed at the higher molecular weight compounds.

2.2 - Experimental Equipment

2.2.1 - Rotary Kiln Incinerator Simulator

The incineration tests were performed using the RKIS facility at the EPA's Air Pollution Prevention and Control Division's (APPCD's) combustion laboratory in Wing-G of the EPA's Environmental Research Center (ERC) located in Research Triangle Park, NC. The facility has a RCRA Research, Development, and Demonstration (RD&D) permit to burn actual and surrogate hazardous waste. The RKIS, shown in Figure 1, consists of a 73 kW (250,000 Btu/hr) rotary kiln section, a transition section, and a 73 kW (250,000 Btu/hr) secondary combustion chamber (SCC). The RKIS was designed for the testing of liquid and solid surrogate hazardous waste materials.

The RKIS was designed to contain the salient features of full-scale kilns, but still be sufficiently versatile to allow experimentation by varying one parameter at a time or controlling a set of parameters independently. The rotating kiln section contained a recess which contains the solid waste during incineration. The recess was designed with a length to diameter (L/D) ratio of 0.8, which is 20 to 25% of a full-scale system. The main burner, based on an International Flame Research Foundation (IFRF) variable swirl design, was the primary heat source for the system. Natural gas was used as the primary fuel during startup and idle, then was switched over to the surrogate waste feed used throughout testing.

From the kiln section, the combustion gases entered the transition section. The gases then flowed into the SCC. The SCC consisted of three regions: the mixing chamber, the plug flow section, and the stack transition section. A replaceable choke section separated the mixing chamber from the plug flow section.

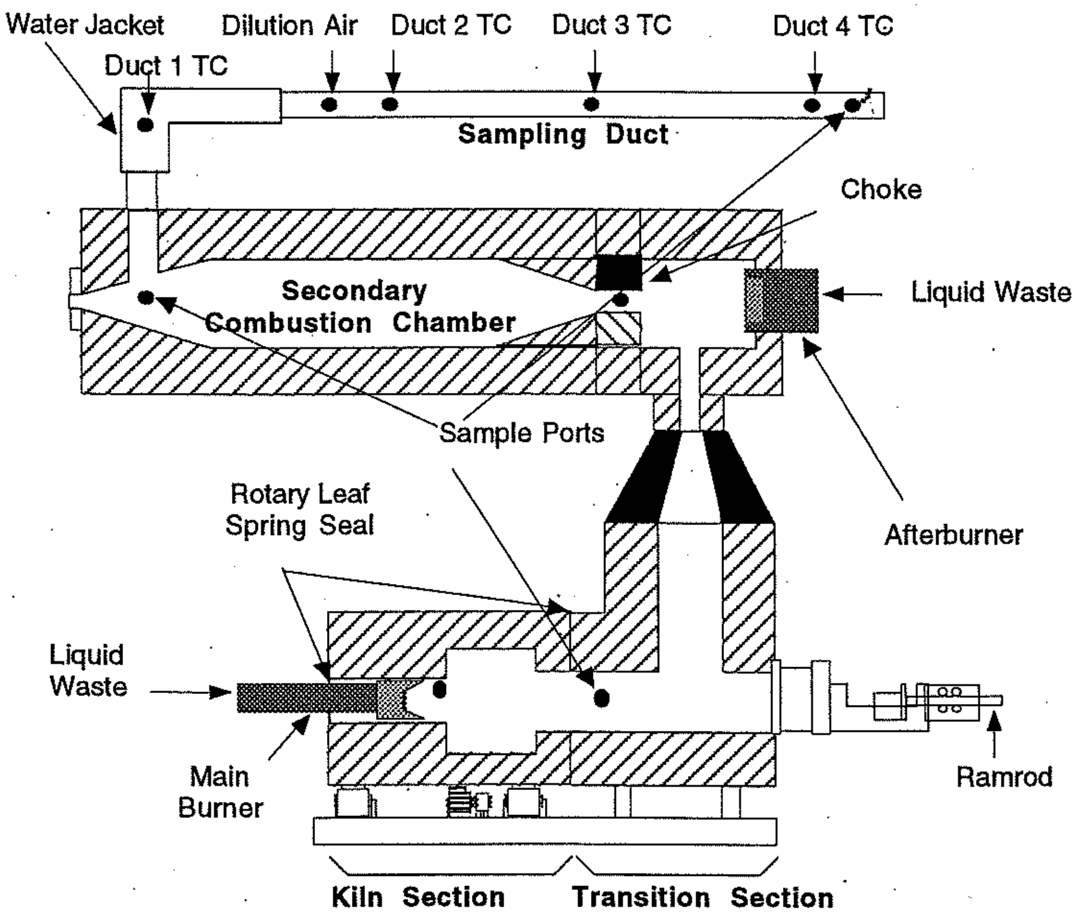

Figure 2-1. Rotary kiln incinerator simulator

A conical refractory insert was installed into the first plug flow sub-section to provide a gradual divergence from the choke diameter to the plug flow section diameter and minimize recirculation zones downstream of the choke. The afterburner, also based on an IFRF variable swirl design, provided heat and flame to the SCC, and was also fired with natural gas during startup and idle times, then switched to the liquid surrogate waste during the tests.

Combustion gases exiting the afterburner passed through a water-jacketed convective cooling section of 20.3 cm (8-in nominal pipe thread [NPT]) diameter stainless steel (SS) ducting. Further cooling was achieved by adding ambient dilution air via a dilution damper located upstream of the 9.9-m (35-ft) sampling duct. Emissions samples were collected at sampling locations 66.7-cm (169.5-in) and 98.6-cm (250.5-in) downstream of the dilution damper. These sampling locations were oriented to meet isokinetic sampling requirements.

2.2.2 - Flue Gas Cleaning System

All of the research combustors in the Wing-G combustion research facility were manifolded into a common flue gas cleaning system (FGCS). The FGCS consisted of a 1.02 MW (3.5 x 10^6 Btu/hr) afterburner followed by a water quench, baghouse, and wet scrubber. The purpose of the

FGCS was to take exhaust gases from the research combustors, destroy any unburned organic material, and remove any particulates and acid gases from the effluents prior to their release to the atmosphere.

A roof-mounted induced-draft (ID) fan pulled exhaust gases from research combustors into a manifold. Flow direction of emissions was then determined by the position of a three-way valve. By-pass (vent fumes mode) flow feeds directly to the draft fan. The flow of fumes (permit mode) feeds through the afterburner, quench, baghouse, scrubber and draft fan.

Exhaust gases were oxidized at temperatures of 1000 °C (1,832 °F) or greater for at least 2 s in a natural-gas-fired Hirt afterburner. The exhaust gases of the afterburner were then cooled by a controlled water spray that is air-aspirated through a nozzle in the quench section. Particulate matter was then removed by filter cartridges in a baghouse. Acid gases were removed in the scrubber by a sodium hydroxide caustic solution that is sprayed into the exhaust stream. After exiting the draft fan, exhaust emissions are continuously monitored for CO_2, CO, and oxygen (O_2). The FGCS is depicted in Figure 2-2.

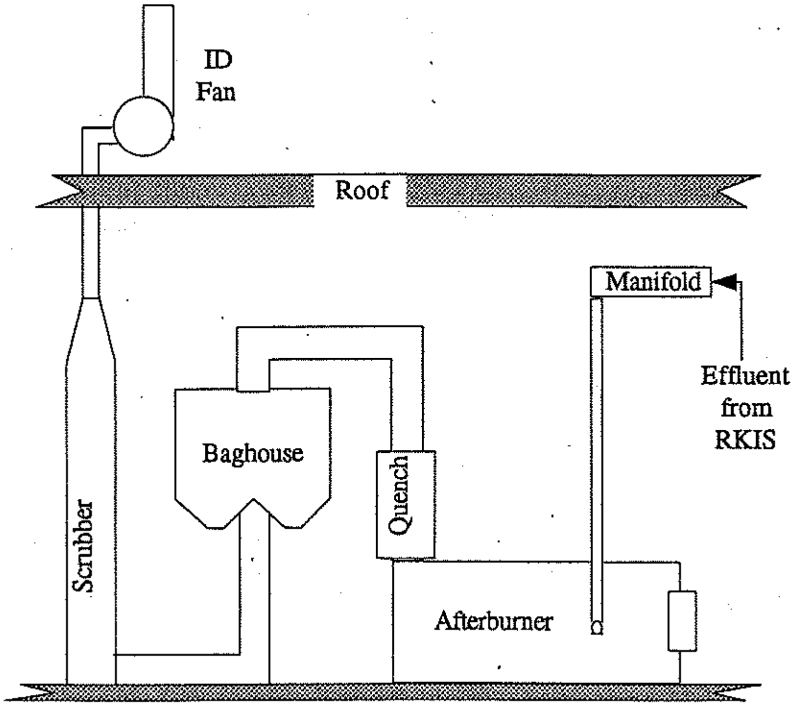

Figure 2-2. Flue gas cleaning system.

2.3 - Waste Feed

The surrogate hazardous waste that was fed during tests was designed to possess representative compounds from many common classes of organic hazardous wastes. The composition of the surrogate hazardous waste feed was developed based on recommendations from members of OSW and the Regional Permit Writers. Table 2-1 lists the composition of the surrogate waste feed. In addition to the organic surrogate waste, an aqueous mixture of metal salts, including zinc nitrate•hexahydrate, nickel nitrate•hexahydrate, and copper nitrate•hexahydrate, was also fed into the kiln. The purpose of the metals injection was to provide a representative supply of metal catalyst to promote any heterogeneous reactions forming PCDDs/PCDFs. Copper (Cu), nickel (Ni), and zinc (Zn) were fed as metal nitrate•hexahydrate compounds dissolved in 100 mL/hr of water with sufficient metal present to reach the target gas-phase concentrations of 60 $\mu g/m^3$ (Cu), 40 $\mu g/m^3$ (Ni), and 90 $\mu g/m^3$ (Zn).

Hazardous wastes are burned in blended mixtures of many waste streams.. These tests were designed to mimic this complexity. The principal purpose of this work was to establish a list of possible compounds that should be investigated as PICs from hazardous waste incineration. In order to have as many compounds on the list as possible, the feed stream was designed to have several organic compounds of several different classes in its makeup. Additionally, since as much of the effort as possible was to be directed at analysis, the cost of the waste feed was designed to be held to as low a level as possible. In addition, it was required that personnel safety be maximized.

With the exception of runs where batch feeding occurred, all runs were performed using the same standard mix of compounds. The nominal chlorine (Cl) content of the waste was 10 % by weight. The waste consisted of a mixture of several compounds co-fired with No. 2 fuel oil. Some brominated organic compounds were substituted for a fraction of the chlorinated compounds. The composition of the waste that was fed is shown in Table 2-1. Note that too much dibromoethane was inadvertently added in Run 10, resulting in a bromine (Br) mass percent 3 times the intended level.

In addition, some of the tests involved batch charging of containerized liquid wastes. The charges consisted of 0.9 L (1 qt) polyvinyl chloride (PVC) containers filled with No. 6 fuel oil that had been doped with hexachlorobenzene (1000 ppm). This waste was fed in 10 minute intervals with the kiln rotating at 0.5 rpm.

During all runs, the kiln and afterburner burned the standard mix of wastes in both the primary and secondary burners, by pumping the makeup fuel (No. 2 fuel oil) from 55 gal. drums, and mixing it with the stream of waste compounds that are being pressure-fed from a 5 gal. container using pressurized nitrogen. The entire system was tied into the flame safety interlock system so that any flameout resulted in the waste feed's being cut off. Flow rates were measured using rotameters. The nominal experimental descriptions that were used are listed in Table 2-2. The combustion blanks consisted of samples taken while no waste was being fed.

The metals solution was injected into the primary combustion chamber using the apparatus shown in Figure 2-3.

2.4 - Sampling Approach

2.4.1 - General Sampling Information

The sampling methodologies and procedures used to conduct this study followed EPA-standardized test methods for the collection of volatile, semivolatile, and non-volatile organics. In general, the test procedures were followed as described in the reference method. Analytical results are not available for all runs for which sampling occurred. Table 2-3 lists the samples taken during the tests for which analytical results are available. With the exception of the continuous emission monitors (CEMs), all extractive samples were taken at the sample ports in the horizontal duct between the RKIS and the FGCS. As shown in Figure 2-1, one set of CEMs sampled at the port located near the kiln exit; another set of CEMs sampled at the port located near the SCC exit; and the HCl CEM sampled just downstream of the sample port where all of the extractive organics sampling trains were located.

Table 2-1. Waste Feed Composition

Class	Compound	Formula	Mass %
carrier liquid	No. 2 fuel oil	n/a	50.0
chlorinated non-aromatic	methylene chloride	CH_2Cl_2	8.0
	chloroform	$CHCl_3$	4.5
	carbon tetrachloride	CCl_4	2.4
chlorinated aromatic	monochlorobenzene	C_6H_5Cl	3.3
	dichlorobenzene	$C_6H_4Cl_2$	3.8
	chlorophenol	C_6H_5ClO	1.5
non-chlorinated aromatic	toluene	C_7H_8	5.2
	xylene	C_8H_{10}	5.2
alcohol	isopropanol	C_3H_8O	2.4
ketone	methyl ethyl ketone	C_4H_8O	4.8
nitrated waste	pyridine	C_5H_5N	5.9
PAH[a]	naphthalene	$C_{10}H_8$	1.5
brominated waste	bromoform	$CHBr_3$	0.75
	ethylene dibromide	$C_2H_4Br_2$	0.75[b]

a - Polycyclic aromatic hydrocarbon.
b - On Run 10, too much ethylene dibromide was inadvertently added.

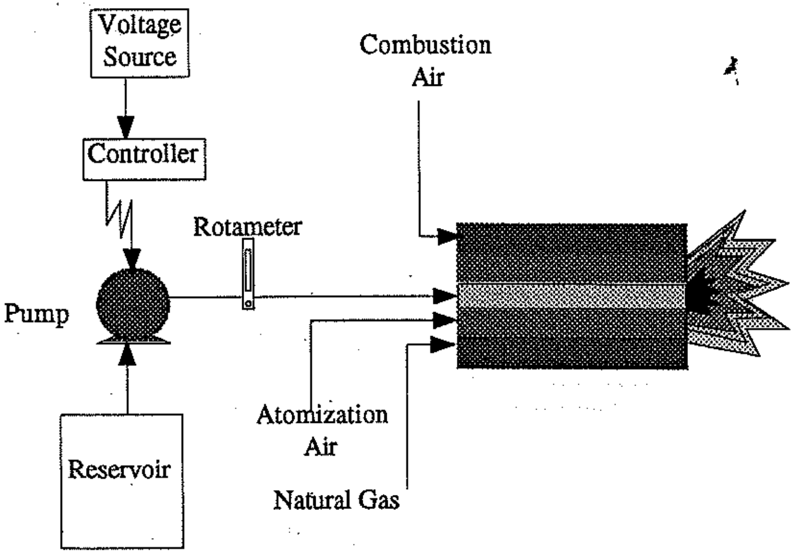

Figure 2-3. Metal solution injection system.

Table 2-2. Test Conditions.

Run	Description	Date
1	Combustion Blank	4/13/95
2	Combustion Blank	4/18/95
3	High Temperature	4/20/95
4	High Temperature	4/26/95
5	Baseline	5/3/95
6	Baseline	5/4/95
7	SCC Off	5/9/95
8	SCC Off	5/10/95
9	Low Temperature	5/12/95
10	Low Temperature	5/16/95
11	Fuel-Rich	5/23/95
12	Fuel-Rich	5/31/95
13	Fuel-Rich	8/14/95
14	Fuel-Rich	8/16/95
15	Batch Charging	8/21/95
16	Batch Charging	8/23/95

Table 2-3. Samples taken during each test for which analytical results are available.

Run	CEMs	Method 0040 Tedlar Bags	Method 0023 Dioxins	Method 0030 VOST	Method 0010 MM5	OLGC
1	X				X	
2	X				X	
3	X				X	X
4	X				X	X
5	X	X	X	X	X	
6	X	X	X	X	X	X
7	X			X		X
8	X			X		X
9	X	X	X	X	X	
10	X		X	X	X	
11	X			X	X	
12	X			X		
13	X		X	X	X	
14	X	X	X	X	X	
15	X			X	X	
16	X			X	X	

2.4.2 - Continuous Emissions Monitors

Two separate CEM benches provided simultaneous gas monitoring of O_2, CO_2, CO, nitric oxide (NO), and THC before and after the SCC. In addition to the two CEM benches, a Perkin Elmer/Bodenseewerk MCS 100 Emission Monitoring System (which is capable of measuring HCl, CO_2, and H_2O simultaneously and continuously under wet conditions) was available throughout most of the tests.

2.4.3 - On-Line GC

Volatile organic PIC emissions were measured on selected runs using an on-line gas chromatograph (OLGC) system, shown in Figure 2-4. The OLGC analytical system[13,14] contained a heated sample delivery system, a purge and trap sample concentrating system, and the GC analytical system. The sample concentrating device was a Tekmar LSC-2000 thermal desorption unit that had been modified to accommodate the direct collection of combustion samples. The GC analytical system was a HP 5890 series II GC equipped with both flame ionization detector (FID) and an electron capture detector (ECD). The effluent of the column is split (ratio 9:1, respectively) to deliver sample to both the FID and ECD simultaneously. Ninteen individual volatile organic PICs can be quantified at concentration levels of about 1 ppbv. The OLGC sampled at two different locations: 1) at the choke in the SCC, and 2) near the exit of the SCC where the other CEMs sampled, in an attempt to measure changes in PICs as a function of residence time.

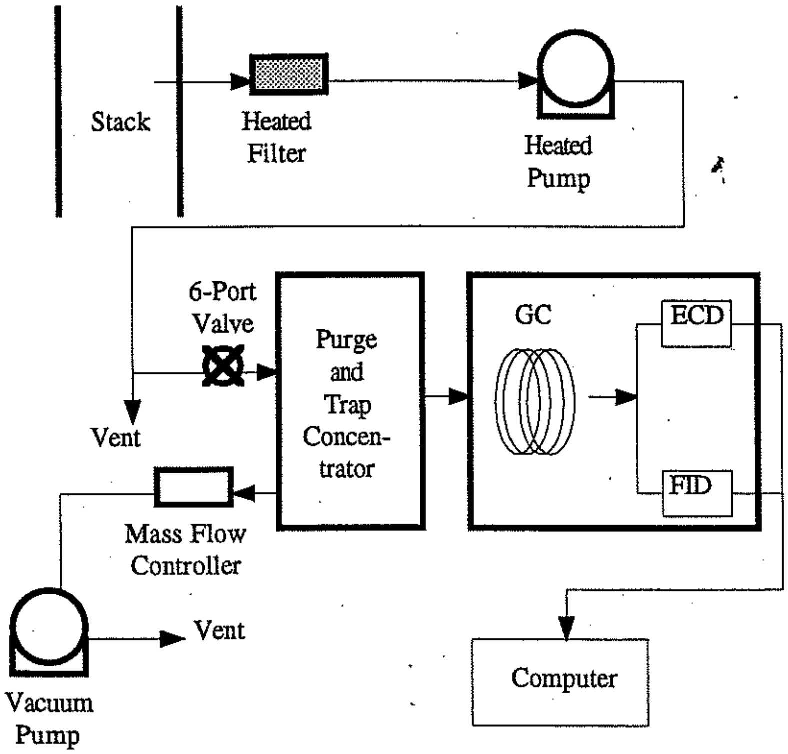

Figure 2-4. On-line GC system.

2.4.4 - Volatile Organics

Volatile organic compounds (VOCs) were collected using both the Volatile Organic Sampling Train (VOST – SW-846 Method 0030)[10] and Tedlar bags (SW–846 Draft Method 0040)[9]. The VOST method is intended to be used for VOCs with boiling points (BPs) ranging from 30 to 110 °C. For the more volatile VOCs (BPs < 30 °C), Tedlar bag samples were collected.

VOST samples were collected as described in SW-846 "Test Methods for Evaluating Solid Waste" Method 0030 "Volatile Organic Sampling Train." Four sets of samples were collected for each test condition (two sets per test day). A total volume of ~ 20 L was collected for each sample. Sampling was performed at 0.5 L/min for 40 min. Liquid condensate samples were also collected daily for separate analysis.

The VOST tube sets were quality control (QC) checked for background contaminants by GC/MS under the same conditions used for actual sample analysis. The acceptable blank level was less than 10 ng for any single target analyte per tube. There is no established level for total VOC contamination. VOST tubes were conditioned in batches of seven sets. At least one set of tubes out of each batch of seven (14.3%) was QC checked.

Once the tubes were QC checked, the Tenax-only tubes were spiked with known quantities of D^6-labeled benzene and bromofluorobenzene (BFB) as part of the quality assurance (QA) procedure for the sampling. The tubes were then individually placed in metal cigar tube-type containers which were secondarily placed in a metal container or glass jar containing activated charcoal. The secondary container was then kept in a refrigerator maintained near 0 °C until delivery for sampling. Following sampling, the tubes were returned to their respective individual containers and then placed in a separate secondary container, also containing activated charcoal, and kept refrigerated until analyzed. All samples were analyzed within 30 days of collection.

Tedlar bag samples were collected as described in SW-846, "Test Methods for Evaluating Solid Waste," and Draft Method 0040, "Sampling of Principal Organic Hazardous Constituents from Combustion Sources Using Tedlar Bags." Only one sample was collected for each test condition. A total volume of ~ 20 L was collected for each sample. The liquid condensate was also collected for separate analysis.

The Tedlar bags were conditioned for use by sequentially filling the bags with nitrogen and then evacuating them with a vacuum pump. This conditioning process was performed at least three times or until the bags were demonstrated to be free of background contaminants. The bags themselves were QC checked for background contamination as described above. The nitrogen used for conditioning was also tested for background contamination. All bags used for sampling were QC checked. Once the bags were demonstrated to be free from background contamination, they were once again evacuated and stored at ambient temperature until used for sampling. Following sampling, the bags were resealed. All samples were analyzed within 72 h of collection.

2.4.5 - Semivolatile and Non-Volatile Organics

Semivolatile organic compounds (SVOCs) were collected using the Modified Method 5 (MM5)[11] train train as described in SW-846 "Test Methods for Evaluating Solid Waste" Method 0010 "Modified Method 5 Sampling Train." Two MM5 samples were collected for each test condition. Samples were collected on separate test days. The trains were operated isokinetically as required by the method. As stipulated in EPA 40 CFR Part 60 Method 1A, the Pitot tube was not attached to the probe. Radial sampling locations were based on the preliminary velocity traverse. A post-test velocity traverse was also performed. The pre- and post-test velocity traverses were used to assess isokinetic variation. The run times were increased to maximize the total volume sampled. A nominal run time of 4 hours was used. As no particulate measurements were made from this train, filters were not weighed. No other method deviations are anticipated.

The MM5 trains were recovered so as to generate five separate components for analysis:

1. The particulate filter (labeled Container 1)
2. The front-half rinse (labeled Container 2)
3. The back-half rinse – all train components between filter and sorbent module (labeled Container 5)
4. The XAD-2 module (labeled Container 3)
5. The condensate and condensate rinse of 1st empty impinger (labeled Container 4)

Note: Container labeling is consistent with Method 0010.

Given the high acid concentration of the sample stream, flushing the XAD-2 sorbent modules with high performance liquid chromatography (HPLC) grade water to remove the concentrated acid was required. This rinse was combined with the contents of Container 5.

The XAD-2 was cleaned and QC checked as described in Method 0010 with several additional solvents. The methylene chloride extraction was followed by acetone, toluene, and once again methylene chloride extractions, respectively. The cleaned XAD-2 was subjected to background contamination quality control checks. Although the method requires that the XAD-2 blank exhibit a TCO level less that 10 µg/g, experience has shown that we can also outperform the recommended level of 4 µg/g, typically demonstrating background levels in the 1 µg/g range. The XAD-2 was also QC checked by GC/MS to screen for any target analyte background contaminants. No QC acceptance criteria have been established for this additional QC check, although less than 5 µg/sample (based on ~30 g sample) has been achieved for individual target analytes. Prior to sampling, 40 g of XAD-2 was packed into the sorbent modules, capped with glass stoppers, the ends wrapped in cleaned aluminum foil, and stored, refrigerated at 4° C until use. Following sample retrieval, the XAD-2 modules were stored in an identical manner. All samples were extracted within 30 days of sample collection.

2.4.6 - PCDDs/PCDFs

PCDDs/PCDFs were collected as described in 40 CFR, Part 60, Appendix A, Method 23 "Determination of Polychlorinated Dibenzo–p–dioxins and Polychlorinated Dibenzofurans from Stationary Sources"[12]. This method is virtually identical to California Air Resources Board (CARB) Method 428 "Determination of Polychlorinated Dibenzo–p–dioxin (PCDD), Polychlorinated Dibenzofuran (PCDF), and Polychlorinated Biphenyl Emissions from Stationary Sources"[15]. The only real differences are in the analytical approach. The MM5 sampling train location and operation criteria presented above also apply to Method 23. The run times were increased to maximize the total volume sampled. All samples were extracted within 45 days of collection.

2.5 - Analytical Approach

2.5.1 - General Analytical Information

The analytical approach considered both screening and analyte-specific analytical techniques. A literature review of bench-, laboratory-, and pilot-scale incineration studies was used to help establish an expanded target analyte list. Similarly, target compound classes such as PAHs, that are made up of many more than the 16 or so compounds routinely targeted, were expanded to include alkylated, chlorinated, and nitrogenated PAHs that have harmful health effects. Sulfonated, oxygenated, and nitrogenated heterocyclic compounds were also targeted.

2.5.2 - Volatile Organics

The VOST and Tedlar bag samples collected were analyzed by gas chromatography/mass spectrometry (GC/MS) following the procedures described in SW-846 Methods 5040/8240[16,17]. This method was suitable for the analysis of both sample types. Method 8240 quantifies compounds with BPs ranging from ~–30 to ~ 200 °C, encompassing the capabilities of both sampling methods. The Method 8240 target analyte list was modified/expanded to include additional potential PICs.

The resulting GC/MS total ion chromatograms were analyzed to identify peaks that were not target analytes. Nontarget PICs were identified by comparing spectral data of the unknown to spectral data contained in the National Institute of Standards and Technology (NIST) and Wiley mass spectral databases. A probability-based spectral matching algorithm assigned tentative identification. The quality of the match, along with investigator spectral interpretation and physical data (e.g., boiling point vs. retention time) was used to assist in identification. Where possible, additional standards containing tentatively identified compounds were prepared and analyzed to confirm identification. Following Method 8240, these unknowns are quantified based on the internal standard closest in retention time and a relative response factor (RRF) of 1. A multiconcentration calibration was performed using standards of the identified compounds to establish RRFs specific to each compound to enhance quantitative accuracy.

The Tedlar bag samples were also analyzed to characterize the highly volatile organic species. The bag samples were analyzed by gas chromatography/flame ionization detector (GC/FID) to quantify such compounds as methane, ethane, propane, chloromethane, and acetylene. The FID response to nontarget analytes was also reported.

2.5.3 - Semivolatile and Non-Volatile Organics

A detailed chemical characterization was performed on the MM5 samples. MM5 analyses were performed quantitatively; however, the main emphasis was on qualitative identification of major emissions components.

Following collection, the MM5 samples were Soxhlet extracted sequentially with several solvents of decreasing polarity. The samples were extracted sequentially with methylene chloride, acetone, and toluene. The individual sample extracts were concentrated to a known volume and archived for analysis. The five containers from each sample train were extracted so as to generate three separate sample components. For each solvent, separate sample extracts were generated from each train. The filter and front-half rinse (Containers 1 and 2) were composited as a single extract as were the XAD-2 sorbent and back-half rinse (Containers 3 and 5). The condensate and condensate rinse (Container 4) is the third sample component. For methylene chloride, the extractions were performed as described in SW-846 Draft Method 5060, "Preparation of MM5 Train Components for Analysis by SW-846 Method 8270." The acetone and toluene extractions were performed similarly with only the filters and XAD-2 being extracted. Surrogates were added only to the MM5 train components.

After initial analyses were performed using conventional GC/MS, and significant unidentified peaks were found, an alternative analytical approach was taken. The methylene chloride extracts from Run 10 were sent to the University of Dayton Research Institute (UDRI), where the technique of multi-dimensional GC/MS (MDGC/MS) was used to further characterize the samples.

The MDGC/MS system used[18,19] is shown in Figure 2-5. The uniqueness of the MDGC technique lies in the ability to further resolve coeluting peaks from the primary column on a secondary column. This system uses a "Deans switching mechanism" for obtaining narrow fractions (heartcuts) from a primary chromatogram. It uses a low-temperature cryogenically cooled trap at -80 °C and uses two 30 m X 0.25 mm open tube columns (OTCs) with a 0.25 μm film thickness. The primary column contained a non-polar 5% phenylmethylsiloxane stationary phase, while the secondary column used a moderately polar 1701 cyanosiloxane stationary phase. Using the second column with a stationary phase of differing polarity enables better separation of compounds that were not cleanly separated in the first column. The effluent from the secondary OTC was passed directly into an HP 5970B mass selective detector. Both OTCs were mounted inside an HP 5890 GC system.

2.5.4 - PCDDs/PCDFs

PCDDs/PCDFs were quantified from the Method 23 sampling train. This procedure is described in CARB Method 428. The PCDD/PCDF analyses were performed as described in Method 23 with only one exception: the analyses were performed by low resolution mass spectrometry (LRMS) as opposed to high resolution mass spectrometry (HRMS). The use of LRMS can generally quantify only different PCDD/PCDF congener groups, rather than individual isomers within the congener groups.

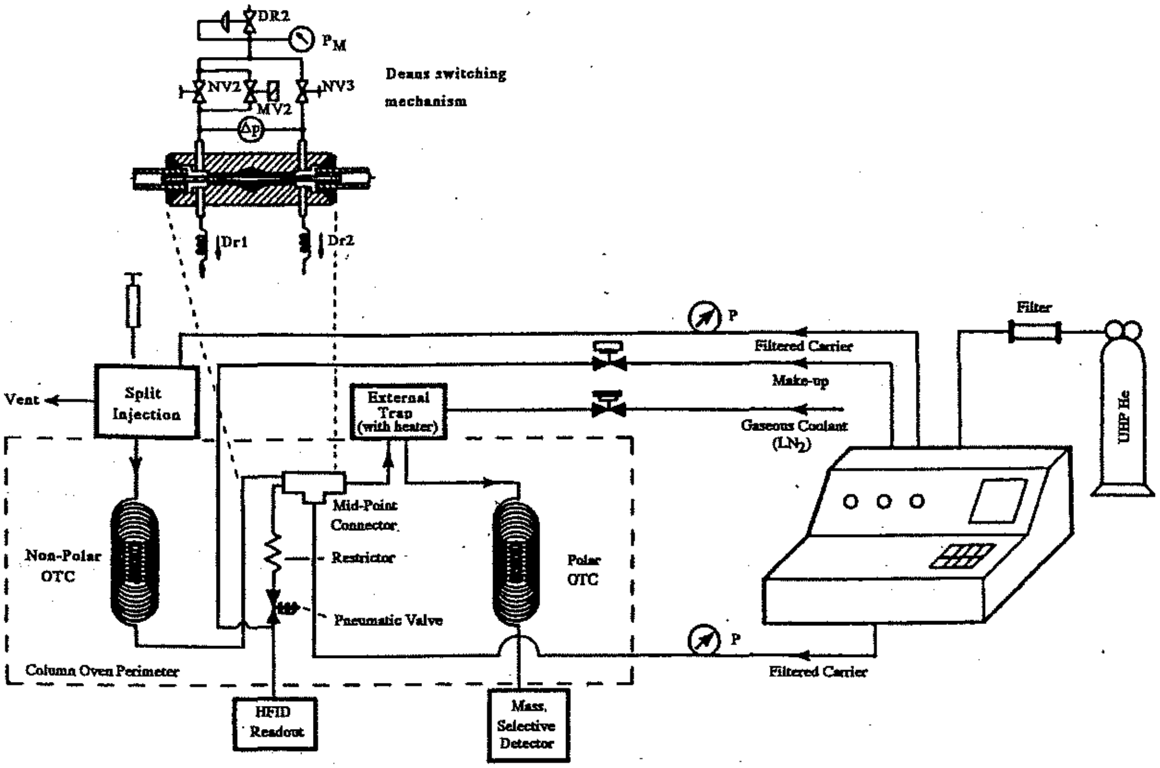

Figure 2-5. MDGC-MS Setup (Copyright © 1996; reproduced with permission of UDRI).

3.0 RESULTS AND DISCUSSION

3.1 - Results from Continuous Measurements

Results from temperature measurements made during the incineration tests are shown in Table 3-1. Note that the thermocouple at the kiln exit broke and was not operational for some of the tests. Also note that we had only mixed success in maintaining constant temperatures in the transition duct. This inability to hold the duct temperatures constant from run to run impacted our ability to develop surrogate performance indicators for PCDDs/PCDFs that are explicitly based on only combustion parameters. The temperatures labeled Duct 1, 2, 3, and 4 represent thermocouples placed at axial positions in the duct leaving the SCC. The Duct 1 thermocouple is just downstream of the water jacket, and the Duct 4 thermocouple is near where the extractive sampling was performed.

Table 3-2 lists the results from the conventional gas CEMs. The columns labeled CO Low and CO High represent the high- and low-range CO analyzers. For runs where CO values were within the normal operating range of the CO Low CEM, the data for the high-range CO analyzer were labeled n/a. The high concentration of acid gases damaged both THC CEMs, eventually resulting in the failure of both instruments (note the n/a's near the end of the test matrix). The HCl CEM was not available for the test days during August 1995. Note that the Duct CO_2 concentrations are approximately 50% of the CO_2 concentrations at the SCC Exit. This is due to dilution air's being added in the transition duct leading to the FGCS. Extractive samples were sampled downstream of the addition of dilution air.

Table 3-1. Temperature Results (°C)

Run	Kiln	SCC Mix	SCC Exit	Duct 1	Duct 2	Duct 3	Duct 4
1	886	890	1006	674	534	327	301
2	865	851	1054	701	552	334	305
3	698	796	1049	712	568	348	320
4	618	778	1007	681	543	333	307
5	470	592	863	548	433	259	236
6	554	632	932	589	462	277	251
7	532	517	497	339	280	218	193
8	495	492	459	313	264	210	186
9	n/a	485	624	387	302	228	193
10	n/a	457	578	352	272	211	181
11	n/a	697	845	488	369	280	243
12	n/a	695	899	548	406	297	258
13	911	567	856	524	370	279	240
14	939	612	867	520	362	263	230
15	925	574	836	554	397	312	272
16	945	562	848	559	403	312	273

Table 3-2. CEM Emissions Results

	Kiln Exit						SCC Exit						Duct		
Run	O2 (%)	CO2 (%)	CO Low (ppm)	CO High (%)	NO (ppm)	THC (ppm)	O2 (%)	CO2 (%)	CO Low (ppm)	CO High (%)	NO (ppm)	THC (ppm)	CO2 (%)	HCl (ppm)	H2O (%)
1	4.53	12.18	33	n/a[a]	190	0	4.25	11.84	41	n/a	148	0	6.69	0	6.59
2	3.79	12.8	27	n/a	217	0	3.51	13.07	46	n/a	150	0	6.98	2	4.93
3	7.73	10.19	25	n/a	540	0	7.09	10.63	30	n/a	454	1	3.13	1259	3.96
4	7.75	10.29	28	n/a	432	1	5.86	11.57	27	n/a	367	0	2.39	1034	2.55
5	9.96	8.3	107	n/a	439	13	8.54	8.91	42	n/a	371	0	5.44	2295	5.5
6	10.53	8.06	41	n/a	364	4	8.89	8.82	11	n/a	478	0	5.76	2577	6.01
7	7.68	10.2	35	n/a	439	3	13.4	5.53	40	n/a	265	10	6.24	2783	3.21
8	9.73	8.6	25	n/a	310	2	14.24	4.84	19	n/a	245	0	5.96	3289	3.78
9	13.77	5.58	37	n/a	162	7	13.15	5.51	306	0.05	229	8	6.34	2436	4.49
10	15.02	4.73	448	0.05	189	3	12.86	5.92	1310	0.14	290	0	5.44	2896	5.81
11	3.73	12.43	1917	0.65	116	33	1.33	14.26	968	0.22	186	59	11.53	5163	11.63
12	3.83	11.98	1891	0.92	108	0	1.47	13.89	1473	0.3	131	0	9.4	4084	9.95
13	2.76	13.2	1770	0.68	231	0	2.64	11.77	1011	0.25	183	0	0	n/a	n/a
14	0.93	14.69	1912	0.82	242	0	1.24	13.67	607	0.11	208	0	0	n/a	n/a
15	4.08	12.34	583	0.35	270	n/a	5.04	16.07	319	0.13	251	n/a	0	n/a	n/a
16	2.45	12.56	524	0.28	215	n/a	4.67	10.58	231	0.15	227	n/a	0	n/a	n/a

a - Not available

3.2 - Volatile Organic Results

3.2.1 - On-Line GC Results

OLGC sampling results are shown in Table 3-3. There are several interesting observations made from these measurements. First, all of the samples taken while no waste was being fed into the RKIS still showed measurable levels of many of the OLGC target analytes. This is likely due to residual contamination of the RKIS itself with some of the chlorinated PICs of interest.

Another observation is that the measurements made at the SCC choke are generally higher than the measurements at the SCC exit, particularly with respect to the chlorinated target analytes. The exception is on Runs 7 and 8, where the SCC's afterburner was off. It is likely that some ring growth was occurring as the gases from the kiln passed through the SCC when no flame was present in the SCC. This observation is illustrated in Figure 3-1, showing the concentration of tetrachloroethylene. Measured values of tetrachloroethene at the choke are consistently higher than at the SCC exit. Figure 3-2 shows this observation for 1,2-dichlorobenzene, a potentially important precursor to PCDDs/PCDFs. Note how the concentration of 1,2-dichlorobenzene is higher at the SCC exit for those runs where the afterburner was off. This shows the potential for significant ring growth to occur in the moderate temperature region of incinerators after the combustion sections, but prior to any heat recovery or rapid quenching.

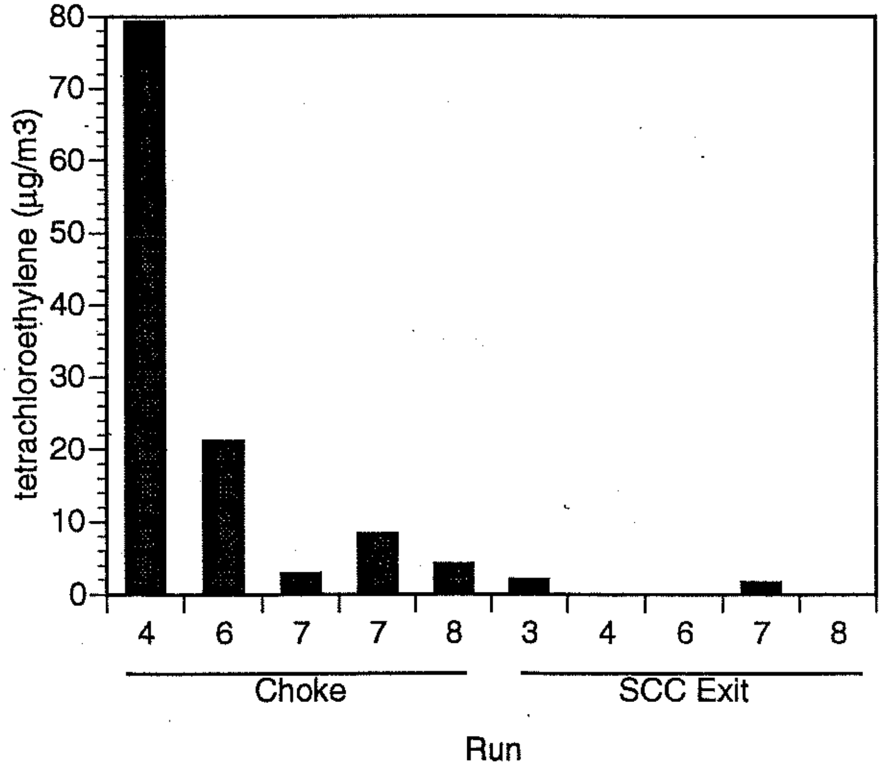

Figure 3-1. OLGC results of tetrachloroethylene concentrations at choke and SCC exit.

Table 3-3. On-line Gas Chromatograph Results for Volatile Organic PICs ($\mu g/m^3$)

Run	chloromethane	vinyl chloride	1,1 dichloroethene	methylene chloride	t-1,2 dichloroethylene	chloroform	1,1,1 trichloroethane	carbon tetrachloride	benzene	1,2 dichloroethane	trichloroethylene	toluene	tetrachloroethylene	chlorobenzene	ethyl benzene	m,p xylenes	styrene	1,3 dichlorobenzene	1,2 dichlorobenzene
3B[a]	32.0	ND[b]	ND	ND	6.0	ND	ND	ND	ND	ND	ND	3.0	2.0	ND	ND	ND	1.6	ND	ND
3	24.8	ND	ND	ND	9.0	ND	ND	ND	ND	ND	ND	4.4	2.0	ND	ND	2.0	2.9	2.7	1.1
4	3.8	23.4	ND	ND	ND	2.0	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND
4C[c]	23.6	ND	9.6	ND	ND	37.5	ND	38.3	4.3	ND	15.9	4.3	79.3	1.7	ND	ND	7.3	30.2	75.9
6B	ND	ND	6.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6	ND	ND	13.0	ND	ND	ND	16.1	ND	ND	ND	ND	11.1	ND	ND	ND	3.5	ND	ND	ND
6C	ND	44.9	17.4	ND	ND	ND	ND	25.6	5.0	ND	11.6	ND	21.2	14.3	ND	ND	ND	25.9	150.9
7B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.17	ND	1.7	ND	ND	ND	ND	ND	ND
7	ND	ND	ND	ND	ND	26.6	5.8	8.5	ND	ND	1.9	ND	1.7	5.6	ND	ND	ND	6.2	6.8
7C	ND	ND	ND	ND	ND	22.9	10.6	27.7	ND	ND	3.4	ND	8.3	ND	ND	ND	ND	ND	ND
7C	ND	ND	ND	ND	ND	21.9	2.3	17.7	3.5	ND	0.7	ND	2.9	ND	ND	ND	ND	8.6	ND
8B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8BC	ND	ND	ND	ND	ND	ND	11.0	9.0	ND	ND	3.1	ND	11.0	ND	ND	3.4	ND	ND	15.3
8	ND	ND	ND	ND	ND	ND	ND	ND	3.7	ND	ND	6.8	ND	11.8	ND	3.2	ND	ND	49.1
8C	ND	ND	ND	ND	ND	ND	8.0	66.8	ND	ND	3.8	ND	4.1	ND	ND	ND	ND	ND	16.2

a - sample taken as combustion blank prior to initiation of waste feed.

b - not detected.

c - sample taken at SCC choke.

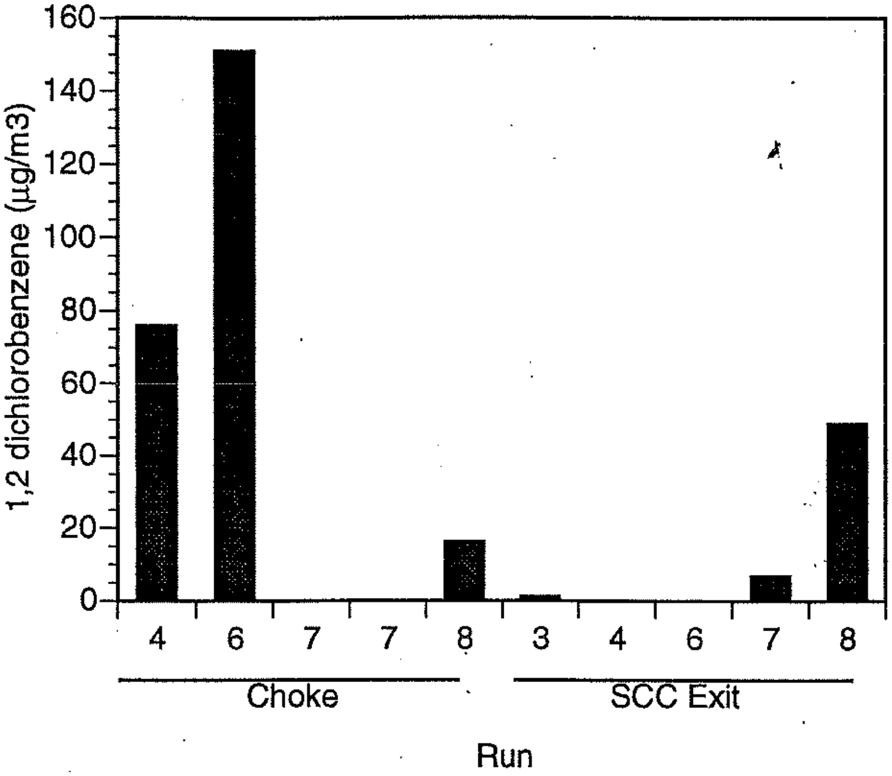

Figure 3-2. OLGC results of 1,2 dichlorobenzene concentrations at choke and SCC exit.

3.2.2 - VOST and Tedlar Bag Results

Analyses of the Tedlar bag samples for C_1 and C_2 non-halogenated alkanes, alkenes, and alkynes resulted in none of those compounds being detected. Estimated minimum detection limits are on the order of 1 - 2 ppm, and apparently none of these compounds were present at these levels. This is consistent, however, with our measured THC concentrations on the order of 1-2 ppm.

The VOST and Tedlar bag analytical results indicate that a significant number of VOC PICs have been identified both as target analytes and as tentatively identified compounds (TICs). Table 3-4 shows the Tedlar bag results for the target analytes, and Table 3-5 shows the Tedlar bag TIC results. VOST results are shown in Table 3-6. The VOST target analyte results are displayed qualitatively in Table 3-7, showing which of the VOST target analytes were detected. Table 3-8 qualitatively lists the VOST TICs. Although differences exist in quantitation levels between VOST and the Tedlar bags, it must be remembered that VOST samples are taken over longer periods of time. Of the 44 target analytes, 38 were detected. It should be noted that several of these compounds are POHCs. Over 50 nontarget analytes were tentatively identified as PICs. However, a large number of PICs present in the VOST samples were not identified. To aid in perspective, at least 82 compounds were detected in a single sample. Of those, 28 were identified as target analytes, 21 were tentatively identified, and 33 remained unidentified.

Table 3-4. Tedlar Bag Results: Target Compounds (µg/m^3)

Run	**5**	**6**	**9**	**14**
chloromethane	18742	2827	1	55
vinyl chloride	ND	ND	ND	ND
bromomethane	8304	667	ND	29
chloroethane	ND	18	ND	ND
1,1-dichloroethene	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND
carbon disulfide	ND	ND	6	33
acetone	ND	1703	137	288
methylene chloride	ND	116	ND	28
1,2-dichloroethene	ND	ND	ND	ND
1,1-dichloroethane	ND	ND	ND	ND
chloroform	ND	50	ND	ND
1,2-dichloroethane	ND	ND	ND	ND
2-butanone	569	232	46	28
1,1,1-trichloroethane	ND	ND	ND	ND
carbon tetrachloride	75	65	ND	ND
benzene	232	64	5	11
trichloroethene	19	ND	ND	ND
1,2-dichloropropane	ND	ND	ND	ND
dibromomethane	ND	5	ND	ND
bromo dichloromethane	15	16	ND	ND
cis-1,3-dichloropropene	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND
trans-1,3-dichloropropene	ND	ND	ND	ND
1,1,2-trichloroethane	ND	ND	ND	ND
dibromochloro-methane	ND	17	ND	ND
1,2-dibromoethane	ND	7	ND	ND
bromoform	15	22	ND	ND
4-methyl-2-pentanone	ND	ND	ND	ND
toluene	27	16	ND	21
tetrachloroethene	ND	ND	ND	20
chlorobenzene	ND	20	ND	ND
ethylbenzene	9	3	ND	ND
1,1,1,2-tetrachloroethane	ND	ND	ND	ND
m,p-xylene	30	8	ND	ND
o-xylene	12	4	ND	ND
styrene	14	4	10	ND
1,1,2,2-tetrachloroethane	ND	ND	ND	ND
1,2,3-trichloropropane	ND	ND	ND	ND
trans-1,4-dichloro-2-butene	ND	ND	ND	ND
pentachloroethane	ND	ND	ND	ND
1,2-dibromo-3-chloropropane	ND	ND	ND	ND

Table 3-5. Tedlar Bag Results: Tentatively Identified Compounds (µg/m^3)

Run	**5**	**6**	**9**	**14**
1,1-dimethoxy ethane	ND	489	ND	ND
1,2-dichlorobenzene	ND	71	ND	ND
1-pentene 3-methyl 2-ethyl	ND	ND	19	357
1-phenyl ethanone	443	296	ND	ND
2-methyl 1-propene	ND	ND	9	175
2-nitrophenol	81	ND	ND	ND
3-methylene pentane	ND	ND	ND	130
3-methyl heptane	ND	ND	6	80
3-methyl pentane	ND	ND	20	2490
3-methylene nonane	ND	ND	7	ND
acetaldehyde	ND	ND	ND	164
benzaldehyde	481	218	ND	ND
benzoic acid methyl ester	325	68	ND	ND
benzonitrile	122	194	ND	ND
cyclohexane	ND	ND	ND	339
dodecane	ND	ND	17	ND
hexane	2402	ND	661	3904
methyl cyclopentane	4850	ND	ND	4896
nitromethane	1223	ND	ND	ND
tetrahydrofuran	7836	ND	96	ND
tridecane	ND	61	ND	ND
trimethyl hexane	ND	ND	77	ND
undecane	103	ND	32	ND

Table 3-6. VOST Results (μg/m^3)

	Run											
	5	6	7	8	9	10	11	12	13	14	15	16
dichlorodifluoromethane	819.6	418.5	50.2	257.9	2.3	0.1	0.6	14.7	2.3	11.4	169.0	1.9
chloromethane	1066	2.0	0.8	4.8	12.6	2.7	5.6	142.8	16.2	3.5	41.5	19.1
vinyl chloride	1.7	0.1	0.7	0.9	11.3	42.3	1.8	94.8	4.5	3.6	44.0	20.0
bromomethane	197.4	6.2	4.1	9.9	27.6	1.7	12.5	74.3	2.3	2.4	12.0	11.0
chloroethane	7.5	0.4	0.1	1.7	0.8	0.1	1.1	2.3	0.1	0.4	1.7	0.9
trichlorofluoromethane	5.9	12.3	0.6	0.7	0.3	ND	0.03	0.2	ND	ND	0.1	0.1
1,1-dichloroethene	6.6	ND	0.9	2.0	46.3	15.4	1.9	56.1	0.7	0.6	5.6	4.8
iodomethane	0.3	0.3	ND	ND	ND	ND	0.1	0.2	0.1	ND	ND	0.6
carbon disulfide	17.4	2.5	1.3	4.7	1.7	0.3	4.6	3.6	1.2	1.5	81.7	31.6
acetone	15.8	8.4	7.1	6.0	2.4	0.3	3.2	37.3	1.6	2.4	4.6	3.5
methylene chloride	26.9	42.7	10.3	15.8	3.3	2.3	3.8	59.5	10.5	13.5	73.6	39.0
1,2-dichloroethene	1.0	ND	0.2	0.4	15.9	1.9	3.6	44.3	1.1	4.6	26.6	23.5
1,1-dichloroethane	ND	0.1	ND	0.1	ND	ND	0.03	0.1	ND	ND	0.1	0.1
chloroform	15.9	26.7	5.5	7.7	9.9	6.3	11.7	19.5	2.1	4.8	19.9	30.8
1,2-dichloroethane	0.7	0.4	ND	0.2	0.2	1.0	1.1	11.0	1.4	1.0	5.5	8.4
2-butanone	2.6	2.4	0.6	0.6	ND	1.0	0.7	0.7	0.7	0.7	ND	1.3
1,1,1-trichloroethane	0.3	0.5	0.1	0.2	0.1	0.1	0.1	0.2	ND	ND	ND	0.1
carbon tetrachloride	6.7	22.7	5.0	29.6	152.4	297.9	8.5	13.9	1.4	1.9	24.5	28.8
benzene	1.9	1.1	1.2	2.1	1.4	268.9	26.0	7.0	36.6	226.7	218.6	221.2
trichloroethene	1.7	0.3	0.7	2.0	40.1	96.2	13.8	54.2	24.4	32.3	52.4	54.8
1,2-dichloropropane	ND	0.1	ND	0.1	ND	ND	0.03	0.1	1.7	1.9	0.1	0.2
dibromomethane	1.4	0.8	4.0	12.2	3.8	201.1	7.4	11.5	1.7	0.8	8.3	9.2
bromodichloromethane	2.4	2.6	5.3	9.5	35.1	165.2	12.6	13.0	2.2	4.4	19.7	27.5
cis-1,3-dichloropropene	ND	0.1	ND	ND	0.1	ND	0.2	0.2	ND	ND	0.7	0.9
2-hexanone	ND	0.2	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND
trans-1,3-dichloropropene	ND	0.2	ND	ND	0.4	ND	0.3	0.3	ND	ND	0.6	0.8
1,1,2-trichloroethane	0.1	ND	ND	ND	ND	ND	ND	0.7	0.1	ND	ND	ND
dibromochloromethane	3.1	3.3	6.4	14.2	43.4	223.2	11.2	5.1	0.4	2.1	15.0	26.4
1,2-dibromoethane	1.6	8.0	0.3	1.9	1.9	109.7	1.9	7.6	1.2	0.5	62.8	39.6
bromoform	16.7	19.4	37.8	44.1	73.0	817.4	40.7	18.0	0.2	0.4	31.7	43.9

(continued)

Table 3-6 (cont). VOST Results ($\mu g/m^3$)

	Run 5	6	7	8	9	10	11	12	13	14	15	16
4-methyl-2-pentanone	ND	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
toluene	15.6	32.6	2.0	2.2	1.4	2.6	0.8	24.1	2.8	1.5	23.1	25.1
tetrachloroethene	5.4	1.5	1.0	5.8	97.0	750.5	20.7	90.2	25.1	31.7	52.5	59.4
chlorobenzene	3.5	36.3	2.1	3.9	46.3	8530	4.3	15.3	5.8	4.7	75.6	72.0
ethylbenzene	1.6	7.2	0.2	0.1	0.4	ND	0.2	0.2	1.3	ND	0.9	1.3
1,1,1,2-tetrachloroethane	ND	0.1	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND
m,p-xylene	5.4	23.2	0.6	0.4	1.5	3.0	0.8	0.6	5.8	0.6	1.3	2.0
o-xylene	1.6	9.7	0.2	0.1	ND	1.2	0.3	ND	0.9	ND	0.6	0.9
styrene	0.2	ND	0.03	0.2	ND	ND	0.1	ND	1.8	1.4	12.0	23.3
1,1,2,2-tetrachloroethane	ND	0.2	0.1	0.1	0.3	ND	0.2	0.03	ND	ND	0.1	ND
1,2,3-trichloropropane	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,4-dichloro-2-butene	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	4.8	13.6
pentachloroethane	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromo-3-chloropropane	0.1	0.4	ND	0.4	0.8	237.1	ND	1.3	ND	ND	ND	ND

Table 3-7. Target Volatile Organic Compounds Detected.

Dichlorodifluoromethane
Chloromethane
Vinyl chloride
Bromomethane
Chloroethane
Trichlorotrifluoromethane
1,1-Dichloroethene
Carbon disulfide
Acetone
Methylene chloride
1,2-Dichloroethene
1,1-Dichloroethane
Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon tetrachloride
Benzene
Trichloroethene
1,2-Dichloropropane
Dibromomethane
Bromodichloromethane
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Dibromochloromethane
1,2-Dibromoethane
Bromoform
4-Methyl-2-pentanone
Toluene
Tetrachloroethane
Chlorobenzene
Ethylbenzene
1,1,1,2-Tetrachloroethane
Xylene (m, p)
Xylene (o)
Styrene
trans-1,4-Dichloro-2-butene
1,2-Dibromo-3-chloropropane

Table 3-8. Tentatively Identified VOST Compounds

Bromotrichloromethane
Chloroethyne
Bromoethyne
Bromochloroethyne
Dichloroethyne
Bromoethene
Bromochloroethene
Dibromoethene
Bromodichloroethene
Dibromochloroethene
Tribromoethene
Bromotrichloroethene
Tribromochloroethene
Dibromodichloroethene
Tetrabromoethene
Bromochloroethane
Bromopropyne
Bromochloropropyne
Bromodichloropropyne
Bromopropene
Pentachloropropene
Dibromopropane
Hexachlorobutadiene
Pentachlorobutadiene
Chlorobutane
Bromoheptane
Chlorooctane
Benzylchloride
Bromobenzene
Bromomethylbenzene
Bromdimethylbenzene
Bromochlorobenzene
Dibromobenzene
Bromodichlorobenzene
Propene
Methyl propene
Methyl butane
Butadiyne
Butadiene
Pentene
Pentane
Hexene
Hexane
Methylcyclohexane
Heptane
Methylheptane
Dimethylheptane
Octane
Nonane
Decane
Methyldecane
Undecane
Methylfuran
Benzaldehyde
Methylpentenal
Benzonitrile
Chlorothiophene
Tetrachlorothiophene
Dibromothiophene

An interesting comparison was made of the C_1 and C_2 halogenated alkanes, alkenes, and alkynes. A table was made of the possible chloro, bromo, and mixed bromochloro organics with one and two carbons (Table 3-9). With only a few exceptions, each compound was detected in at least one sample. These C_1 and C_2 compounds are of particular interest: they are considered to be precursors in aromatic ring propagation reactions leading to higher molecular weight PICs[20].

Table 3-9. Combinations of Detected C_1 and C_2 Compounds

	Target Analyte	Compound Detected
C_1 Hydrocarbons		
chloromethane	Yes	•[a]
bromomethane	Yes	•
dichloromethane	Yes	•
dibromomethane	Yes	•
bromochloromethane	Yes	•
trichloromethane	Yes	•
tribromomethane	Yes	•
bromodichloromethane	Yes	•
dibromochloromethane	Yes	•
tetrachloromethane	Yes	•
tetrabromomethane	No	•
bromotrichloromethane	No	•
dibromodichloromethane	No	
tribromochloromethane	No	
C_2 Alkynes		
chloroethyne	No	•
bromoethyne	No	•
dichloroethyne	No	•
dibromoethyne	No	
bromochloroethyne	No	•
C_2 Alkenes		
chloroethene	Yes	•
bromoethene	No	•
dichloroethene (total)	Yes	•
dibromoethene	No	•
bromochloroethene	No	•
trichloroethene	Yes	•
tribromoethene	No	•
bromodichloroethene	No	•
dibromochloroethene	No	•
tetrachloroethene	Yes	•
tetrabromoethene	No	•
bromotrichloroethene	No	•
dibromodichloroethene	No	•
tribromochloroethene	No	•

(continued)

Table 3-9 (cont). Combinations of Detected C_1 and C_2 Compounds

	Target Analyte	Compound Detected
C_2 Alkanes		
chloroethane	Yes	•
bromoethane	No	
dichloroethane	Yes	•
dibromoethane	Yes	•
bromochloroethane	No	•
trichloroethane	Yes	•
tribromoethane	No	
bromodichloroethane	No	
dibromochloroethane	No	
tetrachloroethane	Yes	•
tetrabromoethane	No	
bromotrichloroethane	No	
dibromodichloroethane	No	
tribromochloroethane	No	

a - Detected, but not quantified.

The results of analysis (from both VOST and Tedlar bags) for halogenated C_1 and C_2 VOCs are listed in Table 3-10. The list contains possible chloro, bromo, and bromochloro organics with one or two carbons. Note that dichloromethane (CH_2Cl_2) was found as a contaminant in some of the blanks, possibly as a laboratory contaminant. Also, it is not known why the chloromethane concentration was so high on one of the VOST tubes for Run 5. The Tedlar bag measurements of chloromethane were also very high for that run. An interesting observation is that, with few exceptions, almost all of these possible compounds were detected in at least one of the runs. If the data are further analyzed, by simply averaging the concentrations of all identified compounds for all of the reported runs, Figure 3-3 can be constructed. Figure 3-3 shows the concentrations of some of the halogenated C_1 and C_2 compounds grouped together, with the chlorinated and brominated analogs compared side by side. Note that the concentrations of the brominated and chlorinated analogs are similar in most cases, even though Br was present in the feed at a mass fraction of only about 10 % of the level of the Cl. This observation indicates that the presence of relatively small amounts of Br can potentially produce quantities of brominated PICs at levels comparable to those of the chlorinated PICs. Table 3-10 also shows that significant quantities of mixed bromochloro PICs were also measured. These low-carbon halogenated PICs are participants in aromatic ring growth reactions leading to the larger organic PIC molecules, such as the chlorinated benzenes and phenols, and possibly PCDDs/PCDFs.

Table 3-11 lists the concentrations of the aromatic VOCs found in the tests. Although the aromatic compounds are not identified as commonly throughout all the runs as the smaller molecules were, a similar pattern is found. The data from Run 10, which had the increased Br feed concentration, show the highest concentration and highest number of identified aromatic brominated and bromochloro PICs. The concentrations of brominated compounds are generally on the same order of magnitude as their chlorinated analogs.

Table 3-10. C_1 & C_2 Halogenated Hydrocarbons ($\mu g/m^3$)

Compound	Run 5	Run 6	Run 9	Run 10	Run 13	Run 14
chloromethane	1066	2.6	12.7	2.8	16.3	3.5
bromomethane	197	7.7	27.6	1.8	2.3	2.4
dichloromethane	26.9	69.3	3.3	2.3	10.5	13.6
dibromomethane	1.35	1.3	3.8	208	1.7	0.8
bromochloromethane	0	0	0	0	0	0
trichloromethane	16.0	24	9.9	6.6	2.1	4.8
tribromomethane	16.7	30.7	73	846	0.17	0.4
bromodichloromethane	2.4	2.2	35.1	171	2.2	4.4
dibromochloromethane	3.1	6.0	43.4	231	0.4	2.1
tetrachloromethane	6.7	19.2	152	308	1.4	1.9
tetrabromomethane	0	0	0	0	0	0
bromotrichloromethane	0	0	12.2	42.1	0	0
dibromodichloromethane	0	0	0	0	0	0
tribromochloromethane	0	0	0	0	0	0
chloroethyne	0	0	0	0	21.1	10.6
bromoethyne	0	0	0	0.8	13.4	9.1
dichloroethyne	0	0	0	0	0	0
dibromoethyne	0	0	0	0	0	0
bromochloroethyne	0	0	0	0	6.5	2.3
chloroethene	1.7	0.2	11.25	43.8	4.5	3.6
bromoethene	0	0	0	2.6	0	0
dichloroethene (total)	7.5	0.15	62.2	17.9	1.8	5.2
dibromoethene	0	2.1	0	0.8	0	6.7
bromochloroethene	0	0	2.3	46.7	1.5	0
trichloroethene	1.7	0.5	40.1	99.6	24.4	32.5
tribromoethene	0	0	0	3.1	8.5	9.1
bromodichloroethene	0	0	0	0	0	38.6
dibromochloroethene	0	0	0	0	14.8	25.9
tetrachloroethene	5.5	1.9	0	0	0	31.9
tetrabromoethene	0	0	0	0	0	0
bromotrichloroethene	0	0	2.4	0	0	0
dibromodichloroethene	0	0	0	5.2	32.4	28.9
tribromochloroethene	0	0	0	0	0	9.5
chloroethane	7.5	0.5	0.8	0.1	0.1	0.4
bromoethane	0	0	0	0	0	0
dichloroethane	0.8	0.5	0.2	1	1.4	1
dibromoethane	1.6	6.3	1.9	114	1.8	0.5
bromochloroethane	0	2.3	7.5	187	2.8	0

(continued)

Table 3-10 (cont). C_1 & C_2 Halogenated Hydrocarbons ($\mu g/m^3$)

Compound	Run 5	Run 6	Run 9	Run 10	Run 13	Run 14
trichloroethane	0.5	0.6	0.1	0.2	ND	ND
tribromoethane	ND[a]	ND	ND	ND	ND	ND
bromodichloroethane	ND	ND	ND	ND	ND	ND
dibromochloroethene	ND	ND	ND	ND	ND	ND
tetrachloroethane	ND	0.2	97.1	ND	11.2	ND
tetrabromoethane	ND	ND	ND	ND	ND	ND
bromotrichloroethane	ND	ND	ND	ND	ND	ND
dibromodichloroethane	ND	ND	ND	ND	ND	ND
tribromochloroethane	ND	ND	ND	ND	ND	ND

a - none detected

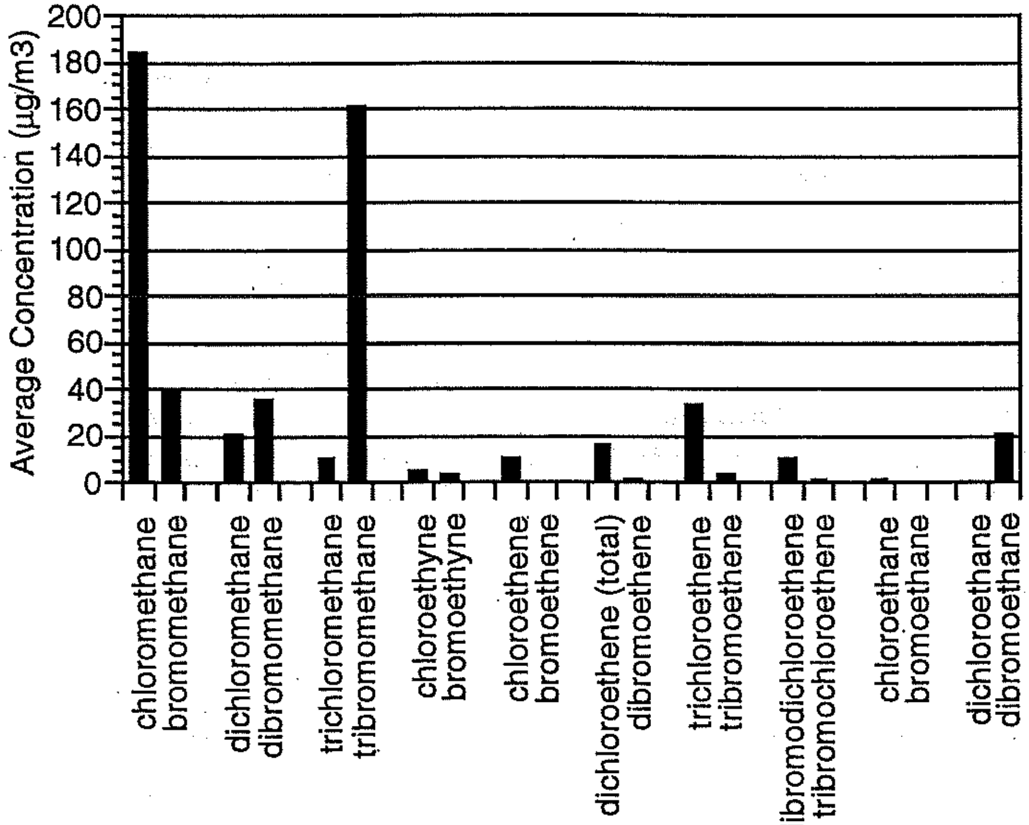

Figure 3-3. Average concentrations of analogous C_1 and C_2 halogenated compounds

Table 3-11. Halogenated Aromatic VOC Results (µg/m^3)

	Baseline				Low SCC Temp			SCC Fuel Rich			
Test Condition	5	5	6	6	9	9	10[a]	13	13	13	14
chlorobenzene	4.2	2.7	36.3	14.8	16.8	75.8	8828	3.7	0	13.7	4.7
bromobenzene	0	0	0	0	0	0	13.2	0	0	1.6	0
dichlorobenzene	0	0	3.8	8.1	0	36.7	37.4	3.5	0	2.8	0.9
bromochlorobenzene	0	0	0	0	0	3.9	38.1	0	0	0.6	0
dibromobenzene	0	0	0	0	0	0	4.0	0	0	0	0
trichlorobenzene	0	0	0	0	2.6	8.7	32.7	0	0	0	0
bromodichlorobenzene	0	0	0	0	0	0	5.7	0	0	0	0
dibromochlorobenzene	0	0	0	0	0	0	0	0	0	0	0
tribromobenzene	0	0	0	0	0	0	0	0	0	0	0
bromomethylbenzene	3.0	0	1.3	0	0	0	0	0	0	0	0
bromodimethylbenzene	0	0	5.7	1.6	0	0	0	0	0	0	0

a - on Run 10, too much ethylene dibromide was inadvertently added

3.3 - Semivolatile and Non-Volatile Organics

3.3.1 - Conventional GC/MS Analytical Results

The semivolatile organic analytical results of the methylene chloride extracts indicate that a significant number of PICs have been identified both as target analytes and as TICs. For the analytical data evaluated, PICs identified as target analytes and TICs are presented in Tables 3-12 and 3-13, respectively. Many of the target analytes were detected. It should be noted once again that several of these compounds were in the original surrogate waste feed. Over 50 nontarget analytes were tentatively identified as PICs. Many of the PICs present in the MM5 samples were not identified. Also, the mix of PICs found on the filter sample fraction differed from that of the XAD-2 sample fraction. For a selected filter sample, at least 174 compounds were detected: 25 were identified as target analytes, 11 were tentatively identified, and 138 remained unidentified. For a selected XAD-2 sample, at least 194 compounds were detected: 18 were identified as target analytes, 17 were tentatively identified, and 159 remained unidentified. Identification of non-target analytes was particularly complicated by coeluting compounds. Coeluting compounds result in combined mass spectra that cannot be compared easily to reference spectra.

Many of the TICs were oxygenated compounds, such as esters, aldehydes, diones, and carboxylic acids. There were also many brominated TICs. There were also a significant number of unidentifiable aliphatic hydrocarbons, silanes, and phthalates that were not reported in Table 3-13. Silanes are frequently found as chromatographic artifacts from degradation of GC columns. Phthalates are commonly found in combustor emissions, but it is not well-established whether they are actual PICs or artifacts resulting from sampling and analytical treatments.

Analysis of the acetone and toluene sample extracts did not result in the identification of additional compounds. These analyses do verify the acceptable performance of methylene chloride as the single extraction solvent.

Table 3-12. Semivolatile Organic Target Results (μg/m^3)

Run	1	2	3	4	5	6	9	10	11	13	14	15
N-methyl-N-nitroso-ethanamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	0.3	0.8	ND	0.5	ND	0.5	ND	ND	4.0	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	0.4	1.8	0.5	1.3
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	0.3	1.0	0.2	1.0
1,2-Dichlorobenzene	ND	ND	ND	0.6	ND	21.9	ND	1.5	0.7	29.3	0.5	2.7
Benzyl alcohol	ND	0.5	ND	ND	ND	ND	ND	ND	ND	1.6	ND	ND
Bis(2-chloroisopropyl) ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylphenol	ND	0.2	ND	ND	ND	1.5	ND	ND	0.3	0.3	ND	ND
Acetophenone	ND	ND	ND	ND	ND	ND	ND	ND	6.2	1.4	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodipropylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND
1-Nitrosopiperidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	0.2	ND	0.2	ND	ND	2.5	3.6	1.0	3.1
Naphthalene	ND	0.3	ND	1.6	ND	7.7	ND	1.0	110	21.9	3.5	107
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND
2,6-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4
N-Butyl-N-nitroso-butanamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methyl-phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	0.2	ND	0.8	ND	1.3	ND	ND	1.6	0.4	ND	ND
1,2,4,5-Tetrachlorobenzene	ND	0.2	ND	0.7	ND	0.2	ND	ND	4.5	1.0	1.2	39.5
Hexachlorocyclopentadiene	ND	ND	ND	0.7	ND	ND	ND	ND	ND	0.2	ND	7.7

(continued)

Table 3-12. Semivolatile Organic Target Results (continued) (μg/m^3)

Run	1	2	3	4	5	6	9	10	11	13	14	15
2,4,6-Trichlorophenol	ND	0.3	ND	ND	ND	0.3	ND	0.4	13.1	2.8	1.2	30.9
2,4,5-Trichlorophenol	ND	0.5	ND	ND	ND	0.5	ND	0.5	ND	ND	ND	30.5
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	0.7	4.2	0.9	ND	199
2-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND
1,4-Naphthoquinone	ND	ND	ND	ND	ND	ND	ND	4.4	ND	ND	ND	ND
Dimethylphthalate	ND	0.2	ND	ND	ND	7.4	ND	1.6	ND	ND	ND	34.6
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	0.7	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	ND	5.9	5.7	1.3	ND	74.6
Pentachlorobenzene	ND	1.2	ND	1.8	ND	1.2	ND	0.8	29.3	6.9	2.8	128
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	ND	0.3	ND	0.2	ND	0.3	ND	1.8	30.9	5.4	2.5	36.9
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	3.2	ND	ND	ND
Diethyl phthalate	0.2	2.2	ND	1.9	0.8	3.1	0.5	0.3	4.1	0.8	1.2	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methyl-4,6-dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diphenylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	0.5	ND	2.6	ND	2.3	9.4	3.4	2.2	18.5
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	1.4	31.3	5.5	1.4	13.8
Pentachloronitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	0.2	ND	ND	ND	ND	ND	8.1	26.7	4.1	0.3	2.2
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibutyl phthalate	35.4	41.9	58.8	91.3	49.9	69.4	153	42.3	50.0	12.9	13.5	3.0
Fluoranthene	ND	0.2	ND	ND	ND	ND	ND	0.8	6.8	0.7	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND

(continued)

Table 3-12. Semivolatile Organic Target Results (continued) ($\mu g/m^3$)

Run	1	2	3	4	5	6	9	10	11	13	14	15
P-Dimethylaminoazobenzene	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Benzyl butyl phthalate	0.2	0.3	ND	0.2	0.9	ND	ND	ND	0.3	0.8	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-N-octyl phthalate	1.4	1.4	3.6	38.9	0.8	278	0.3	ND	448	ND	146	6743
Benzo(b)fluoranthene	ND	0.2	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND
7,12-Dimethylbenz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	0.2	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	0.2	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	ND	0.2	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	0.3	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	0.2	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	ND	0.3	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND

Table 3-13. Semivolatile Organic Tentatively Identified Compounds (μg/m^3)

Run	1	2	3	4	5	6	9	10	11	13	14	15
1,1'-Biphenyl	ND	0.5	ND	ND	ND	ND	ND	ND	3.2	ND	ND	3.3
1,1'-Biphenyl, 2-phenoxy	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrabromoethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.0	ND
1,1,2-Tribromo-2-chloro-ethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.0	ND
1,1,2-Trichloroethane	ND	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4-Tetrachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	3.1	ND	ND	ND
1,2-Dibromo-1,2-dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12.4	ND
1,2-Dibromo-trans-cyclohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	60.0	ND	ND
1,3-Isobenzofurandione	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dibromo-cyclohexane	ND	ND	ND	2.4	ND	25.5	ND	ND	23.7	ND	42.4	ND
1,4-Dimethyl benzene	ND	ND	ND	ND	ND	5.8	ND	ND	ND	ND	ND	ND
1,8-Naphthalic anhydride	ND	ND	ND	ND	ND	ND	ND	29.9	ND	ND	ND	ND
1-Bromo-1,2,2-trichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.6
1-Bromo-2-methoxy-,cis-cyclohexane	ND	ND	1.6	0.9	ND	ND	ND	ND	ND	ND	67.6	ND
1-Bromo-2-methyl-benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.7
1-Bromo-4-methyl-benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.4
1-Bromo-naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.6
1-Hexanol, 2-ethyl	ND	ND	ND	3.3	ND	9.6	ND	12.2	ND	ND	ND	ND
1H,3H-Naphtho[1,8-cd]pyran-1-3-dione	ND	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND
1H-Isoindole-1,3(2H)-dione	ND	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND
2,2,3-Tribromobutane	ND	ND	ND	5.9	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Tribromotoluene	ND	ND	ND	ND	ND	ND	ND	ND	7.6	ND	ND	ND
2,5-Cyclohexadiene-1,4-dione	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND
2,5-Dibromothiophene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5
2,6-Dibromo-p-chlorophenol	ND	ND	ND	ND	ND	7.1	ND	ND	ND	ND	ND	3.7
2-Butoxy-ethanol	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND
2-Chloro-pyridine	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND
2-Ethyl hexanoic acid	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND
2-Ethyl-1-hexanol	ND	ND	ND	ND	ND	ND	ND	ND	11.6	ND	ND	ND
4-Bromo-benzonitrile	ND	ND	ND	ND	ND	ND	ND	ND	3.1	ND	ND	ND
6-Bromo-1,1,a,6-cycloprop[a]indene	ND	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND	ND

(continued)

Table 3-13. Semivolatile Organic Tentatively Identified Compounds (continued) ($\mu g/m^3$)

Run	1	2	3	4	5	6	9	10	11	13	14	15
9,10-Anthracenedione	ND	ND	ND	ND	ND	ND	ND	10.4	ND	ND	ND	ND
9-Bromo-anthracene	ND	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND
9H-Fluoren-9-one	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	ND	2.5	ND	2.3	ND	8.3	ND	ND	ND	ND	ND	ND
Benzaldehyde, ethyl	ND	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic acid	ND	ND	ND	5.9	ND	5.7	ND	ND	11.2	ND	ND	ND
Benzoic acid, methyl ester	ND	ND	ND	0.9	ND	33.8	ND	ND	4.6	ND	ND	4.2
Bromobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butanoic acid, methyl ester	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	6.0	ND	ND	ND	ND	ND	9.1
Cyclohexadecane	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND
Cyclopentanecarboxaldehyde	ND	ND	ND	ND	ND	ND	ND	ND	0.4	4.9	ND	ND
Decane	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromoethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	15.1	ND	ND
Ethyl benzene	ND	1.6	ND	6.1	ND	11.3	ND	ND	ND	ND	ND	ND
Hexanedecanoic acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.3	ND	ND
Hexanedecanoic acid, methyl ester	ND	ND	ND	ND	0.4	12.3	ND	22.0	9.9	18.3	ND	10.4
Hexanedioic acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.7	ND	ND
Hexanedioic acid, bis(2-ethylhexyl)	ND	ND	ND	ND	ND	ND	ND	ND	ND	12.9	ND	ND
Hexanedioic acid, dimethyl ester	ND	ND	ND	0.8	0.5	ND	ND	ND	ND	ND	ND	ND
Hexanedioic acid, dioctyl ester	ND	61.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexanedioic acid, mono(2-ethylhexyl)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexanoic acid	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND
Methyl benzene	147.5	577.3	5.4	840.5	20.5	1446.6	ND	ND	202.2	ND	ND	ND
Nonane	ND	ND	ND	106.4	ND	ND	ND	ND	ND	ND	ND	ND
Octadecanoic acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	21.4	ND	ND
Octadecanoic acid, methyl ester	0.7	ND	ND	0.7	ND	31.1	ND	ND	8.2	17.2	ND	4.8
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12.7
Tetrachloroethane	ND	5.0	2.9	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.6
Triacetin	ND	ND	ND	ND	ND	ND	ND	ND	ND	155.1	ND	ND
Tribromoethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	11.1	ND	ND
Tribromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorobromobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

3.3.2 - Multi-Dimensional GC/MS Analytical Results

Figure 3-4 shows the results from the MDGC/MS analysis of the extract from Run 10. A 15 second heartcut (showing a doublet, two closely spaced peaks) and a 10-second heartcut from a single peak (a singlet) were trapped at low temperature, and then both collected fractions were rechromatographed by the secondary OTC (the more polar phase column). Both heartcuts were chosen by the difficulty of compound identification through MS spectral library searches. The lower section of Figure 3-4 shows the chromatograms and MS identifications for these two heartcuts. It is readily apparent that many more compounds were present in both of the heartcuts than would appear from examination of the primary chromatogram. More importantly, good separation was obtained by using the second chromatography step, resulting in reliable MS identifications. This technique verifies that complex samples, such as incinerator emissions, cannot be fully characterized using conventional techniques due to the problem of compound coelution. Table 3-14 shows a list of compounds identified from the two heartcut fractions. The potential benefits of using this technique for detailed examination of each peak of the primary chromatogram are obvious.

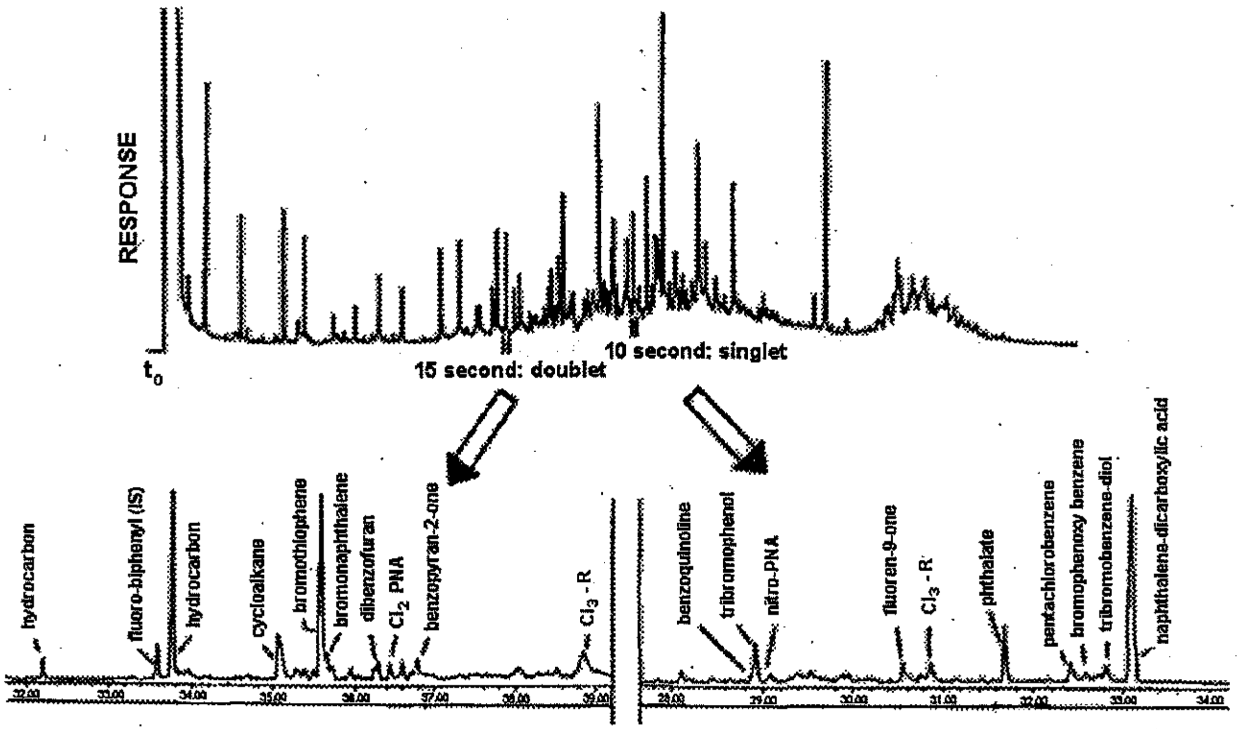

Figure 3-4. MDGC/MS Analysis of Methylene Chloride Extract from Run 10. The upper trace is for the single-column, "one-dimensional" analysis. "Two dimensional" resolution of a singlet and a doublet are shown. (Copyright © 1996; reproduced with permission of UDRI).

Table 3-14. Compounds identified via MDGC/MS

fluorobiphenyl	bromothiophene
bromonaphthalene	dibenzofuran
dichlorinated PAH	benzopyran-2-one
benzoquinoline	tribromophenol
nitrated PAH	fluoren-9-one
pentachlorobenzene	bromophenoxy benzene
tribromobenzene-diol	naphthalene dicarboxylic acid

3.4 - PCDDs/PCDFs and PBDDs/PBDFs

Table 3-15 lists the PCDDs/PCDFs and PBDDs/PBDFs found in the tests. Some congeners were found in all tests. These values reflect data taken at duct temperatures ranging from approximately 200 to 350 °C, and reflect short residence time in-flight formation of PCDDs/PCDFs and PBDDs/PBDFs and emissions of those compounds as PICs rather than formation at longer residence times, such as those found in particulate control devices. In general, the low temperature and high Br process conditions tended to yield higher levels of PICs than the baseline and even the fuel-rich conditions. Of particular interest is the observation of the very high levels of PCDDs/PCDFs that were found during Run 10, when the Br was at the high feed concentration. Tripling the concentration of Br in the feed resulted in an order of magnitude increase in PCDD/PCDF emissions, plus measured quantities of PBDDs/PBDFs were much higher. It may be that the presence of Br inhibits reactions that reduce the production of PCDDs/PCDFs. It may also be that Br may enhance some of the reactions that produce PCDDs/PCDFs. Further work is planned to investigate this phenomenon. It is also of interest that variations between the different run conditions produced a wide variation in concentrations of PCDDs/PCDFs. These data are undergoing further analyses to evaluate differences between run conditions. In spite of efforts to maintain a constant duct temperature, variations did occur, and this may be sufficient to account for some of the variations. HCl concentrations in the sampling duct were on the order of 5000 ppmv, which could provide more than sufficient gas-phase Cl to achieve these levels of PCDD/PCDF emissions. This is not typical of normal incinerator operation, since typically the HCl is removed prior to passing the flue gases through the optimal PCDD/PCDF formation temperature window.

Table 3-15. Polychlorinated and Polybrominated Dioxins and Furans

	Baseline		Low SCC Temp		SCC Fuel Rich	
	Run 5 (ng/m3)	Run 6 (ng/m3)	Run 9 (ng/m3)	Run 10[a] (ng/m3)	Run 13 (ng/m3)	Run 14 (ng/m3)
Monochlorodibenzofuran	0	0	693.79	10944.93	67.38	1.22
Monochlorodibenzodioxin	0	0	16.89	1770.38	0	1.57
Dichlorodibenzofuran	0	0	1145.83	16640.27	52.04	0
Dichlorodibenzodioxin	0	0	35.53	3671.38	0	0
Trichlorodibenzofuran	28.87	0	957.67	8940.27	48.35	0
Trichlorodibenzodioxin	0	0	53.01	4677.70	0	0
Tetrachlorodibenzofuran	28.30	0	421.75	1332.95	39.22	0
Tetrachlorodibenzodioxin	0	0	43.11	29.78	0	0
Pentachlorodibenzofuran	54.34	8.33	358.83	659.23	57.28	0
Pentachlorodibenzodioxin	0	0	43.69	373.04	0	0
Hexachlorodibenzofuran	39.81	0	310.49	470.22	177.09	0
Hexachlorodibenzodioxin	0	0	78.64	386.36	5.63	0
Heptachlorodibenzofuran	47.55	7.04	230.10	206.49	126.99	10.43
Heptachlorodibenzodioxin	7.74	0	73.98	289.18	29.13	0
Octachlorodibenzofuran	16.42	0	535.92	306.49	27.96	14.43
Octachlorodibenzodioxin	56.04	0	553.98	96.51	79.81	8.00
Totals	**279**	**15**	**5553**	**50795**	**711**	**36**
Bromotrichlorodibenzodioxin	0	0	0	90.52	0	0
Bromotrichlorodibenzofuran	0	0	0	0	[b]	0
Dibromodichlorodibenzodioxin	0	0	0	32.45	0	0
Tetrabromodibenzodioxin	0	0	0	0	0	0
Pentabromodibenzodioxin	0	0	0	0	0	0
Bromotrichlorodibenzofuran	0	0	9.71	295.51	0	0
Tetrabromodibenzofuran	0	0	0	8.49	0	0
Pentabromodibenzofuran	0	0	0	0	0	0

a - On Run 10, too much ethylene dibromide was inadvertently added

b - Detected, but not quantified

3.5 - Surrogate Performance Indicators

A surrogate performance indicator is an easily measured compound or group of compounds whose variance can account for the variance in the measurements of a more difficult-to-measure compound, such as PCDDs/PCDFs. In light of that, the data from the VOST analyses were compared to the emissions of total PCDD and total PCDF, both singly and in combination using the STEPWISE regression in the SAS JMP software package. STEPWISE first looked at all compounds measured by VOST and determined whether variance in those compounds could account for any of the variance in PCDDs/PCDFs. Then individual analytes were compared (using the statistical correlation coefficient, R^2) to see if an $R^2>0.5$ was possible by correlating the concentration of that pollutant vs LOG(PCDD) and LOG(PCDF).

Figure 3-5 shows trichloroethylene vs. total PCDD, Figure 3-6 shows trichloroethylene vs total PCDF, and Figure 3-7 shows trichloroethylene vs. total PCDD+PCDF. Trichloroethylene was chosen because it showed the highest correlation coefficient (R^2) for any single compound. These are remarkably good correlations considering that these data points span a wide range of combustion conditions and temperatures, particularly in the transition duct where the maximum formation temperature window for PCDDs/PCDFs can be found. The fact that one of the chlorinated ethenes was found to be the best indicator is also promising. Chlorinated ethenes have been implicated as some of the primary precursors to ring growth reactions resulting in the formation of chlorinated benzenes and chlorinated phenols, the suspected precursors to PCDDs/PCDFs.[21]

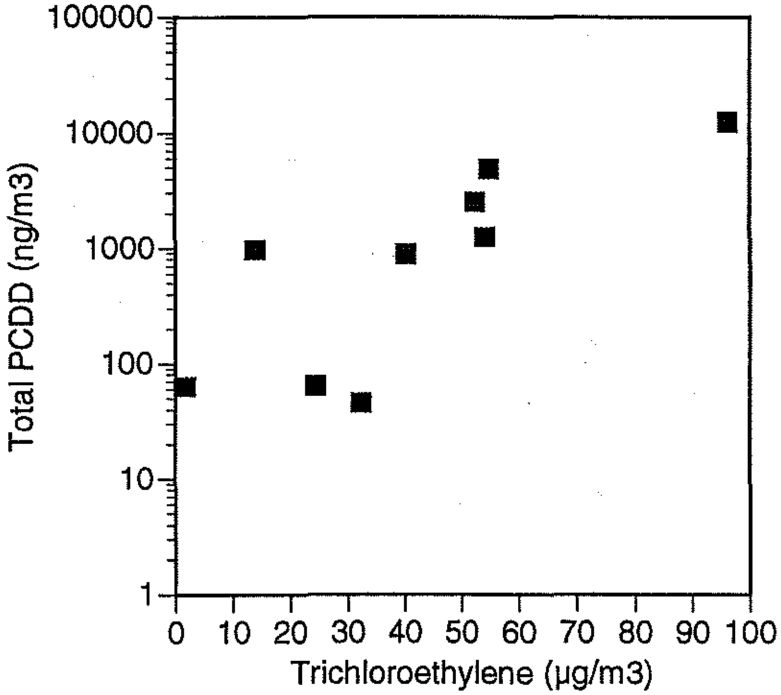

Figure 3-5. Trichloroethylene vs. Total PCDDs; R^2=0.6476 [based on LOG(PCDD)].

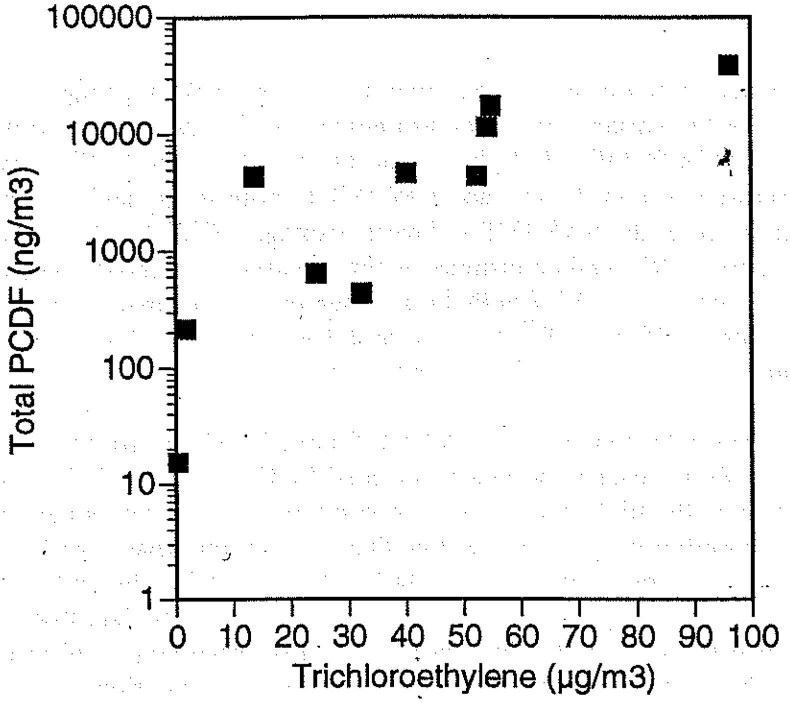

Figure 3-6. Trichloroethylene vs. Total PCDFs; R^2=0.6956 [based on LOG(PCDF)].

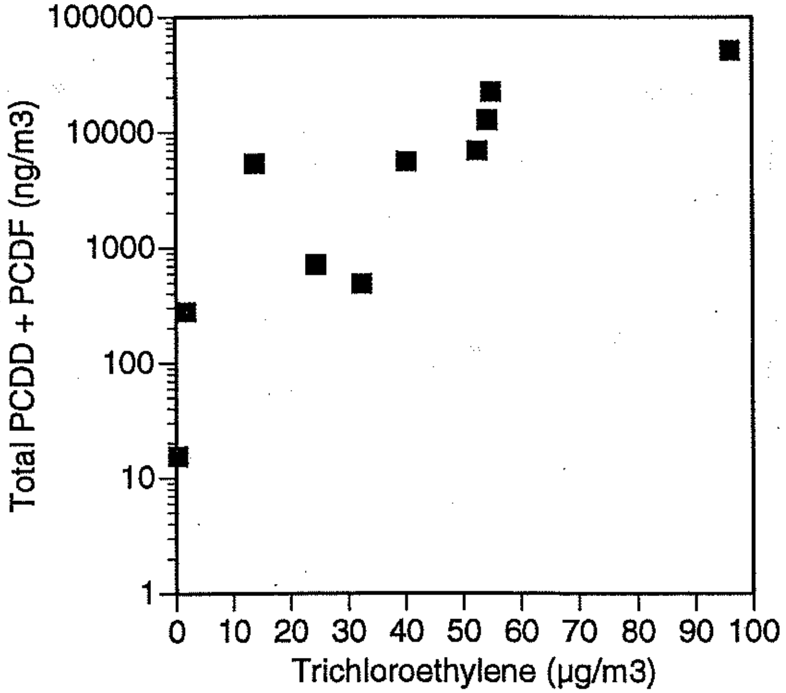

Figure 3-7. Trichloroethylene vs. Total PCDDs+PCDFs; R^2=0.6915 [based on LOG(TOTAL)].

It must be reiterated that these are preliminary findings, based on pilot-scale tests performed on a single waste stream. However, if it is borne out by further investigation that trichloroethylene is an appropriate surrogate for PCDDs/PCDFs, there is good potential that this information could be used for compliance assurance or system optimization, since trichloroethylene is one of the OLGC's target analytes, and could be easily measured in the stack of an incinerator.

Potential surrogate indicators were further investigated by evaluating linear combinations of multiple VOST analytes. JMP was used to do a principal component statistical analysis on all VOST analytes, excluding brominated and fluorinated compounds. Principal component analysis is a statistical tool that is used to transform data to group interrelated variables. It is not statistically valid to directly use many VOST targets simultaneously to predict variance in PCDDs/PCDFs since, with a limited number of measurements such as are present here, you can explicitly predict virtually all of the variance in PCDDs/PCDFs by using a large enough group of VOST targets. However, principal component analysis can allow you to reduce the number of predictors by transforming their axes.The principal components represent variables that take into account the interrelations between similar VOST targets since, for example, it is not possible to use benzene and toluene as completely separate predictors, since their concentrations in the stack are related to each other. This statistical analysis yielded interesting results, indicating that 72% of the variability in the VOST PICs can be accounted for by the first three principal components, which are linear combinations of the various VOST analytes. Performing a least squares regression using the first three principal components vs total PCDD yielded an R^2 of 0.8182, and an R^2 of 0.8450 when correlated against total PCDF, and an R^2 of 0.8487 when correlated against total PCDD+PCDFs.

Using a principal component analysis of multiple volatile PICs may be a useful method with which to derive a surrogate indicator of PCDDs/PCDFs that is based on several analytes rather than a single analyte. It is unknown, however, how site-specific this approach might be. It would be worthwhile to explore this possibility on other existing incinerator datasets to see if this method holds promise.

4.0 CONCLUSIONS

The conclusions are divided into sections relating to the various primary and secondary goals of this study.

4.1 - Target Analyte List

Pilot-scale incineration tests have been performed under varied combustion conditions feeding a mixed surrogate waste, resulting in the generation of numerous PICs. While many of these PICs were identified as target analytes using standardized sampling and analytical methods, the majority of PICs present in the incineration emissions were not target analytes. Although a substantial number have been tentatively identified, a considerably larger number have not been identified at this time. It can be concluded from these experiments that the current sampling and analytical schemes for characterizing HWC emissions are inadequate and provide an incomplete picture of the emission profile. This is primarily due to the presence of an extremely complex mixture of organic compounds in the HWC emission samples. This is particularly evidenced in the semivolatile organic samples. Nearly 200 chromatographic peaks were resolved through conventional methodologies, many of which were coeluting peaks. These coeluting peaks could not be identified due to combined spectra. The complexity of the samples was further illustrated by the MDGC technique. Heartcuts of single, conventional peaks resulted in the resolution and identification of 10 times the number of compounds initially evident. As a result, the number of compounds suspected to be present in incinerator emissions may be an order of magnitude greater than initially suspected. Other techniques, such as fractionation with HPLC, may provide similar benefits for identification of coeluting peaks.

A very promising technique for enabling identification of the complex mixtures present in combustion emissions is multi-dimensional GC/MS. This technique of performing an additional chromatographic separation on chromatographic peaks that confound mass spectral identification, enabled significant additional identification of unknowns on the limited sample for which it was performed. The authors believe that a much more complete listing of PICs could be generated by performing a careful analysis of complex samples such as these using MDGC/MS. However, although MDGC/MS may eventually lend itself to routine analyses, in its current incarnation it is still an experimental technique.

As a result of these experiments, an expanded list of PIC target analytes has been developed. This list is by no means complete or comprehensive. This list should be viewed in context with this particular set of experiments; i.e., waste mix. The PICs resulting from other varied waste streams have not been evaluated.

The PICs identified fall into several chemical classes. A wide variety of chloro, bromo, and mixed bromochloro alkanes, alkenes, alkynes, aromatics, and polyaromatics were detected. In addition, nonhalogenated hydrocarbon homologues along with oxygenated, nitrogenated, and sulfonated organics were detected. MDGC/MS detected chlorinated PAHs. Analytical methods specifically suited to these chemical classes are needed to enhance PIC characterizations.

For this facility burning this particular waste stream, conventional C_1 and C_2 hydrocarbons were present in levels below 1-2 ppm. Since THC analyzer readings were on the same order of magnitude as the detection levels for C_1 and C_2 hydrocarbons, no carbon balance was attempted. In addition, below 10 ppm, THC analyzer readings are not accurate due to biases introduced by the presence of common flue gas constituents.[22]

4.2 - Effect of Presence of Bromine

Brominated C_1 and C_2 PICs were present at higher-than-expected concentrations than their chlorinated analogs, in spite of Br's being present at only 10% of the mass concentration of Cl in the feed. This phenomenon was also observed with aromatic halogenated PICs such as brominated and chlorinated benzenes. A large number of chlorinated, brominated, and bromochloro semivolatile organics were also detected. Even though the sampling was performed upstream of a particulate matter control device, and samples were taken after a fairly short residence time in the optimal formation window between 600 and 200 °C, chlorinated, brominated, and bromochloro dioxins and furans were detected, and some congeners of the PBDDs/PBDFs were detected. During Run 10, with an erroneously high level of Br in the feed, emissions of PCDDs/PCDFs were increased dramatically, and significant emissions of PBDDs/PBDFs and bromochloro dioxins and furans were found. It is not known whether the presence of Br enhances production or inhibits destruction of PCDDs/PCDFs. Additional experiments are needed to confirm these results.

It is also unknown whether bromination increases or decreases the relative amounts and toxicities of the PCDD/PCDF, PBDD/PBDF, and PXDD/PXDF PICs. If bromination of PICs is additive, then brominated compounds (e.g., PBDDs/PBDFs) could add significantly to risk assessment calculations, especially if emissions of PBDDs/PBDFs are at a similar concentration as PCDDs/PCDFs. If the process is substitutive, Br could bring into question trial burn and compliance test PCDD/PCDF results due to bromination of chlorinated PICs resulting in brominated or bromochloro PICs that aren't considered in risk assessment calculations.

4.3 - Surrogate Performance Indicators

Based on these tests, on this facility, burning this particular waste stream, emissions of trichloroethylene give a very good correlation with emissions of total PCDD and total PCDF, even though PCDD/PCDF emissions varied over several orders of magnitude. Trichloroethylene is a relatively easily measured compound in the stack of incinerators, and because of its importance as a ring growth precursor, has a scientific basis for its use as a surrogate for PCDDs/PCDFs, as well as other chlorinated aromatic PICs of interest. It is not known whether trichloroethylene correlates with PCDDs/PCDFs in practical systems, although the authors will investigate whether this is the case. Likely, if trichloroethylene is a viable surrogate in full-scale systems, it will correlate with PCDDs/PCDFs prior to flue gas cleaning equipment, and would need to be coupled with flue gas cleaning equipment temperatures in order to be a viable surrogate for stack emissions of PCDDs/PCDFs.

It is possible to account for most or all of the variance in the PCDD/PCDF data by using linear combinations of several common volatile PICs, using a principal component statistical analysis to account for the interrelationships between the volatile PICs of interest. The first three principal components of the VOST analytes, when correlated against PCDDs/PCDFs, were able to generate R^2s in excess of 0.80. It is not known how broadly applicable or facility specific this observation is.

Measurement of surrogate performance indicators via OLGC appears to have good promise. Not only can the OLGC system make stack measurements, but can measure PICs at intermediate locations within the combustor, to gain insight into PIC formation processes and for system optimization. The analytes that gave good promise for potential surrogates for PCDDs/PCDFs were also OLGC targets. Observations made with the OLGC system show formation of chlorinated aromatics as gases passed through moderate temperature regions.

4.4 - Implications of These Results

The results from these tests have implications regarding incinerator trial burns and compliance tests. Although it is not within the scope of this report to make recommendations related to EPA policy, it is within ORD's charter to bring scientific implications of our results to OSW's attention. This study raises the following questions:

- Can compliance with potential PCDD/PCDF emission limits that have been demonstrated in a trial burn, using a synthetic POHC feed with no Br in the system, be ensured during actual operation when Br is present in the feed?
- If a facility will eventually burn Br-containing wastes during operation, should Br be added to the system during trial burns to challenge the system, even though brominated organics, including PBDDs/PBDFs, are not included in the regulations or the risk assessment calculations?
- How can PICs such as PBDDs/PBDFs be accounted for if their sampling and analytical methodologies have not been validated?
- Is it possible to use a common volatile PIC, such as trichloroethylene, as a surrogate for PCDDs/PCDFs and other chlorinated aromatic compounds? If one can be found, what is an appropriate level to control to?
- How facility specific would it be to use linear combinations of multiple volatile PICs as a surrogate for PCDDs/PCDFs?

4.5 - Recommendations

Much was learned analytically attempting to expand the target analyte list. Foremost is the obvious conclusion that conventional analytical methodologies and approaches are inadequate to characterize the inherently complex emissions samples. This is evidenced by the small number of target analytes observed relative to the large number of compounds present. Part of the problem lies in the fact that existing methodologies focus on the identification and quantification of hazardous waste components and not PICs. The greater problem is that, with complex samples, chromatographic interferences inhibit the ability to identify unknowns as well as confirm target analytes. Complex samples often result in significant numbers of coeluting peaks. The mass spectral fragmentation patterns of coeluting peaks are combined and additive, making individual spectral identifications difficult. This phenomenon would exhibit itself in the form of large numbers of tentatively identified compounds with poor identification probabilities from the mass spectral search. Fortunately, techniques were identified and demonstrated that were capable of deconvoluting the complex samples. The authors strongly believe that improved analytical methodologies emphasizing identification and quantification of unknown compounds would provide the greatest opportunity to reduce uncertainty in risk assessment calculations with minimal expenditure.

Additional testing is recommended that incorporate these techniques. This additional testing should use as a foundation, EPA's Total Organics Approach (TOA). Particular emphasis should be placed on characterization of the semivolatile and nonvolatile fractions. This would equate to total chromatographable organic (TCO) and gravimetric organic (GRAV) fractions of the TOA. Each sample fraction should be segregated or fractionated, based on polar characteristics, to provide a first step towards deconvoluting the sample. This can be quantitatively accomplished using High Performance Liquid Chromatography (HPLC). Each segregated fraction should then be re-subjected to the TCO and GRAV analyses to ensure mass recovery. Then each sample fraction should be reanalyzed by GC/MS as well as MDGC/MS. This will not only improve compound identification and quantitation, but also demonstrate this particular approach as a potential method for characterizing incinerator emissions.

This testing should also include separate efforts to identify the components present in the GRAV fraction. Theoretically, the GRAV fraction includes primarily nonvolatile organics possessing high molecular weight compounds. It is possible, even probable, that a considerable portion of these compounds are not amenable to conventional GC analyses. However, the ability to characterize this fraction has met with mixed results. This fraction typically remains uncharacterized, with only a small percentage of the mass being identified.

It is the authors' strong contention that the GRAV fraction may consist of organic and/or inorganic mass not directly attributable to organic incinerator emissions. This artifact may be comprised of inorganic salts, super-fine particulate, fractured XAD-2 resin, or some other unknown. This artifact may account for the inability to identify a significant percentage of the GRAV fraction. Experiments can be designed to further determine the representativeness of the GRAV fraction. Based on these results, more efficient analytical approaches can be devised to characterize the GRAV fraction, thereby improving the potential for identifying a larger percentage of the GRAV fraction.

Finally, it may be possible to develop a multi-tiered approach to measuring PICs from incineration systems. Some incineration systems may exhibit a relatively small number of identifiable PICs, whereas others may have an exceedingly complex mixture in the stack. This multi-tiered approach could be performed by commercial analytical laboratories on a routine basis. The multi-tiered approach would consist of the following:

Tier 1: First Pass Analysis

The first pass analysis would focus on using existing analytical methodologies that focus more on potential PICs. The MM5 samples would be extracted and analyzed conventionally using a Method 8270C analysis, directed at the Method 8270C targets. The existing target list should be expanded to include common PICs that are amenable to GC/MS analysis. Aliquots from these same extracts would be subjected to further analyte-specific analyses for chlorobenzenes and chlorophenols (Method 8041), PAHs (CARB Method 429), and nitroaromatics and cyclic ketones

(Method 8091). These are more analyte-specific analyses and offer greater sensitivity, particularly through the use of selective ion monitoring techniques. High resolution mass spectrometry (HRMS) may also be used to improve sensitivity, if needed.

Greater emphasis should be placed on the identification and accurate quantitation of unknowns. Guidelines should be developed that standardize this approach. These guidelines should include spectral library searching and spectral interpretation requirements, confirmation of unknowns with known standards where possible, and other criteria that add to the quality of the identification (e.g., retention time, boiling point). In addition, tentatively identified unknowns should be quantified using a response factor of a compound similar to the characteristics of the unknown rather than an unrelated compound closest in retention time.

The Method 23 samples would be analyzed for PCDDs/PCDFs and PCBs using HRMS. The PCB analysis should include both totals and the co-planar isomer specific analyses. Two PCB Methods exist which can accomplish this method: CARB 428 and Draft Method 1668. The Method 23 target analyte list should be expanded to include the mono-, di-, and tri- substituted dioxin and furan congeners as well as the tetra- through octa- as are normally measured. Limited laboratory and field data suggest that the lower chlorinated congeners may be suitable surrogates for the higher chlorinated congeners, and measurement of the lower chlorinated congeners with a CEM may be practical in the near future. It is necessary to develop a database of the lower substituted congeners to develop correlations for different facility and feed types.

Based on the results from the Tier 1 analysis, it will be decided whether the sample was sufficiently complex to merit further investigation (e.g., number of peaks identified relative to total number of peaks). Again, complex samples would result in significant numbers of coeluting peaks, making spectral identifications difficult. This would ultimately result in a large number of unidentified compounds. If the samples analyzed using the Tier 1 approach indicate that a significant number of coeluting peaks exist, then Tier 2 should be used.

Tier 2: Sample Deconvolution

For Tier 2, the MM5 extracts would be run through an HPLC fractionation system. A solvent gradient would be used to partition the material eluting off an HPLC column according to elution time. Separating the MM5 extracts into multiple fractions of varying polarity, then running those fractions back through a GC/MS analysis, dramatically reduces the problems of coeluting peaks. This reduction is due to the fact that GC and HPLC use different techniques to differentiate compounds: GC separates primarily based on compound boiling points; whereas, HPLC separates primarily based on compound polarity.

The fractionated samples could also be run on a GC with atomic emission detection (AED). This detector is element specific and would aid in the interpretation of mass spectral data by confirming the presence of elements such as halogens, oxygen, nitrogen, and sulfur.

Finally, the fractionated extracts could be analyzed by multidimensional gas chromatography (MDGC). The power of this technique has been demonstrated through this study.

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APPENDIX A
QUALITY CONTROL EVALUATION REPORT

This project was conducted under the guidance of an EPA-approved QA Test Plan (APPCD Category III). The Test Plan describes the intended experimental approach and procedures. The Test Plan also presents Data Quality Objectives (DQOs) for this study: to collect data of sufficient quality to develop a qualitative list of organic compounds present in HWC emissions. This list is not meant to be representative of all incineration configurations, conditions, or waste mixtures. Data Quality Indicator (DQI) goals were established to meet DQOs.

Table A-1 presents the DQI summaries for accuracy, precision, and completeness achieved during testing along with the planned DQI goals for each measurement or analysis performed. In general, the intended RKIS operational DQI goals were achieved. However, DQI goals for quantitative organic measurements generally were either not achieved or could not be assessed from the available data. Quantitative DQI goals were not met primarily due to poor surrogate and/or internal standard recoveries. As a result, the analytical data should be viewed as semiquantitative at best. While it is not appropriate to report organic emissions concentrations as absolute, the data are of sufficient quality to make rough order of magnitude quantitative comparisons between test condition data sets. It should be stressed, though, that qualitative identification was the primary goal of this project, not quantitative. The recovery problems have negligible impact on the qualitative identification of the PICs. As a result, the data are of sufficient quality to meet project objectives to develop a qualitative list of organic compounds present in HWC emissions.

Case narratives for specific analytical activities are included in the following subsections.

A.1 - Continuous Measurement Results

The THC analyzers failed after Run 11 due to the high HCl content of the flue gas. Their data were not available for Runs 12 through 16, resulting in a completeness of 69.4%, which was slightly below the desired 70% completeness. In addition, the Bodenseewerk HCl CEM was not available during Runs 13 through 16 due to its redeployment on other facilities, resulting in a 75% completeness of data. Other CEMs passed QC criteria.

The thermocouple at the kiln exit failed after Run 8 and was not available during Runs 9 through 12, resulting in a completeness of 75% for that thermocouple. A replacement thermocouple was installed at that point, and kiln exit temperatures were measured during subsequent tests. All other thermocouples operated normally within QC guidelines.

There was an anomaly in the bromine feed concentration in the batch of feed used in Run 10. All of the other runs were prepared at 449.8 g Br per batch, while run 10 was at 1589.8 g Br per batch.

Table A-1. Data Quality Indicator Summary for Critical Measurements

Measurement	Accuracy Goal	Accuracy Achieved	Precision Goal	Precision Achieved	Completeness Goal	Completeness Achieved
O2	±5	pass	5	pass	70	100
CO2	±5	pass	5	pass	70	100
CO	±5	pass	5	pass	70	100
THC	±5	pass[a]	5	pass[a]	70	68.75
NO	±5	pass	5	pass	70	100
Temperature	±2	NA	±2	±2	100	100 (75)
HCl	±5	NA	5	pass	70	75
VOCs (VOST)	50-150	fail	NA	NA	75	100
VOCs (Tedlar Bag)	50-150	fail	30	NA	75	100
SVOCs	18-120	fail	30	NA	75	100
PCDDs/PCDFs	40-120	*a	30	NA	70	100
VOCs (OLGC)	NA	NA	NA	NA	NA	NA

a - see additional information in text.

A.2 - Volatile Organic Compound Analyses

A.2.1 - VOST Samples

The 30 day holding times to analysis for these samples were generally adhered to.

The surrogate recoveries for the VOST compounds were mostly below the pass/fail criterion of 50-150%. The insufficient recoveries do not, however, impact the qualitative analysis of the data. A possible reason for the failure of the recoveries of internal standards is that the extremely high HCl content (several thousand ppmv) of the flue gas may have degraded the Tenax' ability to adsorb VOCs. The VOST method is intended for application downstream of particulate and acid gas control systems and not in the highly corrosive environment during these tests.

The first internal standard (bromochloromethane) was identified as a PIC. Because of this, the second internal standard was used to quantify the targets that are normally referenced to the first internal standard.

The blanks showed a general trend of having common ketones, solvents, and chloromethane present (as is common for VOST samples) as contaminants. There were also a few instances of a minor carryover from the daily standard. But with target hits as high as 5000 ng per tube of benzene and many other compounds being near 1000 ng per tube, the contaminant levels were insignificant relative to sample levels.

Many of the VOST samples exhibited concentrations higher than the calibration range. The concentrations of these compounds will tend to be over-estimated due to non-linear responses of the mass spectrometer at regions above the calibration range. The nature of the VOST sampling/analysis does not allow reanalysis or dilution to bring these compounds into the calibration range. Data exceeding calibration levels are flagged as estimates. Given the semiquantitative nature of reported results, these estimates do not pose a problem.

A.2.2 - Tedlar Bag Samples

Hold times did not exceed 1 day, which is acceptable.

The blank samples were generally clean with only a few compounds reported above the practical quantitation limit (PQL). Few PICs were found in the blank samples.

There were inconsistencies in the reported recoveries of surrogate standards, which make it difficult to assess the quality of the quantitations. Based on careful examination of available data, in both hard copy and disk form, it is believed that the qualitative results are correct, but that the quantitative results may be in error by a factor of 2.5. Since these data are compared only to other test conditions, relative differences are not affected.

A.3 - Semivolatile Organic Compound Analyses

Semivolatile analysis by SW-846 Method 8270 was completed for eight samples. Filter and XAD-2 fractions were extracted separately. In general, filter extract surrogate recoveries were low, with many being just barely acceptable. The XAD samples, generally showed acceptable recovery. In all analyses, the surrogate recovery is worse for the earlier eluting (lower boiling point) compounds. A contributor to poor recovery was that some sample extracts were concentrated on a rotary evaporator (Roto-Vap) instead of the Kaderna-Danish concentrating apparatus which is specified in the method. This technique is less efficient and would result in greater azeotroping and, therefore, the preferential loss of the more volatile surrogate standards.

After these samples exhibited the poor recoveries, the laboratory stopped using the Roto-Vap apparatus for semivolatile samples and resumed using the Kaderna-Danish apparatus. Volatile surrogate standard recoveries improved somewhat. Matrix effects, due to the extremely high HCl content of the sample collected, also likely impacted surrogate recoveries. Fortunately, the poor volatile surrogate standard recoveries were associated primarily with the filter extracts. During sampling, the more volatile species would tend to be collected on the XAD-2 rather than the filter. While the poor surrogate recovery problem impacts quantitative capabilities, qualitative information should not be compromised. This tenet is supported by the independent identification of overlapping PICs in both the VOST and MM5 samples.

Due to the high concentrations of nontarget analytes in the initial MM5 analyses, many reactive compounds responded poorly. Initial MM5 extracts, once concentrated to 1 mL, were dark and non-transparent. It is likely that the cumulative effect of injection of these corrosive, complex samples caused active sites to develop in the injection port and entrance of the column causing poorer responses for these more reactive compounds. Frequent injector and guard column maintenance reduced this problem. To verify acceptable MS and chromatographic performance, the decafluorotriphenylphosphine (DFTPP) tuning criterion was met prior to sample analyses each day, and the degradation products of dichlorodiphenyltrichloroethane (DDT) (compound in the DFTPP tuning solution) demonstrated less than 6% degradation prior to sample analyses for each day. DDT is a typical example of a labile compound used by the method to determine the condition of the chromatographic system. If degradation of DDT was greater than 20%, GC maintenance was performed. In an effort to improve chromatographic separations, GC conditions were modified to reduce the oven temperature ramping rate and to optimize column carrier flowrate from levels used during the initial analyses.

The five-point calibration ranged from 10 to 120 ng injected on column (except for the acid surrogates which ranged from 20 to 240 ng). Poorer responding compounds' PQLs -- defined here as the lowest point on the calibration curve -- were raised to 30 and sometimes 60 ng to obtain good response correlation throughout the calibration range.

All continuing calibration check compounds (CCC) and System Performance Check Compounds (SPCCs) had less than 30 % relative standard deviation and greater than 0.05 relative response, respectively (prior to daily sample analyses), which satisfies Method 8270 cutoff values.

A.4 - PCDD/PCDF and PBDD/PBDF Analyses

Both chlorinated and brominated DD/DF analyses were performed. As described earlier, the PCDD/PCDF analyses were performed following standardized procedures. A significant portion of the internal standard surrogate recovery results were outside of the method criteria (40-120%)

with many recoveries in the 20-30% range. Recoveries were highly variable but didn't seem to have a pattern. Run 11's filter fraction, Run 12's XAD fraction, and Run 13's filter fraction exhibited below 1% recoveries of the internal standards. Run 14's filter was lost and no extract was produced. These results, although not quantifiable within method criteria, are still usable to evaluate trends between test conditions.

Formalized methods for identifying and quantifying brominated DD/DF do not exist. As a result, the analyses performed were essentially a screening technique attempting to verify the presence or absence of select PBDD/PBDF congeners for which limited standards are available. For the brominated compounds, the ion ratio was the only definitive criterion available to confirm presence: no window defining mixes are available. The retention time was evaluated compared to the ^{13}C labeled TBDD/F standards. We used a general rule that a compound with a bromo substitution would correspond roughly to the retention time area of the same compound with a dichloro substitution. The fully brominated penta, hexa, and hepta diphenyl ethers were monitored for, but none were detected. This indicates that there was no interference between the fully brominated furans and these compounds. This approach is sufficient to screen for the presence of PBDD/PBDF PICs.

A.5 - Online GC Samples

On-line GC measurements were performed primarily to evaluate performance as a potential VOC monitor. No DQI goals were established. Each day a system bias check was performed to verify that recoveries of a 200 ppb sample were within the range of 50-150% by injecting a VOC standard mix into the probe at the stack and comparing the measured concentrations to the same mix injected directly into the sparge vessel of the OLGC. The system passed the system bias check each day. In addition, system blanks were performed to verify that no targets were present in the system prior to each run day, and a calibration was performed each day to verify retention times and concentrations.

TECHNICAL REPORT DATA

Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/R-98-076	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Development of a Hazardous Waste Incinerator Target Analyte List of Products of Incomplete Combustion		5. REPORT DATE June 1998 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Paul M. Lemieux and Jeffrey V. Ryan		8.PERFORMING ORGANIZATION REPORT NO.
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16. ABSTRACT

The report gives results of pilot-scale incineration testing to develop a comprehensive list of products of incomplete combustion (PICs) from hazardous waste combustion (HWC) systems. Project goals were to: (1) identify the total mass of organic compounds sufficiently to estimate the toxicity of the complex mixture; (2) serve as the target analyte list for Omnibus risk assessments and, possibly, for the risk-check element of the yet-to-be-proposed rule on HWC; and (3) enable EPA's Office of Solid Waste to assess the relative importance of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans to other PICs. The tests were performed under varied combustion conditions feeding a mixed surrogate waste, resulting in the generation of many PICs. While many of the PICs were identified as target analytes using standardized sampling and analytical methods, most of the PICs in the incineration emissions were not target analytes. Although a substantial number have been tentatively identified, a considerably larger number have not been identified. It can be concluded from these experiments that the current sampling and analytical schemes for characterizing HWC emissions provide an incomplete picture of the emission profile. Innovative analytical techniques, such as multi-dimensional gas chromatography, appear to show great promise for resolving the unknowns.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Sampling	Pollution Control	13B 14B
Combustion	Analyzing	Stationary Sources	21B
Incinerators	Halohydrocarbons	Products of Incomplete Combustion (PICs)	14G
Wastes		Hazardous Waste	06T
Toxicity			07C
Organic Compounds			

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ATTachment 4B

Waste Not The Reporter for rational resource management **452**

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Reflections on Risk Assessment by Halstead Harrison, a peer reviewer for US EPA on two hazardous waste incinerators in East Liverpool, Ohio and Lock Haven, Pennsylvania.

On June 29th Halstead Harrison wrote us: "Here, for your possible interest, is a letter I sent to Carol Browner earlier this year. I received no reply. Use it as you wish, or not." Halstead was a peer reviewer for the US EPA on two highly controversial hazardous waste incinerator risk assessments. The first was a commercial operation: Von Roll's incinerator, called WTI, in East Liverpool, Ohio. WTI was built in a floodplain on the bank of the Ohio River, 1100 feet from an elementary school, 300 feet from homes, in a valley renown for its frequent air inversions and high pollution levels. Because of the undulating terrain, the top of the incinerator stack is approximately level with the school. EPA released their risk assessment on Von Roll's incinerator on May 8, 1997 --four years *after* the incinerator began operation-- with the statement: "EPA believes this is the most detailed and scientifically sound risk assessment it has ever performed with respect to such a facility (EPA Fact Sheet distributed in East Liverpool May 8, 1997)." This risk assessment is available from NTIS, report # PB97-174486INF, cost $412 - see WN # 406 for ordering details. (Also see WN #s 392-411 for our comments on the risk assessment.)

Halstead was also one of the peer reviewers of the Lock Haven Superfund mobile incinerator. Incineration was EPA's answer to 'cleaning up' the chemical stew at the Drake Chemical Superfund site in Lock Haven which contained dye chemicals and their intermediates, herbicides, and other chemical products that were manufactured at the site from 1948 through 1982. According to Weston's 1997 risk assessment the site contained chemical tanks and reactors, unlined lagoons containing sludge, and several thousand rusted and leaking drums containing various chemicals. This incinerator was also located in a floodplain and in a valley. The site is surrounded by agricultural land, dairy farms and fishing areas. --For more information see WN # 453

Date: April 6, 1999

To: The Honorable Carol M. Browner
Director, US Environmental Protection Agency, 401 M Street SW, Washington, DC 20460

This letter is stimulated by my after reflections upon two experiences serving with EPA's Risk Assessment Forum as an academic technical expert evaluating the risk-assessment process, and its resulting reports concerned with toxic waste incineration. These exercises, I judge, were not successful, and their results not likely to help with sensible decisions. I discuss the problems leading to this conclusion, and suggest reforms.

Public concern and congressional mandate require assessments of risks to public health associated with toxic waste incineration. A consulting industry provides these assessments, following guidelines from the Environmental Protection Agency [EPA].

Responding to the national interest, new money flows into the science of risk assessments, and new research improves the precision and depth of the data and of our understanding of the many processes affecting risks. The evolution of public concerns is also dynamic, but this process has been marked by partiality and litigation. As each new guideline-influenced assessment appears ... too often after the facilities are built and the momentum of commitment too ponderous to reverse ... critics appear to challenge both the assessment and the facilities on grounds of faulty protocols and neglected risks. This irritates managers facing pressing choices about what to do with the toxic wastes, who are frustrated by regulatory mandates that not unreasonably appear to be transitory and politicized.

The "Old Paradigm":

As they evolved through about 1996, guidelines for risk assessments of toxic waste incineration progressively concentrated on emissions of mercury, cadmium, and lead, and certain organic carcinogens, particularly dioxins, furans, and related chlorinated polycyclic molecules. Ironically, some of these molecules are not only inherent in the raw toxic wastes but may also be produced when chlorinated compounds [most plastics, insecticides, and herbistats] are burned at intermediate temperatures [400-600F].

It has been thought that the most likely pathway through which emitted metals and persistent carcinogens may affect human health is though deposition onto the soil and leafy food crops, followed by biological concentration and accumulation in animal and human fatty tissue. Formal risk assessments typically estimate the incremental cancer risks through this path to be one or fewer "extra deaths" per million persons exposed over a lifetime. Note for contrast that about a third of us die of cancer. Many other natural risks in our lives [tornados, lightning, hurricanes, ..] also carry risks to the general population on the order of one-in-a-million, and this level is generally thought "acceptable", at least by those not living in affected communities.

These latter, however, typically divide into advocates concerned with business values and job production, which are not negligible benefits, and "nimby" critics who not unreasonably point out that increments of imposed risk, however small, are not voluntarily accepted by the local sub-population at greatest risk, and that if normalized by the smaller numbers of this at-highest-risk local group, the formal risk estimates increase beyond one-in-a-million, by orders of magnitude.

A Trap:

As it evolved, the "old paradigm" fell into a semantic, political, and statistical trap. In the presence of very large uncertainties .. both in the data and in the complex processes of emission, dispersion, deposition, ingestion, accumulation, and cancer induction .. it was initially hoped that if the risk-modelers were to accept pessimistic [through still plausible] upper-bound estimates at each step, and if the resulting risks then appeared acceptably small, [less than or on the order of one-in-a-million], then relatively quick, simple, and cheap modeling efforts would be adequate to assist decisions affecting proposed projects, before heavy commitments were made on their construction. In the jargon of the trade, such estimates are called "conservative".

In the last years of the "conservative" administration of President Bush, however, [1990-1992], "fiscally conservative" economists in the Office of Management and Budget [OMB], correctly pointed out that "conservative" estimates carry costs of delay or exclusion of otherwise desirable projects, or of excessive investment in pollution control apparatus and governance. This is undeniably true.

Responding to the criticism, the EPA convened yet another panel of competent people to advise yet another revision of the guidelines to be followed in formal risk assessments. That panel advocated, in effect, that risk estimates should no longer be "conservative", but "central". That is, "best" guesses should be used at each step of a supposition chain, not plausibly worst guesses, and these should be accompanied by an additional formalism to assess the uncertainties of estimated risk factors. In 1994 directives from EPA mandated this practice, somewhat ambiguously, but as of 1999 the revised guidelines are not well specified, and recent risk assessments generally do not include specific, formal, and numerically expressed estimates of the uncertainties associated with estimated risks.

One reason for this regulatory lag is that the uncertainties are embarrassingly large. In the case of cancer risks from dioxin emissions through the complicated processes of dispersion, deposition, and ingestion into and through food chain, those uncertainties certainly exceed factors of 10, and likely exceed factors of 100. Thus, a "central" one-in-a-million lifetime cancer risk might in fact plausibly lie in the range between 1-in-10,000 and 1-in-10,000,000. The first of these ratios is considered unacceptable, the second trivial, but how does one wisely choose between them? Are analyses with these uncertainties at all useful?

Another reason for regulatory lag is, interestingly, that the newer, "central", estimates are coming in at about the same levels as the older, "conservative" guesses. Newly perceived risk paths have been added at about the same rate as the older conservative risk estimates have been centralized. That one-in-a-million ratio seems almost a constant of nature: obviously riskier facilities are cut-off early, and obviously safer ones bypass the formal process entirely.

In this situation, what should honorable decision makers to do? Of what value is a formal risk assessment with such broad uncertainties? Some of those studies cost millions. What do we get for our money?

A Shifting Paradigm:

Meanwhile, back at the scientific farm, the risk paradigm has been shifting from nearly exclusive concerns over cancers mediated by dioxins to expanded concerns over the hormone-like behavior of many of these and similar compounds, which appear to affect sperm production and fetal development in many species, including ours. The supporting evidence for these worries is somewhat ambiguous, and perhaps alarmist. But if the claims are approximately correct then other risks than cancers are significant, and should be accounted for.

Further, quite recent studies alert us to the high and growing incidence of childhood asthma, and to convincing associations between emergency-room admissions for asthma, bronchitis, and related stresses, and acute air-pollution episodes characterized by high levels of PM2.5 [aerosol particles with aerodynamic diameters less than 2.5 micrometers].

Unlike the cancers, where incremental risks even as large as 1-in-10,000 cannot be detected in the presence of a natural background of one in three, it appears that childhood asthma [with a baseline incidence of one-in-ten] and adult congestive pulmonary distress [ACPD], which in many cases may be the same thing with a different label, are "canary" symptoms, where .. unlike the cancers .. statistically significant impacts of air pollution upon both health and mortality can be detected in cities with populations exceeding 100,000. If this emerging paradigm proves correct ... as appears likely ... then asthma and ACPD should also be accounted for in formal risk assessments.

Dose-Damage Curves:

One confounding concern of the "new paradigm" is that acute distress ... as from asthma ... is sensitive to relatively rare [a few events per year] episodes of severely degraded air quality, not just to cumulative exposures, as has been assumed to be the case for the cancers. The dose-damage curve for asthma is likely non-linear, with lower thresholds below which our systems do not usually trigger strong immune responses, and higher dose levels at which progressively larger numbers of persons may be acutely affected, at rates that are more than proportional to added doses.

One effect of this non-linearity is to accentuate concern for disadvantaged sub-populations at higher-than-normal risk. Thus, a one-in-a-million risk for the population at large, may be 1-in-100,000 for all children, and 1-in-10,000 for asthmatic children. [Cancers are so prevalent as generally to have been assumed a common blight, with approximately uniform risk to most people. Recent genetic studies question this, however.]

Another effect is to focus air-quality modeling on episodes, rather than long-term averages ... a distinctly harder task.

Forward and Backward Risk Estimates:

A "forward" risk estimate begins with a list of troubles, assigns probabilities to each, and combines these, using standard probability theory for serial and parallel processes. A "backward" estimate looks at a climate of troubles abstracted from real measurements of historical facilities and events. Insurance firms typically operate with backward risk estimates. New technologies are forced into the forward mode, because there are no historical data.

Interestingly, when the two approaches may finally be compared with one another, it too often appears that the forward estimates overlooked a set of serious troubles, or underestimated their severity. Egregious examples of this bias include the wildly optimistic estimates leading to the Challenger and Chernobyl tragedies. For both of these, forward estimates were low by factors of 100. The common failing appears to have been neglect of stupidities, or "pilot error". We naively assume that the processes operate as we have designed them, that we are rational, and that others are too.

Note that risk analyses of toxic waste incineration are performed in the forward mode.

Cost-Benefit Analyses:

We all act upon informal and largely subconscious risk and benefit assessments, but economists stumble when trying to reduce these choices into quantifiable numbers. With toxic waste incinerators, some of the benefits may be measured in dollars that need not be spent in more expensive ways. Capital and labor costs can also be measured in dollars. But costs associated with externalized health risks are not well expressed in dollars, and attempts to do so risk Dr. Strangelove excesses and a repellent algebra when attempts are made to optimize "extra deaths per dollar".

What is the dollar cost of a premature cancer death? Do you count it as a benefit that social-security costs are diminished? [NO!] What are the dollar costs of increased incidence of childhood asthma? Are these greater than with adul congestive pulmonary distress ... essentially the same disease ... because the child is young? Or less, because the societ "saves" on educational costs? [NO!] What are the dollar denominated costs of degraded scenic views? Of eagle-shell fragilit modulated by DDT?

Our tort system indeed struggles to assign dollar-measured prices to these costs, but the "coefficients" [dollars/deatl dollars/view, dollars/eagle] are at best subjective, controversial, and unstable.

At The Margin:

In "Economics 101" it is taught as axiomatic that wise decisions are best made "at the margin". That is, you consid the prospects of additional gain or loss, with respect to additional costs. Past investments, profits, and losses are all "sunk", ai should not be weighed in present decisions for additional investment with prospect of gain, or additional insurance with prospe of loss.

This principle also holds with risk assessments: we are concerned with added risks above present baselines, and add costs of ameliorating those risks. But baseline data .. as for example of present air-pollution levels, or cancer rates, or asthi incidence .. are usually poorly known and not discussed. This is particularly poignant in rustbelt communities that are oft characterized by lower-than-average educations and incomes, and a higher-than-average incidence of smoking and obesity, cance and childhood asthma.

"Peer" Reviews:

The stimulus to this essay was the author's involvement over several years as an external, scientific "peer reviewer' two formal, EPA sponsored risk assessments, one concerned with a very large commercial toxic waste incinerator at E Liverpool, Ohio, the other with soil incineration at a superfund site at Lock Haven, Pennsylvania. The "peers" were narro charged with reviewing risk-assessment documents, prepared by engineering firms under contract with the EPA, primarily a whether those contractors had adequately conducted their assigned tasks. Our participation in the definition of those tasks minimal, and ineffectively late in the risk-assessment process. We were not asked to recommend acceptance or rejection of assessments as a whole, or of their executive summaries, as would have been so were we "peer reviewing" papers submittec publication, or research funding by federal agencies.

Community interest in our review process was high, and was some-what misled into an expectation that these revi provided a last "scientific" chance to deflect the projects. Sadly, a common theme in both communities was a projection the EPA as being more in alliance with the projects' sponsors than with protecting citizen interests. This projection was with intense emotion and directed into personal attacks on the professionalism and integrity of EPA staff. Still more sadly, some of these charges were true.

My Opinions:

In the light of all these difficulties and concerns, it seems to me that:

1. The risk assessment process, as it presently operates, damages the EPA without assisting wise decisions.
2. The process is too late, too slow, and the uncertainties are too large. Diverse risks to health and the environment cannot sensibly be expressed in commensurate units. Health and deaths are not well measured by dollars, nor scenic views, nor eagles. Assessments that attempt non-dollar risks are intrinsically subjective. Assessments that neglect them are incomplete.
3. This futility is perceived by project sponsors, who largely ignore formal risk-assessments except as irritating regulatory interference: thus, we perpetuate a climate of managerial derision and evasion.
4. This futility is also perceived by regulators, where risk-assessment processes grind on long after decisions have been effectively committed by heavy investments in the facilities assessed.
5. Citizens correctly perceive the process as "spin" for decisions already taken.
6. Costs and benefits are distributed to different populations. Some win, others lose. It is naive to assume that disparities between winners and losers impedes the historical, natural, and democratic process of dumping our troubles into others' back yards. Thus toxic waste incinerators are typically sited in already poor communities with high base rates for cancers and asthma.
7. There is an ethical difference between freely accepted risks, as from ski accidents, and imposed risks, as from toxic waste incineration. Stricter standards should be assumed when decision makers impose risks on non-consenting citizens who do not share in compensating benefits.
8. I have not discovered any approximately fair way around the problem of inequitably distributed costs and benefits. It is a reasonable seeming [at least to me] suggestion that compensating benefits might be invested within affected communities ... as for example through subsidies to emergency room care and "Medic One" services. But this suggestion is strongly rejected by all my acquaintances among the decent people who actively oppose toxic waste incineration. If your child has cancer you want zero risks, the incinerator closed, and the rascals punished.

I recommend:

1. Risk assessments should be initiated before major capital investment, and compressed into weeks, not years. In the presence of large uncertainties, early, cheap, and brief are better than late, expensive, and wordy.
2. The EPA's guideline process for risk assessments excessively lags the science. Catch up is necessary.
3. Risks and benefits should be estimated at the margin. This requires baseline measurements of both air-quality and health in the affected communities. Usually, these data are missing. A vigorous program to collect and assess the baselines should be started in the earliest stages of any risk assessment process.
4. In addition to estimating risks to whole populations, we should estimate them also to identified sub-populations at exceptional risk, as for example asthmatic children.
5. The EPA should accept continuing responsibilities towards communities affected by toxic waste incineration. Health and air-quality studies should be improved where necessary.. often greatly improved .. to evaluate effects of the facilities on those communities.
6. Air-pollution modeling and observations should be tilted towards understanding the frequencies and severities of severely stagnant episodes, rather than towards longer-term averages and their standard deviations.
7. Peer reviewers of risk-assessment documents should be asked whether the executive summaries correctly reflect the peer consensus, and whether the assessments as a whole should be accepted or rejected, as usefully contributing to wise decisions.
8. The EPA should with high priority study the effects of aerosols and odors upon asthmatic children.
9. Toxic waste incinerators should not be located on flood plains of narrow river valleys, close to housing and schools.

Repectfully,
Halstead Harrison
Professor, Atmospheric Sciences, University of Washington, Seattle, WA 98195-1640

Waste Not # 452 *Published 48 times a year. Rates: Groups & Non-Profits **$50**; Individuals **$40**; Students & Seniors **$35**; Consultants & For-Profits **$125**; Canadian **$US45**; Overseas **$65**. Editors: Ellen & Paul Connett, 82 Judson St., Canton NY 13617. Tel: 315-379-9200. Fax: 315-379-0448. Email: wastenot@northnet.org*

Attachment 5A
Peter Hille
Common Ground

When Good Rockets Go Bad
Problems with M-55 rocket processing

The original design for incinerating M-55 rockets:

1. The rocket is fed in on a conveyer to the rocket drain/shear station.

2. Holes are punched in the rocket and the liquid nerve agent is drained out and pumped to liquid storage tanks.

3. When the liquid storage tanks are full, the nerve agent is pumped to the liquid incinerator and burned.

4. The rocket is cut into pieces and the pieces are fed into the deactivation furnace and burned.

5. Dunnage (contaminated trash) is burned in a dunnage incinerator.

6. The incineration gasses pass through a pollution abatement system.

7. The contaminated liquid from the pollution abatement system is fed to a brine reduction system.

How it really works:

1. When the nerve agent in a rocket is gelled, it can't be drained.

2. Rockets with gelled agent are cut up and fed right into the deactivation furnace with the agent in them.

3. The brine reduction system is not being used due to failure to operate as designed.

4. The Army has abandoned its plans to use the dunnage incinerator due to technical problems.

The system was not designed to be operated in this manner, in particular having large amounts of nerve agent fed into the deactivation furnace. As a result, the state of Utah has modified the permit for the Tooele incinerator. When the agent in a rocket has gelled, only one rocket can be burned every 40 minutes, instead of 38 per hour. Currently, the Army estimates 33% of the GB rocket stockpile in Utah is gelled (8000 rockets). Given these figures, disposal of the gelled rockets would take twenty-five times as long.

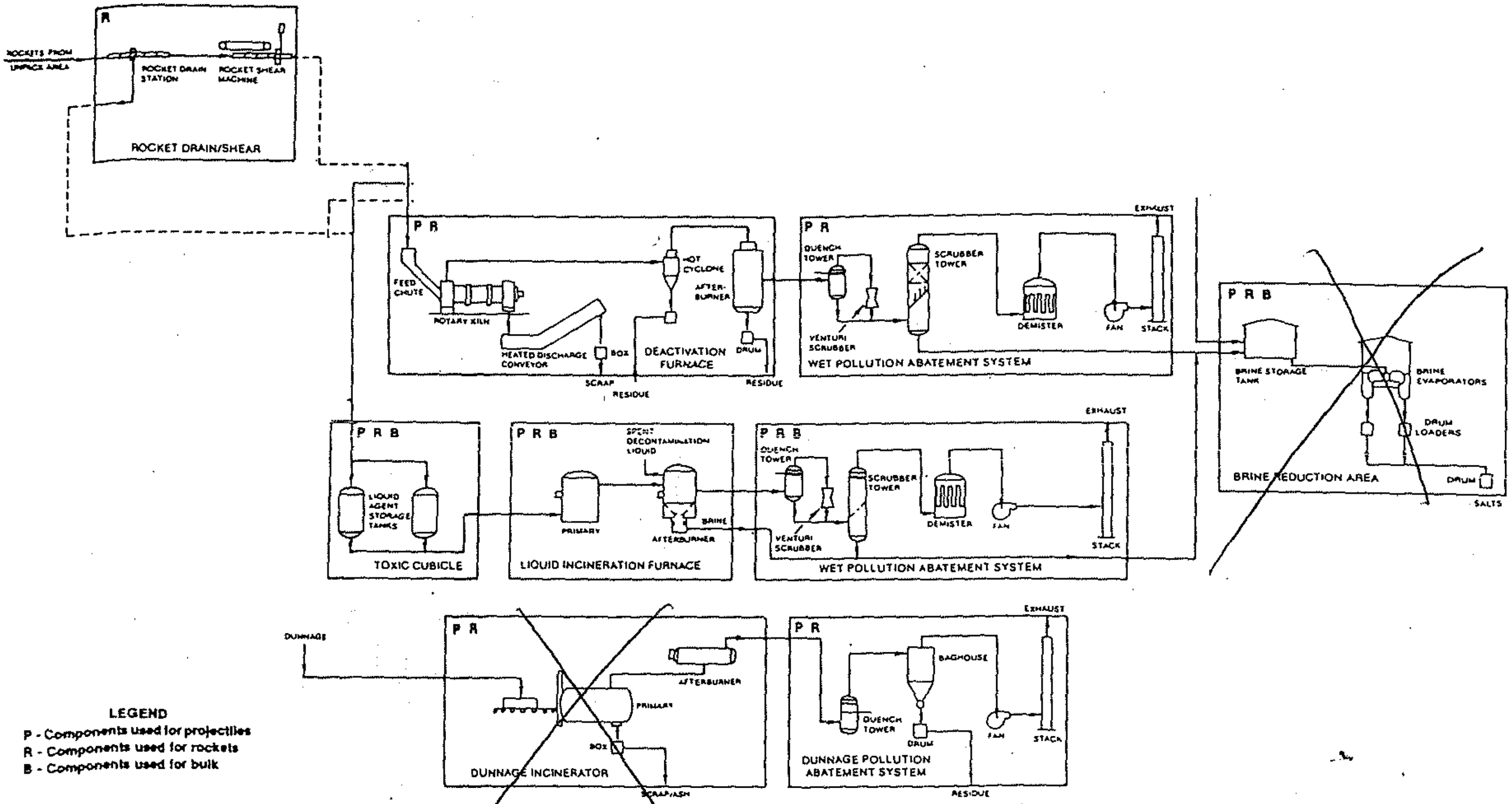

Fig. 1.1.3. Schematic of chemical agent/munition destruction system.

ATTACHMENT 5

EXPERIENCES FROM THE UTAH INCINERATOR:

How does the "operational" incinerator at TOCDF in Utah actually operate?

A Utah resident, Chip Ward, characterized the operation as, "The army promised us a thoroughbred race horse. Instead we were given a one legged pony. EPA is about to raise the hurdles for the race. If I were you I wouldn't bet on the army in this race."

Chip refers to the fact that two out of the five Utah systems have been abandoned by the army, the metal parts furnace has had a release of agent 800 times the permitted level of GB, the liquid agent incinerators have had two $6 million dollar replacements of their brick lining at a cost of $6 million a replacement, and are incapable of processing the highly acidic agent found in some of the ton containers. (5A We anticipate supplementary testimony on this point to be forwarded separately.) Most seriously, agent has been released and lessons have not resulted in critically needed major safety redesigns.

An occurred in March of 1999 in the MPF, workers WERE EXPOSED to nerve gas. (Report by Anthony Flippo on the March Incident included as 5-B)

Now ALL rockets left at Utah are dealt with as jelled. The July 1999 revised TOCDF permit allows processing of only one rocket per hour, (Permit language follows as 5-C and recent information indicates that this number has been slightly revised upward.)

An AP report and notes from the Utah, TOCDF trial are also included here as 5D. **The confirming and detailed legal transcripts from the trial which will be available in the next few weeks must be obtained by the EQC and read in order to understand the full folly of the antiquated furnaces being used at TOCDF and built at Umatilla.** Oregon must not be deceived by paper predictions that have little relationship to reality.

Attachment 1

Responses to 2 July 99 Geoffrey Silcox Questions

1. What fraction of the rounds, rockets, bombs and containers that have been destroyed at TOCDF contain solidified GB or have not been "completely" drained because of problems with equipment?

GB munitions processed at Tooele Chemical Agent Disposal Facility (TOCDF) to date include rockets, MC-1 bombs, ton containers, and 105mm projectiles. To date TOCDF has only encountered crystallized/gelled agent in GB rockets; however, other GB munition types in the DCD stockpile have not been processed at TOCDF. These include 155mm projectiles and weteye bombs. To date, of approximately 29,000 rockets in the Deseret Chemical Depot (DCD) stockpile, approximately 2.5% processed have contained crystallized/gelled agent. Approximately 75% of the remaining 8,700 rockets are estimated to contain crystallized/gelled agent. Of the remaining agents, mustard is expected to contain the most solids and sludges.

At TOCDF there was one instance where an equipment problem resulted in an insufficiently drained MC1 bomb being fed to the Metal Parts Furnace (MPF) (agent in this bomb was not crystallized/gelled).

2. What are the corresponding statistics from JACADS?

The Johnston Atoll Chemical Agent Disposal System (JACADS) defines completely drained as drained to a 5 percent heel. There were no instances where equipment problems prevented complete draining. All GB draining problems were related to the presence of crystalline agent. Crystalline agent was only found in 155mm and 8" GB projectiles. It was not found in rockets, bombs, or ton containers. There were approximately 107,000 155mm GB projectiles at JACADS. It is estimated that approximately 50,000 of these had crystalline agent. There were approximately 13,000 8" GB projectiles at JACADS. Approximately less than half of these had crystalline agent.

3. Has the JACADS operation had experience burning items with excess heels in their Metal Parts Furnace (MPF)? If so, can this data be used to ensure the safety of the plans of TOCDF and DEQ to deal with excess heels?

JACADS burned GB projectiles with excess heels in the MPF. The majority of these were processed at reduced tray loading. That is, the number of rounds per tray was reduced so that the total agent weight per tray remained within the permit limit. In addition, JACADS performed a trial burn using 8" GB projectiles with 35% heels at increased tray loading. Results from this trial burn demonstrated that projectiles with larger agent heels can be successfully and safely processed in the MPF. At JACADS, a mustard (HD) trial burn was recently successfully (for Destruction and Removal Efficiency (DRE)) completed with undrained projectiles.

4. Exactly how would TOCDF and DEQ handle an instance in which an item could not be drained to the level required by their operating permit?

In conjunction with Class 2 Permit Modification TOCDF-MPF-02-0257, Processing Munition Trays with Greater Than Allowable Heel, DSHW added specific language to the permit that allows the TOCDF to process ton containers or projectiles with greater than 5% heels through the MPF. After notification and concurrence from DSHW, these items may be processed through the MPF at agreed upon operating conditions in the primary chamber to control the combustion of the excess agent GB. The afterburner would still be maintained at permitted conditions during this operation. It is anticipated that the modified operating conditions would allow TOCDF to process the greater than 5% heels without requiring a separate trial burn.

The MPF system is operated as a batch feed system. A tray is processed through three Zones governed by timed cycles. The MPF afterburner is designed for a peak volatilization rate from agent contained in the trays. The volatilization rate is limited by controlling the temperature using water sprays in Zones 1 and 2. The afterburner permitted conditions (principally temperature, residence time, and oxygen and CO limits) will be maintained during batch feed of munitions with greater than 5% heel.

5. How long would a new trial burn for the MPF require and how much would such a trial burn interfere with ongoing incineration operations?

The total time required to plan and conduct a trial burn is 6 to 9 months. Preparing the trial burn plan and processing the permit modification require about 4 months. The balance of the time includes 2 months for shakedown and 2 weeks for trial burn execution. Unforeseen problems could extend the schedule another two months. The plant operations would be impacted during the 2 months allocated for shakedown. During the 2 weeks for the trial burn, virtually all other operations would cease. In addition the trial burn would cost roughly $1 million. Therefore, there are significant impacts on plant operations to conduct another trial burn.

6. Based on the answers to the above questions, what can we conclude regarding the threat that incinerating items with excess heels pose to the public? Will a trial burn increase or decrease this threat?

Burning rounds with larger heels does not pose a threat to the public. Safe operation with greater than 5% heel for the MPF has been demonstrated at JACADS. Operating conditions in the MPF primary chamber will be based upon JACADS experience and DSHW concurrence will be obtained prior to processing a load which could not be drained down to less than 5% heel. TOCDF routinely monitors for Agent GB as would be done in a trial burn. The public safety is of utmost importance at TOCDF and we believe that conducting a trial burn for greater than 5% heels will not increase public safety.

No advantage is gained from a trial burn since we already monitor the POHC to the same extent as would be done in a trial burn. Most trial burns are run to monitor the destruction of the POHC. TOCDF monitors for the POHC on a continuous basis.

The DFS system is a batch feed system. A rocket is sheared into eight pieces and these pieces are fed in 3 batches. The DFS system is designed for a high-energy release rate from propellant, explosive and the resin in the fiberglass rocket tube. The added energy release from the rocket's undrained agent does not exceed the design capacity of the afterburner when only one sheared undrained rocket is fed in three drops and permitted conditions (principally temperature, residence time, and oxygen and CO limits) are maintained. Agent destruction efficiency is maintained to the desired level and other emissions on an hourly basis are not exceeded, as the hourly average agent feed rate is maintained within the permitted agent feed rate.

The current permitted rate of 10.2 pounds per hour is the post agent trial burn Agent GB feed rate. The agent trial burn was conducted with a permitted agent feed rate of 20.3 pounds per hour. Feed of a sheared undrained rocket containing 10.7 pounds of agent would have been allowed during the DFS agent trial burn. Further, feeding sheared undrained rockets is validated by the fact that there have been no confirmed agent alarms in the DFS duct and common stack to date during this operation. ARE THEY STILL DOING IT?

3. Control of the DFS afterburner within the permitted conditions will assure agent destruction and control of other emissions.

The final step in the combustion of gases from the incineration of rockets occurs in the DFS afterburner. The trial burns established a narrow operational band for the afterburner which assure that gases generated in the rotary kiln are heated and combusted at the appropriate conditions to assure consistent incineration destruction efficiency. All testing to date has shown that the afterburner performance is well within the appropriate band of control. Also, during the operation of the afterburner under current processing conditions, peak loading of the afterburner is much less than that during full rate processing.

4. Trial burns are run to quantify the POHC in stack emissions.

The main purpose of a trial burn is to determine the DRE for the POHC. For a standard incinerator, knowledge of the destruction of the POHC is obtained only during a trial burn. TOCDF is unique in that the POHC is continuously monitored. The POHC selected for the TOCDF DFS agent trial burn was GB. Since operations commenced, no agent has been detected in the DFS duct and common stack.

MPF - >5% Heel Processing ③

This modification allows the TOCDF to process ton containers or projectiles with greater than 5% heels through the MPF in a controlled manner, and will allow TOCDF to process a partially drained ton container or projectile if ever encountered. A Permit Modification, TOCDF-MPF-02-0257, Processing Munition Trays with Greater Than Allowable Heel, was approved by DSHW on September 18, 1997. After notification and concurrence from DSHW, these items may be processed through the MPF at operating conditions designed to control the combustion of the excess Agent GB. These permit conditions were put in place to allow TOCDF to process the greater than 5% heels without requiring a separate trial burn. To date, no ton containers or projectiles with greater than 5% heel have been encountered.

The following information is provided to show that emissions from processing ton containers or projectiles with greater than 5% heel in the MPF are within the emissions limits demonstrated at the trial burns.

1. The MPF surrogate POHC feed rate during the STB supports the feed of controlled feed of ton containers or projectiles with greater than 5% heels.

   The purpose of the STB was to demonstrate performance of the MPF using surrogate compounds more difficult to destroy than the TOCDF agents. As a worst case, Chlorobenzene and hexachloroethane were selected to be burned during the MPF STB. Also, the DRE requirements for surrogate chemicals were established to be more stringent (99.9999%) than the agent requirement (99.99%). During the STB, ton containers with an average of 97 pounds of the surrogate heel were fed to the MPF. This rate exceeds the current limit provided for ton containers with a 5% heel (75 pounds).

2. Control of the MPF afterburner within the permitted conditions will assure agent destruction and control of other emissions.

   The final step in the combustion of the gases from the incineration of the metal parts with heels occurs in the MPF afterburner. The trial burns established a narrow operational band for the afterburner which will assure that gases generated in the primary chamber will be heated and combusted at the appropriate conditions to assure consistent incineration destruction efficiency. All testing to date has shown that the afterburner performance is well within the appropriate band of control. Also, during the operation of the afterburner, peak loading of the afterburner is much less than that during full rate processing.

3. Trial burns are run to quantify the POHC in stack emissions.

   The main purpose of a trial burn is to determine the DRE for the POHC. For a standard incinerator, knowledge of the destruction of the POHC is obtained only during a trial burn. TOCDF is unique in that the POHC is continuously monitored. The POHC selected for the TOCDF MPF agent trial burn was GB. Since operations commenced, no agent has been detected from the MPF.

4. JACADS has already successfully demonstrated munitions with greater than 5% heels can be processed efficiently.

   JACADS burned GB projectiles with excess heels in the MPF. The majority of these were processed at reduced tray loading. That is, the number of rounds per tray was reduced so that the total agent weight per tray remained within the permit limit. In addition, JACADS performed a trial burn using 8" GB projectiles with 35% heels at increased tray loading. Results from this trial burn demonstrated that projectiles with larger agent heels can be successfully and safely processed in the MPF. At JACADS, a mustard (HD) trial burn was recently successfully (for DRE) completed with undrained projectiles.

   TOCDF has successfully drained the agent from all ton containers and the projectiles to less than a 5% heel to date.

Attachment 5C

DEPARTMENT OF DEFENSE UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR CHEMICAL DEMILITARIZATION
ABERDEEN PROVING GROUND, MARYLAND 21010-5401

REPLY TO
ATTENTION OF

SFAE-CD-C (50q)

9 July 1999
PM-90914.5

SUBJECT: Information Paper for 15 July 1999 Citizens' Advisory Commission Meeting

Dr. Jane Bowman
Citizens' Advisory Commission
5770 S. 250 E.
Murray, UT 84107

Dear Dr. Bowman;

Enclosed please find an Information Paper concerning feeding munitions into the Deactivation Furnace System (DFS) and Metal Parts Furnace (MPF) at the Tooele Chemical Agent Disposal Facility (TOCDF). The paper will be useful in preparing for the Citizens' Advisory Commission meeting scheduled for 15 July 1999.

TIMOTHY W. THOMAS
TOCDF Site Project Manager

Enclosure

Greater than 5% Heel Permit Modifications

Three requests for permit modifications have been submitted to, and approved by, the Department of Environmental Quality, Division of Solid and Hazardous Waste, ~~and have been~~ approved which allow greater than a 5% heel of GB to be processed in the Deactivation Furnace System (DFS) and the Metal Parts Furnace (MPF). These requests were made because of the recently identified differences or the potential for future differences in the physical characteristics of the chemical agent GB being processed at the Tooele Chemical Agent Disposal Facility (TOCDF). These modifications are intended to reduce worker and public risk without increasing emissions above those that were demonstrated during the agent trial burns. The following is a description of the modifications and supporting information, which show that emissions will not increase.

[illegible] Funding

DFS - Full Rocket Processing

A large ~~portion of the remaining~~ GB rocket stockpile contains gelled and crystallized agent (see Attachment 1). Increased frequency of agent strainer maintenance posed an elevated risk to the facility workers due to an increased number of entries required to clean the strainers. Permit modifications (1) TOCDF-DFS-01-0454, Gelled/Crystallized Rockets, ~~and TOCDF~~-DFS-01-0442, Sheared Undrained Rocket Processing, (2) were approved by DSHW on May 19, 1999. These modifications allow TOCDF to bypass the punching and draining operation, and the Agent Quantification System (AQS), prior to shearing the rockets (containing up to 10.7 pounds of agent GB) and processing them in the DFS. To limit agent feed to the current permitted rate (10.2 pounds per hour); the modification allows the TOCDF to feed one sheared undrained rocket every 63 minutes.

INCIDENT IN JUNE?
ACCIDENTAL FEED RATE ↑
TO ~~45~~ ~13 #/Hr
(WILL REQUEST COPY OF UNUSUAL OCCURRANCE REPORT)

The following information is provided to show that emissions from processing sheared undrained rockets in the DFS are within the emissions limits demonstrated at the trial burns.

WHEN?

1. The DFS surrogate Principal ~~Organic~~ Hazardous Constituent (POHC) feed rate during the Surrogate Trial Burn (STB) supports the feed of a sheared undrained rocket.

   The purpose of the STB was to demonstrate performance of the DFS using surrogate compounds more difficult to destroy than the TOCDF agents. As a worst case, Chlorobenzene and hexachloroethane were selected to be burned during the DFS STB. Also, the Destruction and Removal Efficiency (DRE) requirements for surrogate chemicals were established to be more stringent (99.9999%) than the agent requirement (99.99%).

   During the STB, approximately 21 pounds of surrogate compound was fed in the same 3 charges used to feed a rocket. On that basis, the peak surrogate feed rate was approximately twice the current peak feed rate for agent from an equivalent sheared undrained rocket. Moreover, the surrogate compounds were fed at a sustained rate of 820 pounds per hour compared to the current total organic feed rate of 627 pounds per hour (based on the organic compounds in the agent, propellant and bursters). During the agent trial burn, the permitted feed rate for the POHC, Agent GB, was 20.3 pounds per hour. A feed rate of 28 sheared undrained rockets per hour would produce ~~820 pounds~~ per hour of organic feed to the DFS.

2. The permitted agent feed rate achieved during the agent trial burn allows the feed of a sheared undrained rocket.

Attachment 5-B

REPORT

UPDATE TO REVIEW OF 30 MARCH 1998 INCIDENT

NEW INFORMATION

Prepared for Chemical Weapons Working Group

Prepared by
Anthony Flippo
TM Management Inc.
Tooele, Utah
20 August 1999

QUALIFICATIONS

Anthony Flippo
673 Deer Hollow Road
Tooele, UT 84074
435-833-9983

Current Occupation - President of Flippo Construction, a Tooele County, Utah licensed R-100, Building Contractor and President of TM Management, a management service corporation for business and industrial operations management.

Prior Occupation - March 1987 to July 1996 - Supervisory Engineering Technician GS-12 (Retired). Title: Weapons Branch Chief, Test Conduct Division, Dugway Proving Ground (DPG).
Responsibilities: Plan, coordinate, and supervise engineering testing at test laboratories and chemical agent test facilities that conducted engineering testing on chemical/biological defensive systems, weapons systems and munitions.

Work Experience: I have 18 years "hands on" technical experience in the area of testing and demilitarization of conventional and chemical warfare munitions, chemical/biological defensive systems, weapons systems, and firing ranges. I have operated and supervised chemical agent testing facilities, environmental engineering testing facilities, non destructive testing facilities, and weapons testing facilities/ranges. The work in the chemical agent facilities included the dissemination of agent vapor and aerosols in contained environments and the destruction of agent by chemical neutralization and thermal treatment. I have operated and managed hazardous waste facilities that were direct support for waste disposal from testing facilities and firing ranges. This included extensive modification to agent test facilities to ensure compliance with NEPA and RCRA requirements. Some of the facilities modification included improving and validating carbon filter banks, improving air handlers, modifying structure to ensure total and complete containment, changes to the facility for containment of hazardous waste streams, and lighting protection. I was the responsible operator of DPG's Hazardous Waste Operations for Carr Facility governed under the RCRA Part A/B hazardous waste operating permit from the State of Utah. I was one of the founding members of the Environmental Action Committee and I took responsibility to initiate environmental programs in the chemical test facility areas and firing ranges that led DPG to environmental compliance in these areas. I was one of DPG's key managers for the development of programs that supported testing and application of new technologies for munitions identification, recovery and disposal for PM Non Stockpile and Chemical Treaty Verification programs. I was a major player in the development and concept of the Mobile Munitions Assessment System (MMAS). The MMAS is designed and deployed to identify and evaluate recovered chemical warfare munitions. As part of this effort I was a charter member of the Munitions Assessment Review Board established to review the findings and recommend disposition of all recovered chemical warfare munitions I was the Co-chairman (action position) for DPG's training certification program that ensured all personnel were trained in compliance with the CFR's and Army regulations. I was DPG's technical representative to

Department of Army for the control and use of Ozone Depleting Substances. A copy of my resume is included with this report as Attachment 2.

EDUCATION/TRAINING/CERTIFICATIONS/AWARDS

Education:

Over a ten year period I attended numerous Department of the Army schools offered for technical training in the area of conventional and chemical warfare munitions, hazardous waste operations, transportation of hazardous materials, radiological safety, and operational procedures. These schools were taught by Department of Army experts using Army publications and guidance. These schools taught both theory and application of the course material.

Radiological Safety Course - US Army Chemical School - 160 hours
Hazard Analysis for Ammunition Operations - US Army Defense Ammunition Center & School (USADACS) - 28 hours
General Transportation of Hazardous Materials - USADACS - 40 hours
Basic Missile Operational Safety - USADACS - 28 hours
OSHA Initial Health & Safety for Supervisors - Waste Management Inc. - 24 hours
Defense Packaging of Hazardous Materials for Transportation - Logistics Management College 80 hours
Technical Ammunition - USADACS - 306 hours * Award for Outstanding Academic Achievement
Ammunition Demilitarization - USADACS - 104 hours
Contracting Officer Representative Course - Logistics Management College - 40 hours
Preparation of SOP's for Ammunition Operations - USADACS - 48 hours
Non-Destructive Inspection of Materials - Army Materials Lab - 40 hours
Basic Supervisory Training - DPG - 40 hours
Fundamentals of Control Theory for Scientist & Engineers - University of Tennessee - 40 hours
Process Measurement & Control Technology - FOXBORO - 80 hours
Technical Chemical Surety Material Course - USADACS - 80 hours
Technical Writing - DRTC - 80 hours
A.A.S. Degree Business Management - Utah Technical College 4.0 GPA

Certifications:

AR 350-4 Certification for Supervisor Conventional Ammunition & Chemical Operations
AR 350-4 Certification for Operator Conventional Ammunition & Chemical Operations
Level II Radiographer - Army Materials Lab

Awards:

I have received one of the highest Department of Army Awards for Civilians for my active involvement in the development of techniques to analyze, evaluate, and provide environmentally safe disposal of recovered chemical warfare munitions.

Exceptional Performance Awards for Supervisory Engineering Technician 1987 thru 1995 DPG
Achievement Medal for Civilian Service - DPG 1993

Superior Civilian Service Award - TECOM 1995
National Register Who's Who in Executives & Professionals 1999
USADACS - Award for Outstanding Academic Achievement for Technical Ammunition School

PURPOSE & BASIS OF REPORT

I have been asked by legal counsel, Mick Harrison, Chemical Weapons Working Group to prepare this expert report in anticipation of my deposition and testimony at trial regarding the TOCDF litigation.

Summary of material and documents reviewed is at Attachment 1

Opinions offered in this report is based on documents reviewed, my experience, training, and testimony in the deposition for State of Arkansas ligation involving Pine Bluff Arsenal.

This report is an update to my report of 15 February 1999, Review of Incident Tooele Agent Disposal Facility, Metal Parts Furnace, 30 March 1998 and provides new information not provided in the original report. Review of the transcript for the June 7-11 trail in Salt Lake City, Utah, is not possible because it is not yet available. In the interim, counsel, Mick Harrison, has asked me to assume facts as being testified to. These facts are as follows:

1. During the incident of 30 March, 1998, there were three (3) ACAMS in the common stack. There was one ACAMS off line (back-up). The off line ACAMS had a strip chart that was recording during the incident. The strip chart indicated peaks in or intruding into the agent gate.

2. One of the two (2) ACAMS on line in the common stack became saturated with effluent being emitted through the common stack. Verification by challenge was not possible. Technicians changed the components, verification was still not possible. Subsequently, the instrument was changed out in its entirety. Results indicate an unreliable and/or non-functional instrument.

3. The ACAMS discussed in above paragraph (2) had a strip chart reading during the incident that showed peaks in or intruding on the agent gate.

4. The other ACAMS on line in the common stack had a different analytical column than the one that became saturated. It also had a strip chart reading during the incident that indicated peaks, but not in the gates.

5. DAAMS tubes in common stack were removed during incident by monitoring technician Ole Wilson. Mr Wilson made an inquiry to the Control Room for direction to mark the tubes as Alarm Tubes. After a considerable delay, the Control Room responded ***that he was not to*** track the tubes as Alarm Tubes. These tubes were put in a container with 40 other tubes and no chain of custody was created. The Army placed on a proposed exhibit list ***the*** analysis of the tubes that were removed by Mr. Wilson, but withdrew the analysis at trial and never offered the evidence. ***Presumably, there is*** no custody chain to support evidence.

6. The ACAMS in the Metal Parts Furnace (MPF) duct that alarmed has a readout on the instrument that is capable of a reading higher than the 511 Allowable Stack Concentrations (ASC) indicated in the Control Room. The Control Room indication has a maximum reading capability of 511 ASC.

7. The Army claims no employee saw the reading on the MPF duct ACAMS. Mr. Dave Jackson of TOCDF extrapolated a reading from the strip chart of the MPF duct ACAMS of 650 - 850 ASC.

8. It was the consensus of all the Army parties that a chemical emission did exit the stack at 650 - 850 ASC levels. The Army states ***there was*** no agent in the stack, but is not able to identify the chemical emission.

9. During the incident without the approval of some of the management, monitoring technicians attempted to move the agent gate on the duct ACAMS during the period it was alarming. It appears that the technicians were attempting to stop the alarm.

SCOPE OF REPORT AND SUMMARY OF OPINION

This report will address three issues, (1) Update on nature of 30 March 1998 Incident, (2) Agent solidification and crystallization in chemical agent warfare munitions, and (3) Carbon filtration issues.

Update On Nature of 30 March 1998 Incident:

At least two of three ACAMS at the common stack showed peaks on the strip chart on or intruding on the agent gate. The Army*'s* representation that there was no alarm in the common stack is clearly a misrepresentation of the facts. There is no proof offered or available that shows there was not a major release of agent to atmosphere.

Agent Solidification And Crystallization In Chemical Agent Warfare Munitions:

The solidification, crystallization and polymerization of the agent fill in chemical warfare munitions is a problem that has long been encountered by the Army. It has been primarily found in fills that would include vesicants (blister) and nerve agents such as HD, GB, VX, L, and GD in every munition configuration. The Army chemical family has long been aware of the problem. It has been documented at JACADS for many years.

Carbon Filtration Issues:

Carbon filters at agent processing facilities are subject to cracking due to settling of the filter mediums. The cracking allows for channels for contaminates to pass through to atmosphere. The carbon and other filter mediums will release the agent trapped to atmosphere when exposed to high temperatures.

ANALYSIS OF ISSUES

Update On Nature of 30 March 1998 Incident:

One of the interesting facts of the testimony is that at least two of three ACAMS in the common stack showed peaks on their strip charts that were on or intruding on the agent gate. The third ACAMS had a different analytical column that showed peaks, *although* not in the gates. It is my understanding *of* the logic behind having a different analytical column is to reduce interference of non-agent emissions. All three ACAMS show peaks at the same very narrow time frame. Two of the ACAMS are on or intruding on the gate, the other between gates. With a different column, it is not unusual that the peaks could move between the gates. These facts show that all three ACAMS saw something in the stack. The peaks being on or intruding on the agent gates are very good indications of combustion products: agent in various stages of decomposition from raw to consumed; some gases and particles, agent and combustion particles both being affected by oxidation altered by the quench; and contaminants and pollutants due to the shut down of the furnace.

The Army's representation that there was no alarm at the common stack is clearly a misrepresentation of the facts. At least one of the ACAMS in the common stack was saturated and it should have triggered an alarm the same as the one in the duct. It is very likely that the instrument was not working correctly in its ability to send an alarm or a reading to the Control Room. This is evidenced by the technicians changing it out in it's entirety. There is no record of alarm from the stack, however there is clear indication there was an instrument that was showing strong peaks at the same time as the duct ACAMS that was not sending or capable of sending information to the PDARS.

One could argue that the ACAMS in the duct was the instrument that malfunctioned with an alarm. However, it is clear in the record that as soon as the instrument was purged, its readings came down as one would expect. It also stayed on line and the technicians did not change it to another instrument. It continued to make readings that one would expect given the incident.

It is definite that all of the ACAMS saw something. The Army maintains it was not agent. The truth is the ACAMS in the duct and the stack performed as well as they could and they did show peaks in agent gates. However it shows that they are not capable of sorting the combination of products they saw in the stack and duct during this incident. You can make a never-ending argument of what instrument was correct and not correct. The bottom line is the ACAMS are not suited or approved for this type of monitoring and this incident proves that. In addition, the Army totally misrepresented to the public and its regulators the indications that were recorded.

Again, the Army did nothing within their power to gather any other data to prove anything one way or the other.

The TOCDF procedures state ACAMS alarms will be verified by DAAMS tubes. The purpose is to verify the ACAMS reading. It is arguable that neither the DAAMS or the ACAMS are proper for stack monitoring. However TOCDF is using them.

What is very concerning, is that during the incident, DAAMS tubes in the common stack are pulled; a technician asks if management wants the tubes marked as "Alarm Tubes" as would be expected; and is told not to mark them as such. The tubes are placed in a container without any chain of custody or ability to track them. The chain of custody and proper analysis of the tubes is the Army's basis for the confirming alarms one way or the other. In short, there is absolutely no proof that the indications of the duct ACAMS and the strip charts are incorrect. The DAAMS tubes had the possibility of adding credibility to these readings and without chain of custody they are the same as discarded. This is a COMPLETE AND BLATANT VIOLATION of the approved Monitoring Plan for TOCDF. In this case, one can easily make an assumption *that* the Army did not want the data.

With the exception of one issue, there is absolutely no known reason why the maximum reading of the ACAMS is not sent to the PDARS. The exception is when the ACAMS approaches high concentrations it loses reliability and ability to properly measure. It is designed as a low level monitor. In short, without dilution of the air stream the instrument is unreliable. It may well be that 500 ASC or a measurement equivalent to it is the accuracy limit of the electronics. This would limit the accuracy of any signal sent to the PDAR. In addition, the record reviewed does not indicate the range of measurement for the calibration of the instrument.

Mr Jackson's extrapolation of the data on the strip chart raises concern and gives false sense *of accuracy, absent additional information.* With 80-90 lbs of agent going into the furnace and the rapid reactions that occurred, you could well have gone much higher than 850 ASC and in all likelihood did. As stated in my 15 February 1999 report, there was nothing done to verify or discount any release or measurement of it. Considering the location of TOCDF to rail lines and public highways there may have been a violation of the General Population Exposure Limit.

The indication that monitoring technicians attempted to move the agent gate for the duct ACAMS during the alarm represents serious problems. It does represent an attempt to stop the alarm condition of the instrument. It gives false and misleading data that compromises any subsequent analysis of the alarm. This is known fact by anyone that is the least bit familiar with data collection. The fact that the monitoring technicians would even attempt this shows that management either has no control of the technicians or that management has not properly trained the monitoring personnel. In addition, I will state I do not know what was in the management personnel minds, however, short of no control or improper training, it appears that there was a "do not ask, do not see" attitude by management. This is a recipe for disaster.

The Army has stated many times there was no agent release during the incident. However, there are three things missing that support this statement. The first is there is no data to support there was not a major release. The second, in short terms, is the characteristics of the agent exposed to heat, the amount of agent, and the rapid volatilization that took place. The third is the Army's credibility. In short terms, it has taken litigation to get information *about* things that took place during the incident that should have been discovered in any credible Army investigation.

NEW INFORMATION

This area of the report represents new information that was not included in the original report of 15 February 1999.

Agent Solidification, Crystallization And Polymerization In Chemical Agent Warfare Munitions:

The solidification, crystallization and polymerization of the agent fill in chemical warfare munitions is a problem that has long been encountered by the Army. It has been primarily found in fills that would include vesicants (blister) and nerve agents such as HD, GB, VX, L, and GD in every munition configuration. I have seen the agent fill viscosity range from its pure normal form to a solid. I have seen fills where there was a separation of the agent where you have a water like portion with a large amount of suspended particles and a sludge portion that may or may not contain large solid particles. The common finding would be rounds that were almost all sludge or tar-like. I have seen agent that was successfully transferred by vacuum to DOT cylinders in the Depot Agent Transfer System (DATS) system during a range clean up in the 1970's at DPG turn to a sludge or solid in 1985.

As an active and voting member of the Munitions Assessment Review Board as chartered by Deputy Chief of Staff for Chemical and Biological Matters I have evaluated munitions that were thought at one time to be a fill such as White Phosphorus due to its solid fill and configuration. In reality the fill was HD that had gone solid. Recovered munitions evaluated at Edgewood Arsenal and DPG found most of the fills to be sludge-like. A very large number of the suspected chemical munitions evaluated by the review board were found to be sludge-like. This was not an uncommon incident.

I actively conducted tests at DPG for PMCD in 1995 evaluating instrumentation and methods to detect heels in one ton containers stored at Edgewood Arsenal. PMCD has long been aware of this problem. In fact, there were problems at JACADS in 1992 with HD fill in 105 mm projectiles that severely limited production of this munition.

In the 1990's a very large number (thousands) of unfired chemical filled munitions was recovered at Spring Valley, Washington D.C. at the site of the old American University. These rounds were found with the same variety of fill viscosities as any of the other munitions.
With my experience and observations I can easily state this is a very common and unpredictable problem throughout the stockpile and the non-stockpile chemical munitions. It is mandatory that procedures and technology be put in place to handle this situation. Some of the new incineration technologies and alternative treatment technologies have no difficulty with this problem due to the way the fill is disposed of. However, the old punch and drain technology can and has had several problems with the problem fills. This is exactly what happened in the MC-1 bomb incident. It will happen again.

A larger problem exists with the current punch, drain and incinerate technology if the proposed method of destroying the whole round in the furnace is applied. In the MC-1 bomb incident you had agent reacting to the heat which caused an over pressure in the system and a subsequent release. This is exactly what will happen with any full munition sent into the furnace. As proven by the incident TOCDF is not designed or built to properly dispose of full munitions of any weight.

Carbon Filtration Issues:

In my experience at DPG I had the opportunity to encounter many problems with carbon filters on agent test facilities. In addition, I performed tests of chemical defensive equipment that used carbon filters as part of the protection system. I have an extensive practical working knowledge of problems that can *be* and are encountered and how the protection systems use carbon for protection.

In all of agent test facilities at DPG we encountered a problem that was not revealed until the new requirements of testing the filters and newer instrumentation for the testing was put into place. We found that the filters were not meeting the requirements for leakage tests and residency time for the test medium. We found this to be the case on brand new filter elements that were installed. The problem was due to settling of the carbon during transportation that would form small hairline cracks in the element beds. We also found that vibration from the air handlers would cause cracks that would allow leakage. To solve the problem we increased our challenge frequency and had to pack our own filter beds using a "snow flake packer" and pack our element beds on site.

The problem with carbon filters was not a problem isolated to DPG facilities. DPG conducted tests for CAMDS in the early 1990's due to similar problems that were encountered at DPG. CAMDS had an additional problem of having high temperature air flow into the filter banks.

This problem could not be solved due to the nature of carbon. It releases the agent with high temperatures. The only way to solve the problem was to cool the air prior to the carbon filter banks. My experience has shown that agent will start coming off the carbon at temperatures in the 100 -150 degree range.

The experience with agent coming off the carbon was obtained in the mid 1980's when conducting tests on a agent protection system that would extract oxygen. The system was designed to be used in aircraft that may have to land or fly through agent contaminated air streams during battle. The system used zeolite filled beds that would trap everything but the oxygen. The filtered air (oxygen) stream would go to the pilot and crew. The protection system had two beds that would rotate. Once the bed has been contaminated it would cycle the air stream to the second bed. The first bed would then be exposed to a heated air stream to purge it of the agent and nitrogen that was trapped. The purged stream would then be sent to the jet engine and consumed by the extreme high temperatures in the engine exhaust. The test was set up in simulated conditions in a totally enclosed facility. We ran tests using blister, nerve and blood agents at various concentrations, from 50 mg/m3 to 1000 mg/m3. We ran inlet air temperatures from 75 F through 160 F. The purge air temp was approx.150 F to 400 F.

The beds were constantly monitored for agent concentration at each bed. Once a bed reached a total concentration limit, it was purged. The bed would then be monitored for any remaining agent. After the purge the bed would then be ready to absorb agent for another series of agent challenges. After each type of agent test, the beds were removed and new zeolite was replaced. Samples were taken from the remains of the beds and taken to the chem lab for agent analysis. In most cases, there was little if any detectable agent left in the beds. The program proved to be very successful.

To put this in prospective, zeolite is a medium that traps agent much in the same way as carbon type mediums do. The difference is zeolite is much more effective and in fact is used in the chemical industry for filters of air and water. Both zeolite and carbon mediums will release agent when exposed to high temperatures such as those noted above.

CONCLUSIONS

Update On Nature of 30 March 1998 Incident:

The information provide with testimony has validated my report of 15 February 1999. Observations and conclusions made in the report are correct, as my experience led me to believe. At least two of three ACAMS at the common stack showed peaks on the strip chart on or intruding on the agent gate. The Army representation that there was no alarm in the common stack is clearly a misrepresentation of the facts. There is no proof offered or available that shows there was not a major release of agent to atmosphere. The Army took no pro-active steps to confirm the release of agent into the atmosphere. In fact, the Army took the opposite approach and made it such that only litigation has made any information available to the public.

Agent Solidification And Crystallization In Chemical Agent Warfare Munitions:

Any representation by the Army, that solidification, crystallization and polymerization of the agent fill in chemical warfare munitions is a new problem not previously identified is a misrepresentation. The solidification, crystallization and polymerization of the agent fill in chemical warfare munitions is a problem that has long been encountered by the Army. It has been primarily found in fills that would include vesicants (blister) and nerve agents such as HD, GB, VX, L, and GD in every munition configuration. The Army chemical family has long been aware of the problem. It has been documented at JACADS for many years.

Carbon Filtration Issues:

Filter protection systems used at agent processing facilities require close and detailed maintenance. The filter mediums are prone to settling, resulting in cracks, due to vibration from transportation and air handling systems. The cracking allows for channels for contaminates to pass through to atmosphere. The filter mediums will release the agent trapped to atmosphere when exposed to high temperatures

COMPENSATION

My compensation rate for this case is at a substantially reduced rate of $25 per hour. This is due to the extreme public safety concern.

PRIOR TESTIMONY AND DEPOSITIONS

1. Deposition for State of Arkansas Permit Challenge of Pine Bluff Arsenal - 30 July 1999
2. Submitted report and affidavit identified in this report. Review of Incident Tooele Agent Disposal Facility Metal Parts Furnace 30 March 1998.
3. Affidavit of Pine Bluff Non Stockpile Chemical Munitions Waste Storage Problems
4. Testimony June 10, 1999 US District Court, Tooele Agent Disposal Facility Incident 30 march 1998.

I hereby swear under penalty of perjury that the foregoing information is true and correct to the best of my knowledge and belief.

Anthony Flippo

Date

ATTACHMENT 1
SUMMARY OF MATERIAL REVIEWED/REFERENCES

Chemical Weapons Working Group Provided Documents:

1. 1984 Operator's Manual, ACAMS
2. Table 7.1, p. 112--Army-approved detector sensitivity
3. Oct. 15, 1993 Optimal Selection of Gas Chromatographic Columns, Huber et al.
4. Understanding ACAMS Operation and Possible Hazards, TOCDF Monitoring Branch, Troy Burrows
5. January 5, 1987, EPA Larry Johnson memo to EPA Y.J. Kim, re: agent analytical techniques
6. March 23, 1989, EPA Larry Johnson memo to EPA E. Cotsworth, re: stack ACAMS
7. November 12, 1991, EPA/A.T. Kearney report, Evaluation of POHCs for Chem Demil
8. 1994, NRC, Review of Monitoring Activities in Army CSDP
9. January 23, 1996, EPA Carl Daly letter to Marty Gray, DEQ DSHW, re: comments on TOCDF WAP and Agent Trial Burn Plans
10. June 21, 1996 Tim Thomas letter to Dennis Downs, DEQ DSHW, response re: monitoring plan
11. June 21, 1996, Agent Monitoring Plan, Rev. 3 (excerpts)
12. February 10, 1997, Sanderson letter to Janice Ward re: February 3-4 Unusual Occurrence Report, positive DAAMS HVAC stack
13. March/April 1997 Shift Supervisors Log
14. August 15, 1997, RCRA Agent Trial Burn Report for the MPF
15. Page 1663 handwritten, Gary Millar Journal, re: DAAMS tube tracking
16. November 17, 1997 DEQ NOV for TOCDF and December 19, 1997 Army response to NOV
17. December 30, 1997 Downs DEQ DSHW memo to Huber and Thomas re: MC-1 testing
18. February 12, 1998 Deseret News article re: January 28, 1998 ACAMS alarm on LIC restart

19. BDS 102 Log up to March 26, 1998
20. Plant Shift Manager Log 1998
21. Con Utilities Log 1998
22. Plant Status report March 30, 1998
23. Computer Recorded Alarms and Operating Condition Data, March 30, 1998
24. ACAMS Alarms Log handwritten for March 29 through April 2, 1998
25. Off-Line ACAMS Log March 28 through April 1, 1998
26. MPF Furnace and PAS Log 1998
27. PAS Lead Log 1998
28. MPF Waste Feed Log Data and AWFCO report, March 30, 1998
29. MPF Operator Reading Sheets, March 30, 1998

30. Waste Tracking Forms, Operator Reading Sheets, Daily Operations Report, March 30, 1998
31. LIC 2 RCRA waste feed cutoff and operating parameters reports, March 30, 1998
32. Shift Supervisors Log, 1998
33. March 32, 1998 Salt Lake Tribune article re: March 30, 1998 incident
34. April 1, 1998 Deseret News article re: March 30, 1998 incident
35. April 2, 1998 Unusual Occurrence report re: MPF March 30, 1998 incident
36. April 3, 1998 Downs DEQ DSHW letter to Huber and Thomas re MPF restart
37. April 15, 1998 Deposition testimony of Rick Holmes, PMCD, re: March 30, 1998 incident
38. April 17, 1998 Army memo to Downs DEQ DSHW response to April 3 letter re: restart
39. June 19, 1998 Downs DEQ DSHW letter to Cindy King, Sierra Club, re: staggering ACAMS
40. Contingency Procedure: Steps to Process Ton Containers with Greater than 5% Heel
41. TOCDF permit excerpts re MPF waste feed and operating conditions limits
42. Chemical and physical properties of chemical munitions
43. MPF Process Data--Surrogate Trial Burns
44. Agent Monitoring Plan Table: ACAMS/DAAMS locations, codes and levels
45. List of Acronyms, ACAMS codes, etc.
46. 1997 NRC Report, Review of Acute Human Toxicity Estimates for Selected

References

ATTACHMENT 2
Anthony Flippo
Resume

Anthony Flippo
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January 1995 to Present - Contractor:

As a partner in Flippo Construction, a Tooele County contractor, I am responsible for the management of funds for the construction of custom homes. I ensure that all legal requirements and contracts are prepared and complied with during the construction process. I do all of the accounting, taxes, planning and budgets for the company. The homes have ranged from $100,000 to $300,000. The company has an excellent reputation in its ability to manage construction funds and projects.

October 1998 - Present - Management Consultant:

As a partner in TM Management I offer construction and business management services for contractors and other business entities. This includes accounting, bookkeeping, planning, and budgets. In addition, I offer services for industrial operations to include systems safety analysis, industrial operations safety, and technical writing.

March 1987 to July 1996 - Supervisory Engineering Technician GS-12 (Retired)

During the period I was the Weapons Branch Chief for Test Conduct Division at Dugway Proving Ground. I was responsible to plan, coordinate, and supervise all engineering testing. I managed test laboratories that conducted engineering testing on chemical/biological defensive systems, weapons systems and munitions. The laboratories consisted of environmental engineering testing facilities, non destructive testing facilities, weapons testing facilities/ranges, and chemical agent testing facilities. I managed the day to day activities at mid level and had three supervisors and approx. 40 employees under my direction. The employees consisted of three mechanical engineers, 10 engineering technicians, 10 military specialists and other toxic and explosive test operators.

In addition to managing the day to day testing activities I manage the proper disposal of all hazardous waste generated from these testing activities. In addition I was responsible for the procurement of equipment and facilities. I prepared the design specifications for equipment purchase and facilities construction and modification. I was the contracting technical representative on more than 30 contracts with values ranging from $ 50,000 to five million dollars. I was responsible for ensuring that the design specifications and performance were as stated in the contracts. This included extensive modification to agent test facilities to ensure compliance with NEPA and RCRA requirements. Some of the facilities modification included improving and validating carbon filter banks, improving air handlers, modifying structure to ensure total and complete containment, changes to the facility for containment of hazardous waste streams, and lighting protection.

In this position I was one of DPG's key managers for the development of programs that supported testing and application of new technologies for munitions identification, recovery and disposal. This effort included PM Non Stockpile and Chemical Treaty Verification programs. In addition, development of new environmental control technologies for agent testing.

Key Accomplishments - I was one of the founding members of the Environmental Action Committee and I took responsibility to initiate environmental programs in the chemical test facility areas and firing ranges that led DPG to environmental compliance in these areas. As part of this pro-active program I was responsible for overseeing one of the largest environmental clean ups at DPG on record. This effort included thousands of man hours and millions of dollars to clean up the toxic agent test facilities and the firing ranges of hazardous materials. I developed and oversaw the program to bring Bldg. 3008 and the Defensive Test Chamber into State of Utah compliance for contained agent testing. I was responsible for the development and construction of five hazardous waste facilities. I was the Co-chairman (action position) for DPG's training certification program that ensured all personnel were trained in compliance with the CFR's and

Army regulations. I was DPG's technical representative to Department of Army for the control and use of Ozone Depleting Substances. I was deeply involved with Program Manager for Non Stockpile Chemical Munitions in the development and testing of equipment to be used in a world wide clean up. I was a major player in the development and concept of the Mobile Munitions Assessment System (MMAS). As part of this effort I was a charter member of the Munitions Assessment Review Board established to review the findings and recommend disposition of all recovered chemical warfare munitions. In the last five years in my position as Branch Chief, my area received commendations and no findings during for Chemical Surety Inspections and Surety Operations Inspections. In my last three years the agent facilities received only minor findings during State of Utah DHSW inspections. When I started this position, my area was considered an embarrassment to DPG. When I left, the area was being showed with pride and was recognized by the Department of Army and the State of Utah for being an area that others could strive to be.

January 1984 to March 1987 - Engineering Technician

In this position I was the responsible technician in Bldg. 3008 for the set-up and execution of toxic agent testing. I operated and maintained the equipment and facilities for the tests. I designed, fabricated, assembled, and operated the instrumentation, devices and equipment for dissemination of chemical agents in controlled environments. I worked directly with test customers in the development of equipment being tested, established performance criteria, recommended and applied engineering changes, and evaluated overall performance. In addition I operated the test facility to include enclosed chambers, filter systems, scrubbers, air handlers, and hazardous waste sites.

Various Other Positions -

In the early 1970's I was detailed to the Ammunition Equipment Operations for Tooele Army Depot as an electrical technician. I spent approx. 2 years at Rocky Mountain Arsenal in the installation of the equipment for the agent filled cluster bombs demil facility. I installed the automated control systems for the facility.

From 1974 to 1976 I worked at CAMDS as an electrical technician performing installation of control systems for the early versions of the demil equipment tested at the site.

TRAINING -
Radiological Safety Course - US Army Chemical School - 160 hours
Hazard Analysis for Ammunition Operations - US Army Defense Ammunition Center & School (USADACS) - 28 hours

General Transportation of Hazardous Materials - USADACS - 40 hours
Basic Missile Operational Safety - USADACS - 28 hours
OSHA Initial Health & Safety for Supervisors - Waste Management Inc. - 24 hours
Defense Packaging of Hazardous Materials for Transportation - Logistics Management College 80 hours
Technical Ammunition - USADACS - 306 hours * Award for Outstanding Academic Achievement
Ammunition Demilitarization - USADACS - 104 hours
Contracting Officer Representative Course - Logistics Management College - 40 hours
Preparation of SOP's for Ammunition Operations - USADACS - 48 hours
Non-Destructive Inspection of Materials - Army Materials Lab - 40 hours
Basic Supervisory Training - DPG - 40 hours
Fundamentals of Control Theory for Scientist & Engineers - University of Tennessee - 40 hours
Process Measurement & Control Technology - FOXBORO - 80 hours
Technical Chemical Surety Material Course - USADACS - 80 hours
Technical Writing - DRTC - 80 hours
AR 350-4 Certification for Supervisor Conventional Ammunition & Chemical Operations
AR 350-4 Certification for Operator Conventional Ammunition & Chemical Operations
Level II Radiographer - Army Materials Lab
A.A.S. Degree Business Management - Utah Technical College 4.0 GPA
AWARDS -

Exceptional Performance Awards for Supervisory Engineering Technician 1987 thru 1995 DPG
Achievement Medal for Civilian Service - DPG 1993
Superior Civilian Service Award - TECOM 1995
National Register Who's Who in Executives & Professionals 1999

REFERENCES -

Clair McBride - Chief, Safety DPG
Jim Gribble - TECOM Surety
Leonard Rowe - PM Non Stockpile
Bill Brankowitz - PM Non Stockpile

Attachment 5-D
Associated Press
6/18/99

Testimony ends, decision not expected for three months

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SALT LAKE CITY (AP) _ Testimony has ended in a federal court trial of a suit by environmental groups seeking to shut down the Army's chemical weapons incinerator in Tooele County. A decision is not expected for at least three months.

Much of the testimony in the nine-day trial before U.S. District Judge Tena Campbell concerned environmentalists' claim there was a major leak last year.

"We proved a major release of chemical agent into the environment on March 30, 1998," said Mick Harrison, attorney for three groups that contend the waste-burning plant poses an unacceptable risk to public health and the environment. The suit was brought by the Chemical Weapons Working Group, Sierra Club and Vietnam Veterans of America Foundation.

Attorneys for the Army and the private contractor that runs the incinerator presented evidence they said showed that nothing dangerous leaked from the plant during the March 1998 incident.

"It is safely operated and there have been no releases of agent to the atmosphere," said Craig Galli, an attorney for EG&G Defense Systems Inc., the company hired by the Army to run the incinerator.

The incident occurred when an MC-1 bomb containing 75 pounds of liquid nerve agent GB was fed into a furnace.

Critics contend unburned GB escaped up the stack. The Army contended all the GB was destroyed in the incinerator and what went out the stack was an unidentified chemical byproduct generated during the disrupted combustion process.

Normally, a a machine drills a hole in the bomb's metal casing and a tube is inserted to suck out the nerve agent, which is sent to a storage tank and eventually fed into an incinerator designed to handle liquids. The empty bomb casing is sent to a separate metal-parts furnace where it is cooked at temperatures high enough to burn off any residue from the nerve agent.

In the 1998 incident, a hole was drilled in the bomb and a tube inserted, but operators were uncertain whether all the nerve agent was removed.

They tried three times to suck the poison from the bomb then assumed it was empty and sent it to the metal-parts furnace. It was a mistake that led to the control room supervisor's demotion.

The bomb they believed to be empty actually contained about 75 pounds of GB. After being placed in the furnace, the GB burst into flames and sent temperatures within the incinerator soaring, triggering an automatic shutdown of the burners.

Minutes later an alarm sounded and monitors in the control room indicated the presence of nerve agent at more than 511 times the acceptable level in the duct.

Control room operators feared that agent could be escaping from the furnace, so they ordered everyone in the plant to put on protective masks.

The Army and EG&G said their control room officers monitored three other agent alarms at the top of the smokestack for several hours. When they weren't triggered by anything, they assumed that whatever tripped the alarm in the duct must not have been chemical agent. So they allowed employees to remove their masks. As a precaution, they checked a backup monitoring system and found no evidence of problems.

Testimony at the trial showed that one of the three alarms in the smokestack didn't go off because it was "saturated" by an unknown chemical.

Critics also showed that tubes containing samples from the backup monitoring system accidentally were mixed with a batch of old tubes in a recycling bin. Army and EG&G witnesses said they dealt with this problem by testing all of the tubes in the bin and found none contained evidence of chemical agent. The critics suggested that the Army's handling of these tubes was so sloppy that samples collected during the incident could have been lost or hidden.

July 28, 1999

Deseret News
Salt Lake City, UT.

The chemical weapons dilemma

Deseret News editorial

Did the Army lie about not having enough money to test several alternative ways of destroying chemical arms besides incineration? That question, unfortunately, has been added to the debate regarding the disposal of chemical weapons.

The Army says it lacked the $25 million needed to test six alternative methods of destruction while an internal Pentagon memo obtained by Sen. Mitch McConnell, R-Ky., and others, indicates otherwise. The memo indicates $200 million was available for the program.

Regardless of what the truth is regarding the funding, the core issue remains the same: The weapons need to be destroyed in as safe a manner as possible and as quickly as possible.

The Army and other interested parties need to work together to ensure that people's health is not put at risk during the destruction process.

Unfortunately, what has happened in the past ~ such as the reluctance by the U.S. government to acknowledge the dangers associated with the atomic testing programs in the Nevada desert in the late 1950s ~ has led to mistrust and skepticism regarding reports on incineration.

It therefore is understandable that groups such as the Utah-based Families Against Incinerator Risk (FAIR) are not only calling for an accurate accounting but have joined forces to file an environmental lawsuit against the Army's $1 billion chemical weapons incinerator in Tooele County. Maybe the U.S. District Court will determine the next step in the destruction process.

In the meantime, as we have previously stated, procrastination is not the best strategy for dealing with the problem. Either incineration or another method needs to deal with the controversial issue as the Tooele Chemical Agent Disposal Facility is slated to destroy 42 percent of the nation's 30,000 tons of chemical warfare agents.

We concur with the comments made by U.S. District Judge Tena Campbell when she refused to grant an injunction delaying the incineration process in August of 1996: "For individuals living closest to (the incinerators), the risks resulting from continued storage are 100 times greater than the risk resulting from disposal operations."

Therefore, unless the court orders otherwise, destruction of the chemical weapons needs to continue. Until they're gone they will remain not only a topic for contention but a health risk for Utahns and others in the country who reside near chemical weapons stockpiles.

March 30, 1998 Incident

What Went Wrong?

- Workers at TOCDF had had problems draining MC-1 Bombs in the Bulk Draining System (BDS) before March 30, 1998. (Tim Thomas)

- Workers were draining agent from an MC-1 Bomb with the BDS. After trying to drain the bomb, the instrumentation gave conflicting information about whether or not the bomb was actually drained, including a heavy weight reading for the bomb. (T.T.)

- No visual inspection of the bomb was conducted to confirm or disconfirm the heavy reading, and the operator fed the bomb which still contained approximately 80 pounds of agent into the Metal Parts Furnace (MPF). (Judy Moore/T.T.)

- This was a 69 pound overfeed of nerve agent to the MPF, which is a permit violation. (T.T.)

- When bomb was fed into MPF, a temperature limit inside the furnace was exceeded. The furnace automatically shut off, and the bomb was "quenched" with atomized water. (Clayton Hall)

What Was the Result?

- A Carbon Monoxide level of 3000 parts per million (ppm) in the combustion gas - 2900ppm above the permitted limit - was detected during the burning of the heavy MC-1 bomb. This high Carbon Monoxide level indicates rapid combustion of the bomb and its contents. Carbon Monoxide is monitored to ensure effective, efficient destruction of the contents of the furnace. (Clayton Hall/Ray Bills/Marty Gray)

- On March 30, there was one ACAMS (nerve agent monitor) and no DAAMS tubes (air sampling devices for later analysis which are used to confirm or disconfirm the readings of the ACAMS monitors) in the MPF duct, and three ACAMS and DAAMS tubes in the common stack for discharge monitoring. (T.T.)

- TOCDF was not required to monitor continuously at the duct on March 30, but continuous monitoring was required at common stack. TOCDF has been sited numerous times by the state regulatory agency for not maintaining staggered ACAMS which are essential to continuous monitoring of emissions. (Ray Bills/T.T.)

- The highest amount of agent permitted to be released from the stack at any one time is 1.0 ASC (Allowable Stack Concentration). The duct ACAMS rang off at 511 ASC in the control room during this incident, which is the highest reading that can be detected from the ACAMS in the control room. The stack ACAMS, which is separated from the duct ACAMS by nothing but empty space, did not alarm. (T.T.)

- The Site Masking Alarm (SMA) was activated during the incident on March 30. (T.T.)

- ACAMS rang for a matter of hours on March 30th, 1998 at TOCDF. (James Cudahy)

What Came Out of the Stack?

- Technicians and administrators at TOCDF testified that they determined that the March 30th incident probably did not include a live agent release after analyzing DAAMS tubes. However, no one is sure whether or not the specific DAAMS tubes from the time and location of the incident were analyzed, because TOCDF did not have a system to track tubes from a specific location and time to the lab to know which tubes from what location and time are being tested when they are brought to the lab. (T.T.)

- According to evidence submitted to the court, the duct ACAMS detected a chemical during the incident which was identified by the ACAMS as nerve agent. The highest reading by the duct ACAMS was 750-850 ASC, while the stack ACAMS showed a large amount of some chemical which may or may not have been agent. TOCDF technicians testified that they determined that what the ACAMS detected was really just a chemical which resembled nerve agent but was in fact a different chemical, called an "interferent". (Dave Jackson/ T.T.)

- The technician who pulled the DAAMS tubes from the stack which were sampling during the March 30th incident testified that he was instructed by his superior not to treat the tubes as alarm tubes, but to recycle them without testing along with the other non-alarm tubes, which he says he did. (Ole Wilson)

- The lab technician who analyzed the DAAMS tubes that were declared to be clean from the 3:46 am incident analyzed 9 tubes from a bag of 40 or so tubes which had no indication of when they were sampling, then declared the tubes to be clean. (Danny Richardson)

- TOCDF is required to identify and measure waste leaving the stack. Although administration and staff at TOCDF maintain that the chemical released on March 30 was not nerve agent, no effort has been made to identify or measure the chemical recorded by the duct ACAMS on March 30th. (Ray Bills)

Were the Alarms Working?

- Alarms Technician Ole Wilson went to test the 3 stack ACAMS to see if they were working shortly after the 3:46am incident. The first was saturated and would not respond to testing. The second responded successfully to the challenge, and the third was never tested due to the unusual amount of time Wilson had to spend on the non-functioning first ACAMS. (Ole Wilson)

- Continuous monitoring of emissions cannot be achieved when one of the ACAMS in a continuous monitoring cycle is saturated. (Steve Wade)

- At 5:30 and 6:21am following the MC1 bomb overfeed, Shane Perkins twice moved the "agent gate" on the duct ACAMS such that agent being detected with the old setting would probably not be picked up. Why? "Could have been to eliminate interferent readings." It is inappropriate to change the agent gate during an alarm, although Perkins could not recall whether or not the ACAMS was in alarm when he changed the agent gate. (Shane Perkins)

May 21st Incident

- Workers were in inappropriate protective clothing; their masks were at their sides. (Tim Thomas)
- Agent migrated from the ECR (Level A) to the unpack area (Level C) through the airlock. ACAMS alarmed in Level C at 15 (or 19) twa. This is 75 times the alarm level. (T.T.)
- The HVAC system was not functioning properly. No agent registered in the ECV until two minutes after the alarm sounded in the unpack area. (Jeffery Harris)
- Workers in the unpack area were dressed in Level D and E clothing. This protective gear has open an open back, and does not protect workers' skin from agent exposure. (J.H.)
- After the alarm sounded in the unpack area, the seven workers masked and exited. (J.H.)
- There were no ACAMS in the airlock. (T.T.)
- They are having to replace filters more often than anticipated because strainers are clogging. (T.T)
- The only thing between the unpack area and the outside environment is a door with an imperfect seal. Agent may have migrated to the outside.
- Agent migrated through the North and South dampers. (J.H.)
- There is not an ACAMS by the North damper, but there is one by the South damper. (J.H.)
- Simultaneous activity in the unpack area and the ECR is "new" (or unusual) (John Hall)
- This incident was strictly a design system failure. (T.T.)

May 24th Burster Well Incident

- Readings were 1900 twa, 50 times higher than the maximum allowed for Level B clothing. (Tim Thomas)
- The incident took place in the unpack area with workers dressed in Level B clothing, (an apron split in the back). (T.T.)
- According to design, projectile disassembly, (originally intended to be done by machine), would be done in a Level A room. (T.T.)
- This operation has now been moved to a Level B area, to be done by workers dressed in DPE suits. (Ted Ryba)
- Prior to this incident, they had not assessed projectiles to predict the presence of liquid. (T.R.)
- There is no buffer room if the HVAC system doesn't work to prevent the agent from going to the outside environment. (T.R.)

May 26th TMA Incident

- ACAMS reading was 1985 twa. (Col. Huber)
- Workers in TMA were dressed in Level B clothing. (J.H.)
- Workers were removing plastic bags of waste in the TMA. (J.H.)
- There was a ripped bag that caused a high ACAMS reading. (J.H.)
- Corrective action have not prevented recurrences. (Ted Ryba)
- Corrective action did not result in a significant change of procedure. (T.R.)

ATTACHMENT 6-A

Risk estimates did not include all risks and uncertainties, and statistics create a falsely inverted comparison between the dangers of storage and processing.

Lisa Brenner
Oregon Clearinghouse for Pollution Reduction

How is it that the Army's risk assessments show that a day of storage for chemical weapons at Umatilla is more dangerous than a day of processing them with old fashioned burning?

The August 1999 NRC report points out that the Army never actually calculated and evaluated all the risks, that this failure eliminated the possibility of meaningful public involvement, and that any future risk calculations need to be evaluated by an independent party:

> "However, the Committee believes that the piecemeal approach taken in the Anniston and Umatilla PFS HRAs and the use of the TOCDF QRA as a surrogate are neither the simplest nor the clearest way to support risk management conclusions. The Army did not provide the Committee with an integrated analysis that clearly indicates the environmental effects, the public health benefits, or the worker safety implications of the PFS. Nor did they provide quantification (or even clear identification) of the uncertainties associated with the analyses." (p.43)

One of the many risk related comments in their Executive Summary recommendation section concludes, in speaking about health risks:

> "The results, including the acute and latent risks, should be reviewed by independent technical experts." (p.5) and "Because of the length of time required to complete the preliminary PFS risk assessment, the fact that this evaluation is till incomplete, and the status of construction activities at Anniston and Umatilla, meaningful public involvement in the decision to include the PFS at these sites is no longer possible." (p.5)

Carbon Filtration for Reducing Emissions from Chemical Agent Incineration, August 1999,
National Research Council

Most important, the NRC points out that "the evaluation of risk from a potential agent-vapor explosion **did not consider scenarios of poorly drained munitions being processed**, which could significantly increase the amount of agent in the MPF." (p42)

The December 1998 Draft Report stated the problem very explicitly, even without considering jelling for the MPF (metal parts furnace) with a carbon bed filter:

> "The Phase 1 QRAs indicate that PFSs are not associated with any accident scenarios that are likely to expose offsite receptors to agent. The Phase 2 QRA for the TOCDF, however, identified **an accident scenario involving the failure of the additional operating controls necessitated by the PFS that could increase the potential frequency of a MPF explosion severe enough to breach the primary containment around this incinerator.** Mitigation

> measures have not yet been identified, but will be investigated as part of the Phase 2 QRAs and Hazard Evaluations (job safety review) for Anniston and Umatilla."
>
> From 12/3/98 DRAFT of the NRC Carbon Filter Report Chapter 5 p 5-7

The NRC final report said the same thing, but in a way that completely obfuscated the assertion:

> "The Phase 2 QRA, which addresses worker risk associated with agent processing at the TOCDF, was used to provide insight into possible accident scenarios at Anniston and Umatilla, which are expected to have similar designs and operating practices. The QRA analysis carried out using the Phase 2 QRA from the TOCDF **identified blockage of the exhaust gas flow by the PFS, coupled with loss of the induced draft (which maintains the pressure drop for the exhaust-gas flow), as the only upset condition that would result in increased risk from a release of agent caused by the PFS.**"
>
> Final Carbon Filter Report Chapter 5, p42

ATTACHMENT 6-B

Lexington Herald-Leader, July 20, 1999, McConnell: Show me the money: Senator concerned over weapons disposal funds

Eastern Oregonian.com/front page 7/20/99, Weapons disposal program Faces scrutiny

July 19, 1999 Press release by Senator McConnell: McConnell Calls for Federal Investigation Into Army: "McConnell says Army's "bait and switch" risks public safety"

August 23, 1999 Letter from Senator Hatch to Ted Prociv

Defense Environment Alerts

> June 29, 1999 Administration Objects to Chem Demil Cuts, Refuting Appropriators, Tooele Trial Ends, Judge Holds Off On Closing Arguments
>
> July 13, 1999 Comptroller Completes Specialized Review of Chem Demil Program
>
> July 27, 1999 House Severely Cuts Chem Demil Program, Denouncing DOD Practices
> July 14 letter to the GAO office from Senator McConnell and Stevens

CWWG Fact Sheet: The Truth about M-55 Rocket Instability

Dunnage incinerator falsification, 1995 GAO report quoted in The Oregonian, August 27, 1999, Army wavers on burning Umatilla chemical weapons

June 4th Power Outage

- Agent migrated into the Observation Corridors, (Level C), due to a power system outage. (Tim Thomas)
- Power back-up system did not come on automatically; it had to be manually jump-started. (T.T.)
- Army and EG&G have no way of knowing if agent migrated to the outside environment.
- Agent migration occured as a direct result of the HVAC system shutting down. (T.T.)
- This was not the first time the emergency back-up system had failed. (T.T.)
- Seven separate alarms sounded, indicating agent migration. (Marty Gray)
- It took 25 minutes for the back-up generator to come on-line; it should be instantaneous. (M.G.)
- The SMA sounded after the normal power resumed. (Chris Bittner)
- The MDB was evacuated. (Mike Rowe)
- The UPS is designed to provide power to control systems and ACAMS for 20 minutes. (Ted Ryba)
- Agent migration occured after emergency power came on. (T.R.)
- ACAMS continued to ring off through the process of returning to normal power. (T.R.)
- There were no mass balance calculations done. (T.R.)
- They are adding one diesel generator as a corrective action. This technology is the same technology that failed on June 4th. (T.R.)
- During power recovery, the ACAMS sounded in the airlock adjacent to the DFS. This was related to the power outage, but could be considered a separate incident. (T.R.)

July 20, 1999

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City&Region
LEXINGTON HERALD-LEADER

McConnell: Show me the money

Senator concerned over weapons disposal funds

By Gail Gibson
HERALD-LEADER WASHINGTON BUREAU

WASHINGTON — Concerned that the Army misrepresented how much money is available to study alternatives to incinerating old chemical weapons, U.S. Sen. Mitch McConnell has asked the auditing arm of Congress to step in and look at the books.

Sen. Mitch McConnell wants the GAO to audit the Army.

In a joint letter with Sen. Ted Stevens, chairman of the Senate Appropriations Committee, McConnell directed the General Accounting Office to investigate the Army's chemical demilitarization program.

Specifically, the senators want to know how much money the program has spent since 1993, and on what. They also want to know whether it will meet a 2007 deadline for destroying all of the nation's old chemical weapons, including the stockpile at the Blue Grass Army Depot in Madison County.

The GAO report could make clear whether the Army has the money to fully test six potentially safer alternatives to incinerating chemical weapons — something lawmakers and activists have pressed for in the past year.

The Army has said it only could afford to study three alternative methods. But an internal Defense Department memo and a Senate appropriations committee report suggest that the chemical weapons program has millions in unspent funds.

"I am concerned that the Army is pulling a bait and switch," McConnell told reporters yesterday. "We gave them enough money to fully study all viable alternatives and now they say they don't have it. That's why we're sending in the investigators to find where the money is."

Nancy Ray, an Army spokeswoman, said yesterday that she could not comment on the senators' request because she had not seen their letter.

Ray said previously that questions raised about the chemical weapons program's finances are unfounded. The program has traditionally obligated funds well in advance of actually spending the money — meaning that money that appears available really isn't.

Still, the program's finances have come under close scrutiny in recent months.

A Senate Appropriations Committee report this spring said that instead of facing a budget shortfall, the disposal program had more than $200 million in unspent funds at the end of the 1998 fiscal year.

A Senate Appropriations Committee report this spring said that instead of facing a budget shortfall, the program had more than $200 million in unspent funds at the end of the 1998 fiscal year.

Earlier this year, a Defense Department comptroller said in a internal memo that the program appeared to be "banking money."

And last week, a House Appropriations Committee report repeated the same concerns. It concluded by also directing the GAO and the Defense Department's inspector general to investigate the chemical weapons program.

The GAO investigation could take several months to complete. The last GAO review, completed in February 1997, found that the cost of the destroying the nation's chemical weapons was climbing and predicted the deadline for destroying the weapons would not be met.

The head of a Berea-based chemical weapons watchdog group welcomed the calls for a new independent review of the Army program.

"It takes an independent, GAO kind of look-see — that kind of peek under the tent — to really see what's going on," said Craig Williams, director of the Chemical Weapons Working Group. The organization considers incineration unsafe, arguing it could release small but potentially dangerous amounts of nerve agent.

eastoregonian.com /front page/7-20-99

Weapons disposal program faces scrutiny

Senator calls for federal investigation of Army request for more funds

By The Associated Press and the East Oregonian

LOUISVILLE, Ky. — U.S. Sen. Mitch McConnell asked the investigative arm of Congress on Monday to review the Army's program to dispose of chemical weapons.

In a letter to David Walker, Comptroller General of the General Accounting Office, McConnell, R-Ky., and Senate Appropriations Committee Chairman Ted Stevens, R-Alaska, requested that the agency look at all "obligations and expenditures" from the chemical demilitarization program from 1993-1999.

The letter also asks the GAO to examine whether the Department of Defense is on schedule to destroy its chemical weapons stockpile by a federally mandated April 2007 deadline.

"More than $4.5 billion has been provided to the Army and now they claim they don't have the funds," McConnell said in a conference call Monday. "The facts suggest they have enough money to do the job. The bottom line is the Army will do the job Congress told them to do."

The Blue Grass Army Depot near Richmond is home to thousands of rockets holding more than 520 tons of dangerous VX nerve agent. Federal law mandates that the weapons must be disposed of on site because they cannot be shipped out of state.

More than 3,700 tons of lethal nerve gas are stored at the Umatilla Chemical Depot near Hermiston. The $604-million weapons incinerator complex there is more than 50-percent complete, with operations scheduled to begin in October 2001.

The Army determined in the early 1980s that incineration was the only safe and practical way to dispose of the nearly 30,000 tons of chemical weapons across the country. Less than 2 percent of that total is stored in Madison County.

Opponents have argued that burning the weapons is too dangerous, with the potential for small amounts of nerve agent to be released from smokestacks.

Incineration already has started at Johnston Atoll in the Pacific Ocean and at Tooele, Utah. But opponents, including McConnell, have called for the Army to investigate six alternative methods of disposal.

Congress gave the military $40 million in 1996 and demanded it demonstrate at least two other methods for disposal. An independent review group proposed that six methods be studied but the Army and the Defense Department agreed to test only three.

To persuade the military to study all six, Congress agreed last year to allow the military to shift $25 million within the chemical demilitarization budget to fund the studies.

But because no new money was added to their budgets, military leaders said in letters to McConnell — who had proposed letting them reauthorize the $25 million — that they still could not afford to study all six methods.

In an internal memo titled "Pot of Gold," a defense comptroller earlier this year said the money was in fact available within the Army's chemical demilitarization budget. A separate Senate appropriations report also suggested the program had more than $200 million in unspent funds at the end of the 1998 fiscal year.

"Scientists have identified six new technologies," McConnell said. "They simply will not follow the law."

McConnell said incineration might be the best way for disposal in remote areas like the Utah desert and the Pacific Ocean but that the Blue Grass Army Depot sits just a chain link fence away from a middle school and vast residential and rural farm areas. The Umatilla depot is located just five miles west of Hermiston and even closer to Irrigon and Umatilla.

"The problem here is that there is some bureaucrat dug in who will be embarrassed if one of these technologies proves to be safer than incineration," McConnell said. "I don't care if he's embarrassed or not. What I care about is the safety of the people of central Kentucky."

A public hearing sponsored by the U.S. Department of Defense's Assembled Chemical Weapons Assessment Program will be held Thursday at Eastern Kentucky University. Companies developing three of the alternative disposal methods are scheduled to have representatives on hand to answer questions about the benefits and possible risks of each method. A similar presentation in Hermiston last month received a rough reception from residents who fear the alternative technology program could further delay the destruction of weapons at the Umatilla Chemical Depot.

<<PREVIOUS STORY

FRONT PAGE>>

U.S. Senator for Kentucky

MITCH McCONNELL

EMBARGOED UNTIL 11:00 AM EST
July 19, 1999
99-223

McCONNELL CALLS FOR FEDERAL INVESTIGATION INTO ARMY

McConnell says Army's "bait and switch" risks public safety

WASHINGTON, D.C. – U.S. Senator Mitch McConnell today called on the General Accounting Office (GAO), an investigative arm of Congress, to conduct a "thorough and complete review" of the U.S. Army's chemical demilitarization program from FY 1993 - 1999.

"I am concerned that the Army is pulling a bait and switch," said McConnell. "We gave them enough money to fully study all viable alternatives and now they say they don't have it. That's why we're sending in the investigators to find where the money is. The bottom line is the Army will do the job Congress told them to do. This needs to be examined, and that is why I am calling on the GAO to perform a complete and thorough investigation of the program."

The Blue Grass Army Depot in Madison County houses 523 tons of chemical weapons which must be disposed of on site because federal law prevents them from being shipped out of state. In 1996, McConnell directed the Army to study alternatives to incineration because of public health and safety concerns. While McConnell provided $65 million to assess six alternatives, the Army has subsequently claimed they don't have the necessary funds to study all six. However, earlier this year, a defense comptroller wrote in an internal document that money was available within the Army's chemical demilitarization budget.

In a letter to David Walker, Comptroller General of the GAO, McConnell and Appropriations Committee Chairman Ted Stevens (R-AK) requested that the agency review all "obligations and expenditures" from the chemical demilitarization program. McConnell also urged the GAO to examine whether the Department of Defense (DoD) is on schedule to destroy its chemical weapons stockpile by April 2007, the deadline set by the Chemical Weapons Convention (CWC).

Last month, McConnell pushed a plan successfully through the Senate which blocked construction at the Bluegrass Army Depot until the Army completes full studies of all six alternative technology as called for in the Assembled Chemical Weapons Assessment program in the FY'97 Defense Appropriations Act.

"The Army must be held accountable for the safety of those living near the Blue Grass Army Depot," said McConnell. "I will continue my push to ensure that the Army only utilizes the safest, most effective technology available for the destruction of the weapons."

-30-

FOR MORE INFORMATION CONTACT ROBERT STEURER, PRESS SECRETARY, (202) 224-8288, FAX (202) 228-3416. SR-361A, WASHINGTON, D.C. 20510-1702.

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United States Senate
COMMITTEE ON APPROPRIATIONS
WASHINGTON, DC 20510-6025

July 14, 1999

The Honorable David M. Walker
Comptroller General
General Accounting Office
Washington, D.C. 20548

Dear Mr. Walker:

In April of 1997, the Senate ratified the Chemical Weapons Convention (CWC) thereby setting April 2007 as the deadline by which the United States has agreed to destroy its chemical weapons stockpile. More than a decade prior to ratification of the CWC, America was working towards identifying a means of destruction and implementing a program that would rid the nation of these weapons. Today, $4 billion later, less than 10% of the stockpile has been destroyed and America's program is struggling to meet its schedule.

From 1993 to date, Congress has appropriated $4.5 billion for R&D, Procurement, Operation and Maintenance and Military Construction for costs associated with this national effort. We are concerned that DoD has failed to adequately implement the national strategy, to account for the funds appropriated by Congress, and has shifted funds for this effort to meet other Department priorities.

In light of these issues, we request that the General Accounting Office conduct a thorough and complete review of all programs relative to Chemical Agents & Munitions Destruction, Defense and Chemical Agents & Munitions Destruction, Army for the time period FY 1993 -1999. This would include, but not be limited to PMCD expenditures within the Chemical Stockpile Disposal Program (CSDP) for fiscal years 1993-1999. This review should include obligations and expenditures from Operation and Maintenance, Procurement, Research & Design and Construction and the Assembled Chemical Weapons Assessment accounts for this time period. Further we request that this examination evaluate schedule compliance and time lines and a determination of whether the Department's chemical demilitarization process is moving forward in a manner that will enable it to meet CWC mandates.

We look forward to working with you as you undertake this important investigation.

With best wishes,

Cordially,

MITCH McCONNELL
Chairman
Senate Appropriations
Subcommittee on Foreign Operations

TED STEVENS
Chairman
Senate Appropriations
Subcommittee on Defense

ORRIN G. HATCH
UTAH

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United States Senate

WASHINGTON, DC 20510-4402

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INTELLIGENCE

INDIAN AFFAIRS

August 23, 1999

Dr. Ted Prosiy
Deputy Assistant Secretary of the Army (RDA)
Department of the Army
Washington, D.C. 20310

Dear Ted:

I wish to bring to your attention a matter of great importance to me effecting the Army's role in the Chemical Demilitarization Program, and to thank you for your past help.

The Defense Authorization Conference has identified $40 million to assess the results of three alternative technologies to the baseline incineration process. The three "total solution" technologies to be assessed will be identified from the original Army's Assembled Chemical Weapons Assessment (ACWA) program, in addition to the three previously selected, and to be reported by DOD to Congress in September 1999.

I am recommending that the Army include in its assessment any appropriate "less-developed" technologies solicited under the July 1997 Broad Agency Announcement (BAA). It appears that several bids against the 1997 BAA carry assessment costs that are fraction of the $40 million prospectively available from Congress this year, and that one or more of BAA technologies may be a useful insertion into one of the more advanced ACWA alternatives.

My concurrent concern is the high cost to business, many of them small, to respond to the BAA, a process which is now two years old, and the length of time it took both Congress and the Army to decide its value to ACWA. As the ACWA panel convenes this week, I would ask that you raise my concerns on this matter.

I send my highest personal regards.

Sincerely,

Orrin G. Hatch
United States Senator

ORRIN G. HATCH
UTAH

PATRICIA KNIGHT
CHIEF OF STAFF

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August 23, 1999

Dr. Ted Prosiv
Deputy Assistant Secretary of the Army (RDA)
Department of the Army
Washington, D.C. 20310

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I send my highest personal regards.

Sincerely,

Orrin G. Hatch
United States Senator

ADMINISTRATION OBJECTS TO CHEM DEMIL CUTS, REFUTING APPROPRIATORS

The Clinton Administration plans to appeal a $140 million cut the Senate has made to the Army's fiscal year 2000 appropriation for the chemical demilitarization program. The administration's move essentially refutes appropriators' charges that the additional funds are unjustified given that the department ended last year with a large sum of unexpended money.

The Army concedes it had over $200 million in unexpended operations and maintenance (O&M) dollars at the end of the year, but says all of those funds were obligated to accomplish on-going chemical demilitarization work.

In recent weeks, charges of mismanagement and misrepresentation of the chemical demilitarization budget have been flying, now prompting the Army Audit Agency to begin an investigation into the matter. The charges — stemming from Senate appropriators' examinations and an internal DOD memo — are that the chemical demilitarization program hid excess funds, while claiming its budget was too tight to pay for testing the full array of non-incineration chemical agent destruction technologies that are being considered for use at the Army's stockpiled chemical weapons sites. These technologies are being tested under DOD's Assembled Chemical Weapons Assessment (ACWA) program and are being considered as alternatives to the Army's baseline destruction method of incineration.

The House Appropriations Committee's Surveys and Investigations staff is also conducting an examination of the chemical demilitarization program. Sources could not be reached on the specifics of the investigation.

The White House, however, is staunchly defending its chemical demilitarization budget request for FY00, and is protesting an amendment attached to a military construction bill that would effectively force it to fully test all of the ACWA technologies shown to be viable or face a bar on using any appropriations to build a destruction facility at one of its stockpile sites. In both instances, the administration says that if the legislation stands, the United States would be in jeopardy of breaching the Chemical Weapons Convention (CWC), an international treaty that requires destruction of stockpiled chemical weapons by 2007.

"There's no question" that the administration will formally appeal the cut to Congress, despite the recent charges inside and outside the Pentagon over the program's accounting, says one DOD source. "Everybody wants to believe badly that there is no money [available]. That's the answer they want the most," this source says, referring to officials within the Pentagon and Office of Management & Budget (OMB).

OMB will probably look closely at this account next year, but this year, it has to defend the budget it submitted, this source explains. As well, the Army's chemical demilitarization program is defending its accounting methods in the face of the recent charges. In the latest allegations, citizen activists are pointing to a leaked internal DOD comptroller memo that essentially indicted the chemical demilitarization program's accounting method (*see text on p11*). Similar to Senate appropriators, the comptroller's office found large amounts of unexpended dollars at the end of FY98 as well as instances in which excess funds were "hidden" unnecessarily in certain projects (*Defense Environment Alert*, June 15, p3).

An Army spokeswoman says the chemical demilitarization program disagrees with the conclusions of the comptroller memo.

In addressing the unexpended amounts they found, Senate appropriators in report language attached to the FY00 defense appropriations bill told the Defense Department that "the program growth in the budget request is not justified," and directed DOD to report back on actions taken to improve budget execution within the program (*Defense Environment Alert*, June 1, p3). But the White House objected to the cut through a Statement of Administration Policy on the bill, saying that "A reduction of this magnitude would cause a breach in the Chemical Weapons Convention deadline for the destruction of these chemical weapons." The Senate passed the defense appropriations bill June 8.

The Army in a written response to questions from *Defense Environment Alert* concedes to the appropriators' finding that the program had at least $200 million unexpended at the end of FY98. However, it says all of this money was obligated and points to "several anomalies in the Chem Demil Program which affect the expenditure rates." The Army says that a large portion of O&M funds are executed through contracts and not for in-house pay, and that some of these "are obligated on contracts requiring a one-time deliverable/product that started in FY98 but are not scheduled for completion until the latter part of FY99." This disbursement will not occur until that work is done and bills are submitted, the response says.

White House objects to McConnell amendment

The administration also objected to an amendment included in the FY00 military construction appropriations bill that would require the full testing of all six ACWA technologies before the Army could use any appropriations to build a destruction facility at its Bluegrass stockpile site in Lexington, KY. The ACWA program tested only half of the six technologies so far because of limited funding; high-level Army and Defense officials claimed no additional funds were available to give to the ACWA program, even though a defense statute signaled Congress favored the reprogramming of additional funds to the program.

In a Statement of Administration Policy on the military construction bill, the White House says it "strongly opposes" the Bluegrass amendment, known as Section 129. It says DOD has already met the requirements of the law for testing at least two ACWA technologies and that prompt construction of the facility is critical. "This provision would delay construction of the Bluegrass site by at least one year, resulting in a breach in the Chemical Weapons Convention deadline," the statement says. The Senate passed the bill June 16, after some floor debate.

Sen. Jeff Bingaman (D-NM) on the floor also expressed concern that Section 129 could hamper DOD's ability to meet the CWC. Bingaman urged the conferees on the upcoming House-Senate conference of the bill to modify the amendment so it would not have what he deemed an unintended effect of preventing the United States from meeting its treaty obligations.

Sen. Mitch McConnell (R-KY), the amendment's sponsor, though responded that the amendment would have no effect on schedule in FY00 because it allows for construction of non-technology specific work at Bluegrass — work not linked to a specific destruction method. Proponents say non-technology specific funds are the only type of construction appropriation DOD is asking for at Bluegrass next year. "The language contained in Section 129 should have no adverse impact on the U.S. being able to satisfy its [CWC] obligations," McConnell said June 16. The ACWA program estimates that testing out the remaining three non-incineration technologies would take one year, given certain caveats, such as the test sites being available within that time, according to an ACWA source. While this source believes the permitting schedule for ACWA technologies can be accelerated, the source speculates it would be highly unlikely that the Army could meet the 2007 deadline if the program had to demonstrate the remaining technologies and wait for their testing to be completed before moving forward with choosing technologies for stockpile sites.

Despite the Statements of Administration Policy, one source says that administration officials in recent days have begun to further review the impact of the $140 million cut and the section 129 amendment, after questions were raised over the basis for the administration's position that these amendments could lead to CWC breaches.

At the same time, some proponents of ACWA are working to ensure ACWA survives in its current form past the end of this fiscal year, with one source saying that Army staff are threatening to take any chemical demilitarization cuts "out of the hide of ACWA." This source says the defense bills lack language that protects ACWA. The Army requested $130.2 million for ACWA next year, according to the Army's written response to questions.

Meanwhile, the citizens coalition that advocates alternative non-incineration technologies, Chemical Weapons Working Group (CWWG), recently sent out a packet of documents and statements made by Army officials this past year that the group says is evidence showing that the chemical demilitarization program and its top official, Army Deputy Assistant Secretary for Chemical Demilitarization Ted Prociv, "misrepresented budget information regarding funding for alternative technology demonstrations." An accompanying letter from CWWG chronicles these statements and points to the comptroller memo as key evidence in its arguments. CWWG charges Prociv had direct knowledge of the budgetary situation and had fiscal oversight of the program. The group calls for his resignation. At press time, the coalition had not received a response from the Army or DOD.

The Army spokeswoman at press time said Prociv was not planning to resign and that the Army would be responding to the CWWG request. She denied the program tried to subvert the ACWA program by limiting the number of ACWA technology tests, as charged by CWWG. To the contrary, she said the Army exceeded the requirements of the law, testing three rather than the minimal two required.

Summing up the charges, one environmentalist says that there are "a lot of angry people inside and outside the system."

Editor's Note: Below is the full text of the DOD comptroller memo on the chemical demilitarization program. The last two paragraphs of the memo were mistakenly left out of the text run in the June 15 issue.

Text: Internal Comptroller Memo on Chem Demil Accounting

Memorandum
DATE: 22 February 1999
TO: Bill Lynn
VIA: A. Maroni
B. Dauer
W. Hall
FROM: Ron Garant
RE: Pot of Gold

Now that we have the CHEM/DEMIL program in the Army it was worth the trip to Aberdeen MD to demonstrate to them just how much fat can accumulate in OSD managed programs that are relatively untouchable. I will admit that the levels don't approximate the juice that came out of the NRO but it still isn't small change.

Prior to going up I sent the Army the memo at tab (a). After no more than a couple of hours of the standard kabuki dance it became evident to all that they were banking money. The first two R&D documents that we looked at reflected MIPR's going to Rock Island and DOE's Sandia lab to hide excess FY 1998 funds.

Of the $40 million of unbilled FY 1998 R&D funds $8 million related to a MIPR to Rock Island for the development of a portable munitions disposal unit. The MIPR was issued in Aug

1998 and as of September 98 an $11 million FY 1997 MIPR for the same product still had only $8 million billed. There obviously wasn't a requirement for FY 1998 funding for this program.

The second item was a MIPR to SANDIA for $11.0 million that had nothing billed against it. Despite no performance, the MIPR, which had initially been issued in June for $4 million, was amended by the additional $7 million in August. Even with this obvious Mexican banking of excess FY 1998 funds they ended the year with $5.8 million unobligated out of the $66.3 million appropriated. The $173 million FY 1999 program probably has $60 million that could be reprogrammed through stringent financial management practices.

When it comes to the Procurement funds it is like drilling for oil in Saudi Arabia. Their MIPR's to FEMA dating back to FY 93 total $68 million with only $5 million billed to date. No additional funds should be MIPRed in FY 99 and substantial portions of the FY 97 and 98 funds should be recoverable. This is over and above $62 million of O&M that also went to FEMA which only $6 million billed.

In the world of O&M what they are doing is almost criminal. Here they are contending that they will have a 6-month slip in the program and they had over half of their FY 1998 $416 million unexpended at the end of the year. To make matters even worse there was $53 million of the FY 1997 O&M unexpended at the end of FY 1998. This is 12 months after the end of the fiscal year.

Hopefully the Army SARDA representative caught on to what we were pointing to. Now that we have this program out of the OSD goodie bag there is ample incentive for the Army to step in and do a swamp drain. OSD managed programs don't have the advantage of the zero sum game to keep them in line. We usually have to wait until the numbers are in the billions as with the NRO.

We had processed a 440 releasing the inflation savings a couple weeks ago to keep the wolf from the door. They contended that they were going to have to lay people off if we didn't add to what they perceived as an under funded program. Attached is the 440 withdrawing the inflation release of a couple weeks ago. I fully expect that the Army will be using a substantial portion of the excess CHEM/DEMIL assets to cover their omnibus reprogramming requirements.

Editor's Note: MIPR is an acronym for military interdepartmental purchase request.

NON-STOCKPILE PROGRAM EYES ACWA TECHNOLOGY FOR WASTE DISPOSAL

The Army, bolstered by promising findings of an initial study, is exploring ways to apply technologies proposed for DOD's Assembled Chemical Weapons Assessment (ACWA) program to its non-stockpile chemical warfare materiel disposal program.

Although the Army is developing neutralization technologies for non-stockpile materiel that will satisfy the conditions of an international treaty calling for the destruction of chemical weapons by 2007, those technologies will produce waste streams that still must be treated as hazardous waste. The baseline treatment method for these waste streams is incineration, but that is strongly opposed by citizen activists.

The results from a recent study by Army contractor Mitretek Systems show a good match between non-stockpile requirements and two ACWA-proposed technologies. These are General Atomics' super critical water oxidation (SCWO) and Eco Logic's Gas Phase Critical Reduction (GPCR) technologies. SCWO was part of the recent ACWA technology demonstrations, but GPCR was not tested due to the Army's claims of a funding shortfall.

SCWO and GPCR "are leading solutions," Wayne Jennings of the non-stockpile program told a National Research Council (NRC) panel June 15. A more detailed presentation of the Mitretek results was given by Mitretek's George Bizzigotti June 16.

A community activist who champions the use of non-incineration technology said the NRC meeting was "very encouraging" because it became clear that the non-stockpile program is actively pursuing non-incineration disposal methods. "That's the kind of program we wanted," the source says, explaining that citizens had written to the Army earlier this year emphasizing their desire for non-incineration, transportable technologies.

Of the remaining four ACWA technologies, Burns & Roe's Plasma Waste Converter and AEA Technology's Silver II process emerged in the middle, the Mitretek report said. And Teledyne-Commodore's solvated electron technology and Parsons/AlliedSignal's neutralization/biotreatment technologies have the weakest match with non-stockpile needs, Mitretek found. Burns & Roe and Parsons/AlliedSignal are part of the ACWA tests while AEA and Teledyne-Commodore did not advance to the demonstration phase because of insufficient funding.

Mitretek recommends that the non-stockpile program conduct demonstrations of SCWO and GPCR with wastes from a non-stockpile system that has treated Chemical Agent Identification Sets and from a non-stockpile system that has treated buried chemical munitions. And ACWA test results, as well as other Army technology test results, should be reviewed, Mitretek says.

Jennings called for a "maximum synergy" with other chemical weapons disposal efforts.

ARMY PROPOSING NEW TECHNOLOGY TO DESTROY NON-STOCKPILE ITEMS

The Army's project manager for non-stockpile chemical materiel has started a new research and development project to destroy single items of chemical agent identification sets (CAIS) in a more cost-effective manner than current methods. But, the move appeared to surprise a National Research Council (NRC) panel investigating non-stockpile destruction technologies.

The new technology, called Single CAIS Access & Neutralization System (SCANS), is still in the early project planning stages, having been established as a separate research project less than two months ago, Ed Doyle of the non-stockpile program told the NRC panel June 15. SCANS' purpose is to develop a cost effective disposal technology for "single" finds of CAIS, he said. Another CAIS disposal technology under development is geared toward processing large volumes of CAIS, he said. The technology could solve the need for a cost-effective method to handle small numbers of CAIS.

CAIS are glass vials or containers filled with various chemical agents that were used in Army training between 1928 and 1969. Approximately 110,000 CAIS were produced in that time frame, and 21,458 CAIS have been destroyed to date. About three to five CAIS items continue to be found annually.

CAIS that are packed in large bundles known as PIGS and other large quantities of CAIS are expected to be neutralized through a portable treatment technology called the Rapid Response System (RRS). The Army is aiming to begin operations testing of the RRS by October. But, Doyle said, using the RRS for the CAIS "onesies" and "twosies" is cost prohibitive.

Some NRC members questioned whether SCANS duplicated another Army technology under development, the Expedient CAIS Disposal System (ECS). But Doyle said that development of ECS has been put on hold, in part because the military's CAIS disposal objectives can be better met through the SCANS' objectives. The ECS only existed in concept and did not have provisions to cut apart PIGS for treatment, an NRC source says.

These objectives include managing small quantities of CAIS, providing a permanent solution for CAIS, fielding the technology in a minimum amount of time and taking less than 90 days to deploy the technology and operate it in the field. This last objective would allow the technology to operate without a Resource Conservation & Recovery Act (RCRA) permit, Doyle said. Additionally, SCANS would be able to operate with a crew of only four people — comprised of existing Army personnel or contractors — while the RRS would require contractor operation and a crew of 20 people, he said.

The initial concept for SCANS is to combine an existing scanning technology with "treatment in a container." The scanning technology, called a portable raman, identifies what type of agent is in the glass containers. The agent type determines how it will be neutralized.

Other technology updates

In addition to discussing SCANS and the RRS, non-stockpile staff updated the NRC panel on several portable units and one fixed-location facility to destroy non-stockpile materiel. These are the Munitions Management Device (MMD) versions 1 and 2, and the Munitions Assessment Processing System (MAPS). The staff also discussed the Explosive Destruction System (EDS), which will be used to dispose of explosively configured chemical materiel that is too unstable to be processed through the MMD-2. Transportability is a key component for gaining community support of the technologies.

The MMD-1 uses a three-step process to assess the condition of a chemical-filled container, analyze the chemicals and then neutralize them using a decontamination solution. The multi-trailer system, which began "simulated hot operations" this month, will only treat non-explosively configured chemical warfare materiel. The Army expects to field the MMD-1 in the second quarter of fiscal year 2001.

The MMD-2 will process explosively configured chemical munitions, as long as they are stable. It uses the same neutralization process as the MMD-1, but includes a detonation chamber for the explosives. The Army's target date for test demonstration is the fourth quarter of fiscal year 2003.

In response to questions from the NRC panel, Wayne Jennings explained that MMD-1 was developed on a fast track, and a premium was put on having a technology with a compact footprint. The MMD-2 requires the use of very large open spaces for set up.

William Brankowitz, of the non-stockpile program, told the panel that EDS may at some point replace the MMD-2, but the Army is not sure how many explosions the EDS can handle before it fails. Michael Duggan, also of the non-stockpile office, said the estimate is about 500 explosions.

Jennings also clarified that the MMD-2 is being developed for prolonged disposal campaigns lasting several months while the EDS is designed to handle the occasional munition.

The fixed-site version of MMD-2, MAPS, is being planned for construction at Aberdeen Proving Ground in Maryland due to citizen pressure, Brankowitz and Jennings said. NRC panel members questioned why the

Army would even consider a fixed location disposal process when its emphasis to date has been on transportability. Brankowitz and Jennings explained that in addition to community pressure for a fixed facility, Aberdeen is a unique site. Aberdeen was used as a test and training site for chemical warfare materiel for decades, longer than any other test and training site, meaning the Army expects to continue to find a large volume of buried chemical weapons. The military expects that the discovery of these buried weapons will be greater than normal because of an ongoing Superfund cleanup at the base, the men said. The Superfund cleanup is expected to last 20 to 30 years, they said.

TOOELE TRIAL ENDS, JUDGE HOLDS OFF ON CLOSING ARGUMENTS

The Army, environmentalists and citizen activists recently ended nearly two weeks of oral arguments over whether the Army's chemical weapons incinerator in Tooele, UT, is violating federal environmental laws. In the case's first trial on the merits before a federal court, the two sides largely focused on a March 30, 1998, incident in which an insufficiently drained bomb was fed into the incinerator, causing it to overheat, sources say.

The case posits the Sierra Club, Chemical Weapons Working Group (CWWG) and the Vietnam Veterans of America Foundation against the Army and its Tooele plant contractor, EG&G Defense Materials, Inc. The plaintiffs allege that the incinerator at the Tooele Chemical Agent Disposal Facility is in violation of environmental regulations, and that the incineration "poses an imminent and substantial endangerment to public health and the environment and to workers at the facility." The plaintiffs allege that the incinerator cannot be operated in accordance with the law, based on both design and operational problems, says an official with the Utah-based Families Against Incinerator Risk, which is a coalition member of CWWG.

The judge in the case delayed closing arguments. Once the trial transcripts are available, the judge will give the parties time to submit to the court findings of fact and conclusions of law.

A big thrust of the trial was focused on a March 30, 1998, incident, in which the plaintiffs charge that the incinerator released the chemical agent GB, also known as sarin. While a misfed bomb resulted in a temperature spike and the sounding of one alarm, the Army maintains that there was no release because monitors further down the pipeline were not triggered. The Army's expert testified that he believed the high temperature in the furnace destroyed the agent.

But the plaintiffs argue the monitors further down the pipeline did detect a substance and had concentrations of a substance well above the allowable stack concentration levels. The substance was detected in the nerve agent "window," which the plaintiff source argues is calibrated to focus on nerve agent detection and exclude other substances.

Following the trial, representatives for both the Army and the plaintiffs expressed confidence in the arguments made by their side. The trial lasted June 7-18.

RCRA

EPA FLOATS RCRA CLEANUP LITIGATION COMPROMISE TO STAKEHOLDERS

EPA's Office of Solid Waste has offered a settlement to environmentalists, states and industry aimed at ending litigation over agency regulations relaxing Resource Conservation & Recovery Act (RCRA) remediation waste rules, sources say.

The compromise package contains a number of changes to EPA's remediation waste regulations, including modifications of the definition of remedial waste, treatment standards for primary hazardous constituents and a requirement for groundwater monitoring and cleanup.

While many of the tenets of the proposed settlement appear to eliminate some flexibility in RCRA cleanup regulations to appease environmentalists, other provisions — such as protecting ongoing cleanups — are clearly designed to garner industry support.

The proposed settlement has also been sent to DOD for comment.

EPA, industry and environmentalists would not predict whether the proposed settlement will be successful. But one industry source did say it is "a good start" and that the agency has expressed a commitment to work with stakeholders to resolve the issue. State sources were unavailable for comment.

Under the proposed settlement, EPA would draft changes to the agency's remediation waste cleanup, treatment, storage and disposal rules, including the 1993 corrective action management unit (CAMU) and 1999 hazardous

COMPTROLLER COMPLETES SPECIALIZED REVIEW OF CHEM DEMIL PROGRAM

The DOD comptroller's office has completed a review of the chemical demilitarization program budget that specifically looked into allegations that the program has misrepresented its obligated monies and expenditures. High-level officials were expected to be briefed on the review last week.

The review's findings have not yet been released, but an Army spokeswoman at press time expected its release to be imminent.

The re-examination by the comptroller's office comes in the midst of allegations from senators, citizen activists, and staff within the comptroller's office that the chemical demilitarization program hid excess funds and had large amounts of money unexpended at the end of fiscal year 1998, while claiming its budget was too tight to pay for testing the full array of non-incineration chemical agent destruction technologies that are being considered for use at the Army's stockpiled chemical weapons sites. The Senate in its fiscal year 2000 defense appropriations bill responded to the findings regarding the unexpended monies by cutting the chemical demilitarization budget by $140 million. Senate appropriators in report language told DOD that "the program growth in the budget request is not justified" (*Defense Environment Alert*, June 1, p3).

The comptroller's re-examination, at least in part, sought to determine the level of a budget cut that the chemical demilitarization program could sustain, according to one DOD source, who says that data will then go into the department's appeal to the Senate to restore the FY00 money the Senate cut. The Defense Department's appeals on the defense bills were expected to be completed by the end of last week, another DOD source says.

The Clinton administration has already objected to the cut through a Statement of Administration Policy — a general statement saying such a reduction would cause the United States to default on its treaty obligations to destroy all of the country's stockpiled chemical weapons by 2007. The House has not yet weighed in on the issue as it has not yet approved defense appropriations legislation. At press time, the defense appropriations subcommittee was scheduled to mark up its bill July 12. Meanwhile, the House Appropriations Committee's Surveys and Investigations staff has been examining the chemical demilitarization program's costs.

The comptroller's re-examination follows the leak of an internal comptroller memo that found the Defense Department had hundreds of millions of dollars in the chemical demilitarization account unexpended at the end of last year (*Defense Environment Alert*, June 15, p3). At the time, the account was within DOD, but has since moved over to the Army. The Army, however, has contended that these funds were obligated for on-going chemical demilitarization work.

CITIZENS FILE ENVIRONMENTAL EQUITY COMPLAINT AGAINST PINE BLUFF

An Arkansas citizens group has filed an environmental justice complaint with EPA, alleging that a planned chemical weapons incinerator at the Army's Pine Bluff Arsenal will disproportionately affect the area's low income and minority communities.

The June 25 discrimination complaint from Pine Bluff for Safe Disposal and the Chemical Weapons Working Group asks that EPA force the Arkansas Department of Environmental Quality (DEQ) to revoke the incinerator's operating permits and require the use of an alternative chemical weapons' disposal technology. The complaint charges that DEQ's granting of operating permits "reinforces a pattern of discrimination by the U.S. Army in which lower income communities of color are being asked to accept chemical weapons incinerators, while other communities move forward with safer technologies." The Army maintains that incinerators are a safe and proven disposal method for chemical weapons.

The citizen groups claim there are safer destruction technologies that, unlike incineration, do not result in toxic chemical releases into air and water.

The issues raised by the citizens are similar to written comments they submitted to the state when the planned incinerator's permits were out for public review (*Defense Environment Alert*, Oct. 6, 1998, p10).

A state source says the DEQ is reviewing the complaint and evaluating the state's legal options. Any response from the state will depend, in part, on EPA guidance and policy, the source says, adding that the state may decide to respond to the complaint even if EPA does not require a state reply.

The citizens, citing statistics from the Environmental Defense Fund, say that Jefferson County ranks in the top 20 percent of all U.S. counties for cancer hazards, non-cancer hazards and air releases of recognized carcinogens. The city of Pine Bluff and the arsenal are located in Jefferson County. "Already, nearly 2 million pounds of chemicals are released annually into Jefferson County's air" by a variety of industrial sources, the complaint says.

"Because this site is an African American community with a high level of poverty and pollution, the [DEQ] had an obligation to take these things into account in permitting another pollution source," the complaint says. The citizens cite Army data showing that Jefferson County "has a much higher minority population as compared to the 'ater Act and the Clean Air Act as proof that no waiver of sovereign immunity for civil penalties exists in n Air Act. "We find the argument unpersuasive," the appeals court said.

ie United States contends that *United States Dep't of Energy* controls the case at the bar because the Clean contains the same pairing of 'process and sanctions' and because there is no reason to read the word ons' in the Clean Air Act as meaning anything different in the Clean Water Act," the appeals court said in its But, the appeals court said, "The federal facilities provisions of the two statues may not be read in isolation . . ." irases must be interpreted in light of the rest of the statutes of which they are a part.

o begin with, the Clean Water Act's federal facilities provision contains an express limitation on penalties that found in the Clean Air Act, the court said. Even if the word "sanction" when paired with the word "process" Clean Air Act has the same limitations as the Clean Water Act under the federal facilities section, the Clean ct contains very clear waiver language in section 304(e), the state suit provision.

'[A]ny administrative remedy or sanction' means precisely that, and a respectable argument can be made, we ve, that 'sanction' in [section 118(a)] has the same non-restrictive meaning it obviously has in [section e)]," the appeals court said, adding that it does not rest its decision on this argument because the language in on 304(e) answers the questions in the case.

"In view of the significant differences between the Clean Water Act and the Clean Air Act, we reject the United es' argument that *United States Dep't of Energy* is controlling here," the court said. "In [section 304(e)], we clude, the Clean Air Act contains a waiver of sovereign immunity broad enough to encompass the administrative ialty assessed by the Board against the United States."

mical Weapons

SE SEVERELY CUTS CHEM DEMIL PROGRAM, DENOUNCING DOD PRACTICES

Lawmakers in the House have slashed the Army's chemical demilitarization budget request even more than the enate, weighing in on internal DOD findings that disclosed the program had large unexpended balances in prior ear accounts.

The House July 22 passed the defense appropriations bill for fiscal year 2000, slicing the chemical demilitarization rogram's request for $1.169 billion by $388 million, resulting in a budget commensurate with the current funding level.

At the same time, both House and Senate lawmakers are calling for an investigation by Congress' General ccounting Office (GAO) into the program's financial accounting.

"Since not only the Committee, but also the Office of the Secretary of Defense Comptroller's staff, can not etermine the validity of the program's prior year obligations, the Committee recommends the program be held at ast year's level," the House Appropriations Committee said in its report accompanying the bill. The reference to omptroller staff relates to an internal comptroller memo that found the program had large sums of unexpended ioney at the end of FY98.

The committee in the report language also took the Army to task for allowing paid consultants to "promote" the hemical demilitarization program to members of Congress. In response, the committee specified a $4.5 million cut with prejudice against program management consultants." *Text of the House Appropriations Committee report anguage follows the story.*

The actions by the House are the most severe cuts to the program in all of the defense bills. In approving a $780 illion budget for the chemical demilitarization program, House lawmakers call for distributing the $388 million eduction to the Army's requested budget across the three main facets of the program. The mark would give rocurement $116 million — a $125.5 million cut, research and development $173 million — a $161 million cut, nd operations and maintenance $492 million — a $101.5 million cut.

The lawmakers also added their concerns to the many that have already been raised over the past several weeks mong Congress members and watchdog groups over budget execution within the program.

ivestigations into program abound

The House's call for an investigation by GAO and DOD's Inspector General is on top of a barrage of investigais and reviews already targeting the program's management of funds.

Recently, the chairman of the Senate Appropriations Committee, Ted Stevens (R-AK), and Sen. Mitch IcConnell (R-KY) requested an all-out review of all of the accounts within the chemical demilitarization program om the years 1993 through 1999, and a look at schedule compliance and whether the program's progress makes it kely that the Army will meet the chemical weapons destruction mandates in the Chemical Weapons Convention CWC). The CWC is an international treaty under which the United States has committed to destroy its stockpiled iemical weapons by 2007. A House Appropriations Committee spokesman says that with duplicate calls for a AO investigation, there will actually just be one GAO review. *A copy of the senators' letter is reprinted on page 6.*

The senators in their request to GAO point to the Army's struggle in meeting the schedule — with the Army destroying less than 10 percent of the stockpile on a $4.5 billion budget from 1993 to the present. "We are concerned that DOD has failed to adequately implement the national strategy, to account for the funds appropriated by Congress, and has shifted funds for this effort to meet other Department priorities," the senators say in a July 14 letter to the GAO comptroller general. Observers and activists are applauding the move to call for a GAO investigation. The "allegations of the internal comptroller memo are sufficiently damning" to deserve an investigation in a public forum, one observer says, adding "That's what GAO would do."

At the heart of the allegations surrounding budget execution is whether the Army or Defense Department had enough money to fund the testing of all viable non-incineration technologies under the Assembled Chemical Weapons Assessment (ACWA) program. Army and DOD officials over the past year claimed the overall chemical demilitarization program was strapped for funds and couldn't afford to give the ACWA program another $25 million to pay for six destruction technology tests. Instead, the Army funded three of the tests — one more than required by the law, Army officials have pointed out. But the recent discovery of an internal memo from DOD's comptroller office has led to accusations that the Army and DOD were not being truthful when making their claim (*Defense Environment Alert*, June 15, p3). The Army though has said that the funds in question, while unexpended, were obligated for other needs.

"I am concerned that the Army is pulling a bait and switch," McConnell said in a press statement July 19 regarding his call for a GAO review. "We gave them enough money to fully study all viable alternatives and now they say they don't have it. That's why we're sending in the investigators to find where the money is."

Meanwhile, the DOD comptroller's office has completed a more thorough investigation into the allegations of improper budget execution surrounding the program, but DOD's leadership is still considering that review, according to a Pentagon spokeswoman. The Army Audit Agency has also launched an examination of the program's management, its use of current funding, and its future funding needs, an Army source says. The House Appropriations Committee's Surveys and Investigations staff has been conducting a broad, in-depth review of the program. And GAO recently did a quick, three-week examination of the program's budget execution, at the request of the Senate Armed Services Committee — the only defense committee to vote to fully fund the program. The committee has not yet been briefed on those findings.

House, Senate versions both call for cuts

The Senate's call for a $140 million cut to the chemical demilitarization program and the House's approval of a $388 million cut will likely result in some reduction to the program, according to a congressional source. But one citizen activist believes that Congress in conference should go a step further and specify how the cuts should be levied on the programs within the three major chemical weapons destruction accounts. A congressional source says the conferees may in fact direct the distribution of the cut. "Congress has got to go to the next level and direct a change in the management and oversight structure of this program," a spokesman for the Chemical Weapons Working Group (CWWG) says. CWWG advocates non-incineration destruction technologies in place of the Army's baseline incineration method. Otherwise, the spokesman believes, the very staff accused of mismanaging the program will now decide where to distribute the cuts.

An Army spokeswoman would not comment on the House cuts, but said the mark will be evaluated. The Clinton administration, however, in a statement of administration policy on the House bill voices its "strong" opposition to the cut. Echoing earlier protestations of the Senate bill, the administration says the cut would cause the United States to miss the CWC 2007 deadline. It would also cause 1,000 layoffs for at least a year and raise the cost of the program by $400 million, the statement says.

One congressional source says though that administration officials, including the president, have lacked leadership in addressing the program. They could have reigned in their cost problems and given guidance and leadership to ACWA at a critical point last year when pressure was mounting from various sides to fully fund six ACWA technology demonstrations, the source says. Instead "they let it founder" and actually programmed money out of the chemical demilitarization program to go to unrelated Air Force activities. For them to say that the program will die with the cuts being levied by Congress "is just ridiculous," the source says.

The House also approved a provision that endorses completing the testing of all viable alternative destruction technologies. While the language in the bill's report does not go as far as an amendment in the Senate version, it calls on the Army to expeditiously "complete the evaluation of the merits of all practical methods, including alternatives to incineration, that may effectively and efficiently dispose of stored chemical ordnance." The Senate approved an amendment that would halt non-technology-specific construction of a chemical weapons destruction facility at the Bluegrass, KY, stockpile site until all viable alternative technologies had been tested. If DOD refused to conduct the tests, it would not be able to fulfill the mandates of the CWC because the stockpile at Bluegrass is covered by the CWC and must be destroyed by 2007 in order for the United States to meet its treaty obligations.

text appears on next page

Excerpts: House Appropriations Committee July 16 Markup

mical Agents and Munitions Destruction, Army

cal year 1999 appropriation	$780,150,000
cal year 2000 budget request	1,169,000,000
mmittee recommendation	781,000,000
ange from budget request	-388,000,000

mmittee Recommendations

rogram Reductions

The Army requested $1,169,000,000 for the destruction of hemical Agents and Munitions, Army. The Committee recmmends $781,000,000, a decrease of $388,000,000. Of the ecrease, $4,500,000 is taken with prejudice against program anagement consultants. Of the funds available, $75,303,000 hall be transferred to the Federal Emergency Preparedness Program to provide off-post emergency response and preparedness ssistance to the communities surrounding the eight continenal United States chemical storage and disposal sites.

The Chemical Agents and Munitions Destruction Program, Army mission is to safely destroy all U.S. chemical warfare munitions and related materiel while ensuring maximum protection of the public, personnel involved in the destruction effort, and the environment. The Committee commends the Army for its efforts in destroying chemical munitions in a safe manner. [illegible]f March 17, 1999, over 13.5 percent, or 4,259 tons, of the stockpile has been destroyed. Currently there are two sites operational and five sites in the design phase. Despite the fact that two additional sites are on hold until completion of the Assembled Chemical Weapons Assessment Demonstration, the Committee is hopeful that the U.S. will meet the deadline of April 2007 for the destruction of chemical munitions as called for by the Chemical Weapons Convention.

Although the Committee is extremely supportive of this important national program, it is troubled at the lack of management and financial oversight exercised by both the Army and OSD on such a large program. In earlier years, the Committee expressed its concern because the chemical munitions destruction program was plagued by cost growth and schedule delays. It appears as if the DOD has made an attempt to rectify cost and schedule issues by managing the program as an Acquisition Category 1 program. The Committee hopes that this action will allow the Army better control over the schedule and costs in the future.

The Committee is aware that the chemical agents and munitions program uses the practice of budgeting in advance of need and uses funds outside of the funded delivery period. As a result, the funds are often obligated later than anticipated.

The Committee remains concerned over the extremely slow obligation and expenditure rates for the chemical munitions destruction program. Recently, the Committee has learned that its concerns are not invalid.

Through an internal DOD comptroller memorandum, the Committee has learned that the chemical agents and munitions program uses unique and questionable budget execution actions. Not only are there large unexpended and unobligated balances of prior year funds, but the budget request is $388 million higher than last year's appropriated amount. Since not only the Committee, but also the Office of the Secretary of Defense Comptroller's staff, can not determine the validity of the program's prior year obligations, the Committee recommends the program be held at last year's level.

The Committee is disturbed to learn that individuals employed by the Department of Defense have visited the Congress with paid consultants to "promote" the chemical agents and munitions destruction program. Therefore, the Committee recommends the decrease in program management for consultants.

Given the questionable budget execution and management activities, the Committee directs that the DOD Inspector General and the General Accounting Office report to the Congress no later than March 15, 2000 on the chemical agents and munitions destruction program.

Alternative Methods

The Committee recognizes the proximity of densely populated areas and the importance of safely and completely destroying chemical munitions such as those stored in the Bluegrass Army Depot. The Committee directs the Army to proceed in a timely manner to complete the evaluation of the merits of all practical methods, including alternatives to incineration, that may effectively dispose of stored chemical ordnance.

Text: Senators' Letter Calling for GAO Investigation

United States Senate
Committee on Appropriations
Washington, DC

July 14, 1999

The Honorable David M. Walker
mptroller General
neral Accounting Office
Washington, D.C. 20548

Dear Mr. Walker:

In April of 1997, the Senate ratified the Chemical Weapons Convention (CWC) thereby setting April 2007 as the deadline by which the United States has agreed to destroy its chemical weapons stockpile. More than a decade prior to ratification of the CWC, America was working towards identifying a means of destruction and implementing a program that would rid the nation of these weapons. Today, $4 billion later, less than 10% of the stockpile has been destroyed and America's program is struggling to meet its schedule.

From 1993 to date, Congress has appropriated $4.5 billion for R&D, Procurement, Operation and Maintenance and Military Construction for costs associated with this national effort. We are concerned that DoD has failed to adequately implement the national strategy, to account for the funds appropriated by Congress, and has shifted funds for this effort to meet other Department priorities.

In light of these issues, we request that the General Accounting

Office conduct a thorough and complete review of all programs relative to Chemical Agents & Munitions Destruction, Defense and Chemical Agents & Munitions Destruction, Army for the time period FY 1993-1999. This would include, but not be limited to PMCD expenditures within the Chemical Stockpile Disposal Program (CSDP) for fiscal years 1993-1999. This review should include obligations and expenditures from Operation and Maintenance, Procurement, Research & Design and Construction and the Assembled Chemical Weapons Assessment accounts for this time period. Further we request that this examination evaluate schedule compliance and time lines and a determination of whether the Department's chemical demilitarization process is moving forward in a manner that will enable it to meet CWC mandates.

We look forward to working with you as you undertake this important investigation.

With best wishes,

Cordially,

Mitch McConnell
Chairman
Senate Appropriations
Subcommittee on Foreign Operations

Ted Stevens
Chairman
Senate Appropriations
Subcommittee on Defense

NRC PANEL GENERALLY ENDORSES ARMY REFERENCE DOSES FOR AGENT

In a recent report, the National Research Council (NRC) found that the Army developed "scientifically valid" oral reference doses for four types of chemical warfare agent, but concluded that the reference doses and another toxicology measurement for two other types of agent were too high and therefore not protective enough.

The reference doses will be used to establish site-specific cleanup levels for drinking water, soil and other media that have the potential to be ingested by persons at or near remediation sites. Reference doses are not media standards for the purposes of safe cleanup or decontamination goals, the NRC report says.

The Army's surgeon general proposed the reference doses "to ensure that consistent health-based criteria were applied in ongoing initiatives requiring decisions on the safety of contaminated sites," the report says. The sites in question are the nine U.S. chemical weapons stockpile sites and the 82 identified non-stockpile chemical materiel sites. "There are concerns, based on storage and past disposal practices, about soil and groundwater contamination at those sites," the report says.

The July 14 report, *Review of the U.S. Army's Health Risk Assessments for Oral Exposure to Six Chemical-Warfare Agents*, notes that although multiple agents are present at stockpile and non-stockpile sites, the NRC was asked to evaluate the agents only on an individual basis. "Furthermore, although the most likely routes of exposure to chemical-warfare agents at these sites are the inhalation and dermal routes, the [NRC] was only asked to evaluate toxicological risk from the oral route at this time." The Army is in the process of developing inhalation exposure guidelines, the report says.

The NRC's tasks were to determine whether the Army had appropriately considered all the relevant toxicity data; to review the uncertainty, variability and quality of the data; to determine the appropriateness of the assumptions used to derive the reference doses; and to identify data gaps and make recommendations for future research.

Reference doses (RfDs) are toxicological values developed for non-cancer effects. They are estimates of daily oral chemical exposures that are unlikely to have deleterious effects during a human lifetime. For chemicals identified as carcinogens, oral slope factors (SFs) are also calculated. SFs are estimates of upper-bound lifetime cancer risk from chronic exposure to an agent.

The agents examined by the NRC panel were GA, also known as tabun; GB, also known as sarin; GD, also known as soman; VX; sulfur mustard; and lewisite.

The NRC found that the guidelines used to derive the Army's interim RfDs were consistent with guidelines used by EPA and were appropriate. The NRC also determined that the Army's interim RfDs for GA, GB, GD and sulfur mustard were scientifically valid but concluded that the RfDs for VX and lewisite and the SF for sulfur mustard were too high, and therefore not fully protective of human health.

The Army and NRC-supported interim RfD for GA is 4×10^{-5} miligrams per kilograms of body weight per day (mg/kg/day). The interim RfD for GB is 2×10^{-5} mg/kg/day. The interim RfD for GD is 4×10^{-6} mg/kg/day. And the interim RfD for sulfur mustard, the most frequently identified materiel, is 7×10^{-6} mg/kg/day.

The NRC recommended adjusting two of the uncertainty factors for the sulfur mustard RfD, but that change would not alter the actual RfD. The NRC notes, however, that the adjustments are scientifically justified changes that should be reflected in the Army's supporting documentation.

Sulfur mustard is the only agent with sufficient evidence of carcinogenicity in animal studies, and therefore the only agent for which an SF was derived. The Army used an indirect approach of comparing the carcinogenic po[illegible]y of sulfur mustard to that of the well-known carcinogen benzo[a]pyrene (B[a]P). NRC found that the Army's approach to developing an SF for sulfur mustard was valid, but it recommended the use of a more recent risk estimate of the carcinogenic potency of B[a]P.

"On the basis of that estimate, the [NRC] concludes that the Army's interim SF of 9.5 per milligram per kilogram per day should be lowered to 1.6 per milligram per kilogram per day."

For VX, the Army proposed an interim RfD of 6 x 10^{-7} mg/kg/day, based on a sheep toxicity study. But the NRC concluded that uncertainties about the relevance of the sheep model to humans and weaknesses in the study design undermine its use for deriving an RfD. Instead, the NRC recommends using a 1964 study of human volunteers. On the basis of the human study, the NRC concludes that the data support a slightly lower RfD of 5 x 10^{-7} mg/kg/day.

The Army's proposed interim RfD for lewisite was 1 x 10^{-4} mg/kg/day, and was based on two oral studies in rats. But the NRC concluded that a study involving rabbits was more appropriate "because there is evidence that the rabbit might be more susceptible to lewisite than the rat." On the basis of the rabbit study, the NRC recommended the RfD for lewisite be lowered to 1 x 10^{-5} mg/kg/day.

Congress

DOD SEEKS CHANGES IN DEFENSE BILL TO AVERT ADVERSE EFFECTS

The Defense Department has asked congressional conferees on the fiscal year 2000 defense authorization bill to change several measures that DOD believes would adversely affect its environmental programs. Lawmakers have begun conferencing on the House and Senate bills and hope to finish a final version by the August recess.

In a set of formal appeals recently sent to Congress, DOD objects to measures that it says would hamper cleanup at closed bases, prevent the department from implementing most of its energy efficiency program, severely curtail construction of some hazardous waste storage facilities, and could disrupt construction of chemical weapons estruction facilities. The authorization for full funding of these programs was cut in at least one chamber of ongress. This resulted as part of lawmakers' decision to vote against an incremental funding/advance appropriation scheme DOD had proposed for its military construction activities.

Most of the appeals relate to funding issues, but one addresses a management issue: a Senate provision that would change how DOD administers its environmental technology program.

The appeals are reprinted on page 10.

DOD requested authorization of $1.282 billion for its BRAC military construction account. This included $705.9 million for FY00 and an advance appropriation of $577.3 million for FY01. But neither the House nor the Senate bought into the Pentagon's advance appropriation proposal and did not include any advance authorization of appropriations. The House approved $705.9 million for FY00 while the Senate approved $892.9 million.

DOD, in its appeal, says the advance authorization for this account is vital "in order to keep BRAC environmental cleanup on schedule and to avoid higher costs." Even the higher Senate figure would be insufficient to execute the planned FY00 program, DOD says.

A DOD spokeswoman says the advance authorization is necessary to keep cleanup activities on a steady pace, and to avoid the typical delays that occur at the beginning of new fiscal years when the military is waiting for new funds to be obligated.

Without advance authorization, "the Department will have to prioritize the funding of critical BRAC construction and relocation/severance costs at the expense of valid cleanup requirements at BRAC sites," the appeal says.

DOD urges the conference committee to approve the advance authorization, but at a minimum to support the higher Senate funding level.

In a separate appeal, DOD opposes a Senate provision prohibiting the obligation of funds for military construction projects if the funds wouldn't be enough to complete the project.

Section 2802 of the Senate bill is intended to prevent DOD from submitting a military construction budget, similar to the FY00 request, where most projects are incrementally funded.

DOD takes issue with the Senate provision because it prohibits incremental funding in all cases, "even when incremental funding promotes national security and the efficient use of tax dollars," the appeal says. Incremental funding refers to appropriating only the amount of money that is expected to be needed in any given year. Military construction projects are typically fully funded upfront, although the money is expended over several years.

DOD says it supports fully funding projects, but notes that the Office of Management & Budget has in some cases approved incremental funding for large projects costing over $50 million. An example is the chemical demilitarization facilities. DOD hoped to do more incremental funding this year, with smaller projects as part of a budgetary

The Truth about M-55 Rocket Stability

Scare Tactics by PMCD:

* In public information brochures distributed by the Army, entitled "Safely Destroying America's Chemical Weapons", page 5, entitled "Is This Storage Safe" a picture of M55 rockets is shown with three paragraphs devoted to the M-55 deterioration.

* On May 12, 1994, at a public meeting in Kentucky, the then Chairman of the NRC Stockpile Committee stated that, "the M-55 rockets stored here could start "cooking-off" anytime," and that if he lived in the community "I would be begging the Army to begin building an incinerator tomorrow." No comment was made by PMCD representatives present.

* In the July 19, 1995 *Pine Bluff Commercial*, an Assistant Army Secretary is quoted as saying, "there are 400,000 M-55 chemical rockets stored around the country, and statistically one could "go off" at anytime."

* In the July 14, 1995 *Anniston Star,* Army officials are quoted as saying, "Most of the M-55s are about 30 years old, and because they combine the chemical agents with propellant, there is a risk of spontaneous explosion."

* In the December 31, 1995 *Oregonian* , it's reported that, "The Army has raised the specter that some of the aging rockets are deteriorating and could self-detonate, causing others to "cook-off" or ignite as well."

* In the February 12, 1996 *Salt Lake City Tribune,* Army safety engineer, Dave Jackson states, " Most people don't realize how dangerous (M-55) storage is."

* *Time Magazine*, February 12, 1996, "Military experts at first estimated that the M-55s were safe until 1986, but a '93 Army report suggests the danger zone could be reached in 1997."

Facts:* The latest PMCD sponsored report (December 1994) states, " less than a one-in-a-million chance of auto ignition of a non-leaking M-55 Rocket before 2013, even using the most conservative data this time period may extend to 2043 or even 2064".

*There is **no** evidence that any M-55 has ever had agent leak into the propellant, thereby *possibly* increasing the chances of auto ignition.

* There is **no** conclusive evidence that agent leaking into the propellant would increase the risk of auto-ignition.

* Army contracted reports and PMCD agree that M-55 rockets can be reconfigured to eliminate any possible auto-ignition. Studies by Army contractors also indicate a 2-3 year implementation period for complete M-55 separation at all sites. Since 1985, when these studies were released, PMCD has chosen to ignore them and opted to try and intimidate citizens into accepting hazardous waste incinerators as the "only method" available to eliminate the risk of these rockets to the communities.

Conclusion: By creating perception of a lose-lose situation, either you accept a bad technology for disposal or your community has nerve gas rockets getting launched into it, PMCD continues to push it's incineration program using fear, intimidation and misinformation.

The Oregonian
August 27, 1999

Army wavers on burning Umatilla chemical weapons

The military wants to explore other ways to get rid of the waste, which has Oregon officials fearing a delay in the project

By **BRENT HUNSBERGER**
THE OREGONIAN

The U.S. Army has irked state environmental leaders by seeking changes in how it disposes of secondary waste at its nerve gas incineration complex now under construction in northeastern Oregon.

Three years ago, state officials gave the Army permission to incinerate 7.2 million pounds of chemical weapons stored at the Umatilla Chemical Depot. Plans for the $280 million facility included a special incinerator for secondary waste — trash, wood-packing materials and spent charcoal used in the handling and disposing of munitions, much of it nerve gas.

Now, Army officials, ~~looking to stem~~ costs, want to explore other ways of disposing of secondary waste, including shipping it off site. Such methods, they say, could save millions annually.

That puts Oregon's Environmental Quality Commission in a bind. State officials want the Army to have an on-site disposal plan in place well before it begins burning Umatilla's chemical weapons there in 2001.

Congress has ordered the Army to destroy most of the nation's 30,000-ton chemical weapons stockpile by 2007. Any delay, scientists say, increases the risk of exposing 27,000 people living near the Umatilla depot to deadly nerve and mustard agents packed in thousands of rockets and artillery shells, some of them corroding.

"We don't want to delay the start date," said Sue Oliver, senior hazardous waste specialist in the Department of Environmental Quality's Umatilla office. "At the same time, we don't want to be another Hanford. We are very concerned that they are going to be generating secondary waste without a plan in place to get rid of it."

State officials say they have repeatedly told the Army that its disposal plan must account for all waste generated during

Please see **UMATILLA**, Page A17

Umatilla: Revising Army's permits could take months

Continued from Page One

the storage, maintenance, processing and ultimate closure of the depot. "I would think it's going to be a pretty hard sell to change the permit conditions," said Carol Whipple, the commission's chairwoman.

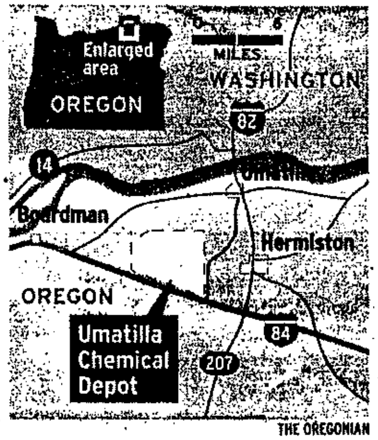
Other states are taking a less rigid stand.

The Army never fired up the secondary waste incinerator — or dunnage incinerator, as it is known — that it built at Utah's Tooele Chemical Depot, the first facility in the nation to begin incinerating waste and in many ways a model of Umatilla's facility. Utah officials have allowed secondary waste to be stored on-site while they analyze other disposal methods, including shipping some of the waste to special landfills or commercial incinerators.

One option the Army cites would be to use a metal-parts incinerator to burn wood pallets used to transport the weapons. And Army officials say they are considering pulverizing and then burning spent carbon filter elements.

But state officials are worried that dioxins could escape into the atmosphere if plastic piping or synthetic clothing were among the materials burned in a facility not specifically designed for them.

* A 1995 federal report appears to have foretold the dilemma. The General Accounting Office report criticized Army officials for spending $17 million in developing dunnage incinerators while plans already were under way to dispose of contaminated products by mulching or sending them to commercial hazardous waste facilities.



THE OREGONIAN

The report suggested that the Army feared changing its plans at the time because it would delay the approval of environmental permits, which were necessary before construction contracts could be awarded.

Now, state officials say that revising the Army's permits could take 18 months and require another round of public hearings in which incineration opponents will get another chance to fight the project.

The Environmental Quality Commission is expected to decide whether to revisit the permits at its November meeting.

◆

You can reach Brent Hunsberger at 503-221-8359 or by e-mail at brenthunsberger@news.oregonian.com.

ATTACHMENT 7

Safe STORAGE: If it were reconfigured to protect from accidents and sabotage, the stockpile would be stable long enough to modernize the disposal plan, even with leaking rockets:

1. The army's own reports indicate a 30 year period of safe storage before the stockpile would develop a risk of instability. (1996 & 1998 DOD Interim Status Assessment)

2. An inadvertent NRC miscalculation confusing days with weeks in calculating risk of storage in their first report was never corrected in later risk estimates.(Craig Williams Memo, 1994)

3. The army took an upward curve of storage risk and recalculated it as a straight line, a statistical technique for making the risk of storage look immediate and larger than it actually is:

> "The risk that is driving the incinerator project ... that is, concerns over deteriorating storage ... should be appreciated as not constant per unit time. Instead, this risk has some .. we hope .. lesser level now, but is expected to grow rapidly later. **We do have** a window to think about the problem, to do it right. We **should not** be driven to exclude thought about all other risks, in a turkey stampede to get on with the job." Halstead Harrison

4. Leaking rockets are now known to neutralize the explosive component of the rockets rather than advancing auto-ignition. This information has never been used to recalculate the risk of simple storage in the army's internal reports or any other risk statements by the NRC. (SAIC Tooele Risk Assessment, 1996attached)

5. The public has never been informed that leaks can be "mopped up." The agent itself is not volatile, and must be volatized to be injurious.

6. Risk estimates did not include all risks and uncertainties, and statistical errors create a falsely inverted comparison between the dangers of storage and processing. (Attachments 1-A, 3)

7. Advanced technology has been demonstrated to effectively and safely deal with Umatilla chemical weapons stockpile components. Neutralization of the stockpile with water is now a viable way to quickly eliminate the danger of accidents because secondary treatment methods have been approved which eliminate the large volume of water previously needed for neutralization.

ATTACHMENT 8

Advanced technology works for every component of the stockpile and is in use.

While appropriate public comments at the time accurately disputed E&E's comparison of incineration to more advanced technology for disposal of chemical agent; based on the ALTEC 1 report, subsequent implementation and upcoming September 30 ACWA report, at this time there can be no question that advanced approaches to destroying the chemical agent stockpiles, including the rockets are tested, available, and **being implemented at the site where Army managers of this program live**. Although we have not received confirmatory documentation, we understand that the Under-Secretary of Defense publicly announced the certification of two of the alternatives tested for use as alternatives to incineration

(We anticipate independent testimony to be submitted separately.)

FACSIMILE COVER PAGE

To : Um.Pgm. Mgr. Wayne Thomas

From : Lisa Brenner & Tom Stibolt

S : 9/19/99 at 6:40:10 PM

Pages : 22 (including Cover)

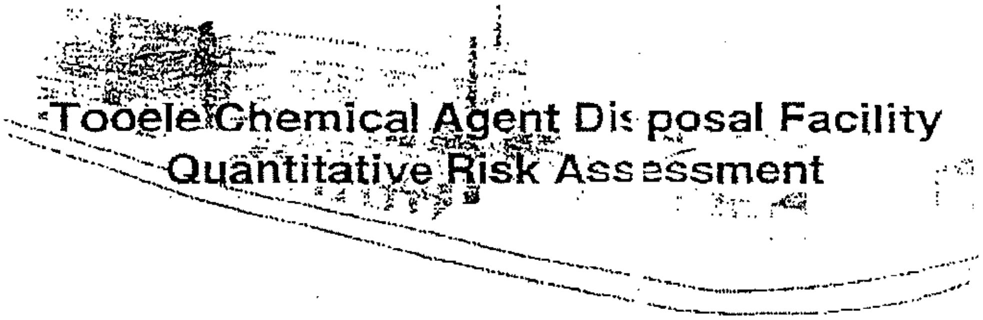
Subject : Attachment Response to Chance to Comment

I inadvertantly left Attachment #7 out of the comments that I Federal Expressed to your office to be delivered on September 20, 1999. Please include te following as Attachment 7 to the Oregon CPR Comments.

Attachment 7 21pp.

An Employee-Owned Company

Report No. SAIC-96/2600



Tooele Chemical Agent Disposal Facility Quantitative Risk Assessment

Prepared by:

Science Applications International Corporation
Abingdon, MD 21009
Under Contract DAAA15-91-D-0005

Prepared for:

U.S. Army Program Manager
for Chemical Demilitarization
Aberdeen Proving Ground MD 21010

September 1996

Summary Report

Risk Results

The scope of the analysis includes both public and worker risks. The risk to the offsite public is presented first, followed by a discussion of the worker risk. The results presented here are summaries of detailed calculations. The QRA documentation describes these results in more detail, and discusses the more subtle points regarding interpretation of the results.

Public Risk

Figure S-2 summarizes the findings of the study concisely. It illustrates the risk of disposal processing at TOCDF, the risk of munition storage at TEAD-S during the approximate 7-year disposal period, and the risk of continued storage for 20 years (if no processing were undertaken). The storage risk during the disposal period accounts for the reduction in the inventory of munitions as they are processed at the facility. Figure S-2 illustrates, on the vertical scale, the probability of exceeding the number of fatalities shown on the horizontal scale. For example, the probability of incurring one or more public fatalities is approximately:

1 in 33,000 for 7.1 years of disposal processing at TOCDF
1 in 5,500 for 7.1 years of stockpile storage at TEAD-S during processing
1 in 500 for continued stockpile storage at TEAD-S for 20 years with no processing.

The area under each of the curves in figure S-2 is the value most typically referred to as the risk, also termed *expected fatalities*. It represents the average risk over all accidents and potential consequences. The results of the TOCDF QRA indicate that the fatality risk is approximately:

0.0002 for 7.1 years of disposal processing at TOCDF
0.002 for 7.1 years of stockpile storage at TEAD-S during processing
0.05 for continued stockpile storage at TEAD-S for 20 years with no processing.

Another way of considering the expected fatalities is by the number of years (of processing or storage) that would be required, on the average, to result in one fatality:

44,000 years of disposal processing at TOCDF
500 years for continued stockpile storage at TEAD-S.

It should be noted that the risk is a summation of the products of accident sequence probabilities and their associated consequences. The risk of an infrequent accident with large consequences can therefore contribute equally with a more frequent accident with smaller consequences. For example, the seismic contribution to storage risk is primarily due to earthquakes less frequent than every 500 years, but that might involve more than one fatality if they occurred.

There is one potential stockpile deterioration issue under investigation that could be risk significant. The Army has evidence that suggests that exposure to nerve agent may accelerate the normally slow deterioration of the propellant in M55 rockets. A panel of experts has determined that available evidence suggests that this deterioration could leave the propellant inert. However, more information is required about the chemical reactions that occur in order to determine whether the propellant is adequately stabilized throughout the deterioration process. Therefore, the potential for an M55 rocket autoignition due to stabilizer depletion cannot be eliminated as a concern, but was not considered in the QRAs at this time. The Army is aggressively studying this issue to determine whether there is a potential impact with respect to continued safe storage of the M55 rockets. Preliminary results suggest that accelerated stabilizer depletion is coupled with a loss of potency in the propellant. Complete results are anticipated to be available in the fourth quarter of FY97.

The stockpile risk is generally controlled by unlikely events that could have significant consequences. Earthquakes have been found to be risk significant due to the potential for large agent releases. Lightning effects are also potentially risk significant for the storage of M55 rockets. Leakage and spills of GB nerve agent from ton containers were found to be somewhat risk significant at Tooele. The risk assessments have shown that the risk of the disposal process is very small compared to the continued storage risk. Continued storage risk will be eliminated by proceeding with the CSDP in a safe and expeditious manner.

To minimize risk to the public prior to stockpile disposal, the Army has instituted the Chemical Stockpile Emergency Preparedness Project (CSEPP). CSEPP enhances the emergency management and response capabilities of the states, local communities, and Army installations at each stockpile storage location. Enhanced emergency response capabilities enables additional protection to the public in the unlikely event of a chemical accident or incident involving the stored items. CSEPP provides technical expertise and funding that augments the pre-CSEPP capabilities. The Army is also

Confidential

Memo: NRC Stockpile Committee Telephone Conversations of July 25-28
From: Craig Williams
To: Robert Brauer
Date: July 29, 1994
Subject: Stockpile Condition (M55 Rocket) Reassessment

In conversation with a member (name witheld) of the Stockpile Committee of the National Research Council, on July 25 and 26, 1994, the following information was received:

a) The NRC Stockpile Committee was briefed during the week of July 18-22, 1994 by the Army on their mistaken analysis in the M55 Rocket stability study known as the *Mason Report, 1993.* This member stated that the Army admitted that the risk was measured on a depletion rate of stabilizer per day when it should have been measured **by week.** Thus the conclusion reached of the "theoretical possibility for a single rocket motor to autoignite by the year 2002" based on reaching .05 % 2-NDPA (the virgin stabilizer agent) was off by a factor of 7. Therefore the possibility should have been calculated to be beyond 2094, over 100 years.

b) That the NRC Stockpile Committee relied entirely on information and data supplied to by the Army, and did **no independent analysis.**

c) That a Stockpile Committee Member briefed the Committee on the mistakes contained within the 1993 *Mitre Report* . Details of this briefing are in the following section of this memo. These findings confirm the information provided by the NRC stockpile committee member we spoke to.

d) That no consideration was given to comparing risk of alternative approaches to continued storage as is vs. on site incineration (ie: reconfiguration).

e) That no consideration was given to measuring the risk of the Army's baseline program against any alternative technology.

In conversation with this other member of the Stockpile Committee on July 28, 1994 the following information was received:

a) Confirmed all the data that was conveyed to me via the previously mentioned member.

b) An extensive briefing on the MITRE Corporation's risk analysis. The major points made were as follows:

1) In assessing the depletion rate of the propellant stabilizer in the

Confidential

M55 rockets, MITRE used the lowest lot mean concentration level found in any of the five tests that have been run on the same rockets in the period 1985-1993. Tests have been run on the same lots in 1985, 1987, 1989, 1990 and 1993. The data from the four most recent tests show conclusively that the lowest concentration, 1.31%, found in the 1985 test is an inaccurate figure. This inaccuracy was due to improper analysis methods corrected since the 1985 tests. Yet, MITRE used this number as its base assumption, thus creating a false image of the stabilizer depletion.

2) Knowing that higher temperature increases stabilizer depletion, MITRE, ignored temperature data collected from igloos in Anniston, Ala., which averaged 70 degrees F. Instead MITRE calculated "accelerated depletion based on an average temperature of 95 degrees F. This adjustment led to the conclusion that .5% 2-NDPA (the threshold of "increased surveillance") would be reached in 2008 and that .2% 2-NDPA (threshold for possible autoignition) could be reached by 2019. According to this stockpile committee member, this calculation is off by a factor of 5. Therefore, the expected date for .5% should have been 75 years or 2068, and .2% should have been 130 years or 2123! This member pointed out that this would still be erring on the side of safety since his calculations put the mean temperature 5 degrees above the known mean.

3) The Hercules Corp., who manufacture the double based propellants used in the M55 were contacted by the above mentioned committee member during his reassessment and communicated to him that their own review of the MITRE data coupled with their 40 year history in the field of propellant production led them to conclude that adequate stabilizer would be available in the propellant for close to 400 years!

4) Mr. Dudley Robertson of the Advanced Research Projects Agency (ARPA), Picatinny Arsenal, New Jersey was also contacted. Mr. Robertson is involved with the monitoring of the CW Stockpile. Mr. Robertson pointed out that the MITRE study ignored yet another piece of information in reaching their conclusion.

The 2-NDPA, during depletion, produces daughter products due to its reaction with the propellant. These daughter products have their own capability of acting as stabilizers within the munition and perform the same function as the virgin stabilizer, absorbing oxides of nitrogen. Recent data developed by ARPA indicate therefore that measurement of virgin stabilizer is not an accurate measurement of stabilizer capability since it ignores the capability of the daughter products.

This information was available to MITRE, yet they chose to ignore

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it. Mr. Robertson concurred with the Hercules, Corp. calculation of safe shelf live of the M55 for up to 400 years.

NOTE:

Although both members agreed on the reassessment figures, they were still concerned about the possibility of continued *indefinite* storage, as is the CWWG. It must be noted that the above mentioned NRC committee member has requested more data on the mean temperature within the storage igloos and further study of the daughter products of the 2-NDPA.

Concern was articulated for possible autoignition due to mismanufacture of one or more M55's and increased leakers (although leaker numbers have **not** increased with the passage of time). Both agreed that site specific measurements should be undertaken concerning the M55.

Both agreed that *Internal* risk from the other munitions within the stockpile was below measureable quantity (ten to the minus eight or below) based on available information.

One of these members felt it was important to get this information out to the citizens in the communities. This member explained however that the Army requested to develop a report on this reassessment and present it to the Stockpile Committee in late September. This would indeed keep the information private until **after** the Joint Conference had completed its work on the 1995 Defense Authorization and Appropriations legislation. This member had no problem with my making this information known.

Annual Status Report
on the
Disposal of Chemical Weapons and Materiel
for Fiscal Year 1998

September 30, 1998

XII. SAFETY OF THE CHEMICAL STOCKPILE

Assessment of the Safety Status and Integrity of the Chemical Stockpile

In accordance with Section 177 of the FY 1993 Defense Authorization Act, the United States (U.S.) Army submitted a comprehensive report on the physical and chemical integrity of the chemical stockpile to the Congress in August 1993. This report, prepared by MITRE concluded the following:

- For the near-term (through 1995) and mid-term (through the year 2004), the chemical weapons stockpile is safe for continued storage.
- For the long-term (after 2004), the safety of storage of the stockpile is more uncertain. Conditions due to aging, such as increased leakage; internal pressurization; and unknown long-term interactions between agents, propellant, high explosives, fuzes, and decontaminants, make long-term safety difficult to predict.

The safety of the stockpile continues to be monitored through both an inspection program and analytical work. This analytical work has concluded that the continued existence of the chemical stockpile poses the most significant public risk. The conclusions of Quantitative Risk Assessments (QRAs) performed at six of the eight continental U.S. chemical stockpile storage locations have confirmed this assessment (QRAs at APG-EA, Maryland, and NECD, Indiana, will be performed during design and construction of the chemical-treatment pilot facilities). The QRAs have concluded that the probability of an external influence causing a catastrophic event poses a risk. These external influences include events such as lightning striking an igloo, an earthquake, or an aircraft crashing into a storage area. In every case, this probability of an external event causes the risk of continued storage to far outweigh the risk posed by disposal.

The U.S. Army continues analytical work to address chemical stockpile storage safety issues. Past studies have determined that M55 rocket storage is the most significant of these issues. Not considering the catastrophic events caused by external influences, the storage life of M55 rockets, based only on autoignition probabilities, is predicted to extend until at least the year 2017(PMCD, *Report of the Expert Elicitation on Autoignition of Nonleaking Rockets*, May 1997). However, the probability of a catastrophic event associated with continued M55 rocket storage in existing igloos is 10,000 times greater, on a per year basis, than M55 rocket autoignition. The risk associated with continued storage is, therefore, of much greater concern to the U.S. Army.

The deterioration of munitions make leaking chemical munitions a worker safety concern. When detected, these munitions are isolated and place in special storage containers to await disposal. Over time, the number of leakers will increase. This will continue to increases the risk of handling chemical munitions and is a concern for both stockpile storage operations and transport of chemical munitions to disposal facilities.

The fact that chemical munitions remain in storage is a risk to the public. This has been confirmed by the QRAs and analytical work completed to date. Risk will increase over time. The way to reduce risk is to pursue timely disposal of the stockpile.

Studies of the Effects of Lightning on M55 Rocket Squibs

QRAs published in FY 1997 indicated that M55 rockets in particular, the M55 rocket squibs, may be susceptible to ignition in the presence of strong electromagnetic fields. Scenarios associated with lightning-initiated ignition of stored M55 rockets dominate public risk at three eastern continental U.S. chemical weapon storage installations (Anniston Army Depot, Alabama; Pine Bluff Arsenal, Arkansas; and Blue Grass Army Depot, Kentucky). Lack of quantitative information on the squib response and the protection provided by the igloo yields analytical uncertainty. An expert panel was assembled by the Enhanced Stockpile Surveillance Program to study the likelihood of inadvertent M55 rocket ignition during lightning strikes to the storage igloos.

The panel concluded that lightning-induced ignition might occur when the following conditions existed: (1) external conduits entering the storage structure are not connected to the metal concrete reinforcement (rebar or wire mesh) located inside the igloo's concrete walls, (2) the igloo was built without physically attaching the metal concrete reinforcement (rebar or wire mesh) between the floor and walls, and (3) M55 rockets inside the igloo are too close to the igloo walls.

Currently, M55 rocket storage igloos have external conduits entering the structure that are not connected to the igloo rebar. Intrusion detection systems were installed in these igloos in the mid-1980s, and are still in use at each storage location. The lightning expert panel has recommended that these conduits be attached to igloo rebar at all installations where M55 rockets are stored. Igloo characterization and testing programs are currently underway to verify the type of igloo construction at each installation. Testing is being done to determine if igloo rebar is attached between the floor and walls. Two storage locations (Blue Grass Army Depot, Kentucky and Anniston Army Depot, Alabama) were visited by members of the lightning expert panel this year to test a small number of the igloos. All tested igloos were found to be acceptable, and safe storage distances from the igloo walls have been calculated for the igloos tested.

The expert panel also is currently developing test plans to measure M55 rocket sensitivity to electromagnetic fields. This test data will be used to further define the uncertainty associated with M55 rocket ignition and verify other mitigation measures and proper stand-off distances from the igloo walls to prevent arcing.

Studies on the Effects of Chemical Agent on M55 Rocket Propellant Stability

A comprehensive laboratory test program is underway to evaluate the effects of chemical agent on the stability of M55 rocket propellant. Tests were completed to evaluate stabilizer depletion following exposure to various concentrations of chemical agent vapor. These tests indicate that the reaction mechanism for stabilizer depletion is the same for contaminated and uncontaminated propellant but the depletion rate can be much faster following chemical agent contamination. A threshold concentration of chemical agent has been observed, above which stabilizer depletion is greatly accelerated and below which the stabilizer depletion rate is much slower. Tests are underway to measure the heat generation in the propellant due to the propellant degradation reactions. These tests show that the peak in heat generation rate occurs only after the stabilizer and effective stabilizer daughter products are fully depleted. Analyses are being performed using a thermal model of M55 rockets in storage to determine if the heat generation rates measured in the tests may lead to autoignition. The potential for autoignition depends not only on the heat generation rate, but also on the fraction of the propellant exposed to high concentrations of chemical agent and the magnitude of the heat losses from the surface of the M55 rockets. Tests are currently being performed to evaluate the extent to which the chemical agent diffuses into the propellant grain and the magnitude of the heat losses from the surface of the M55 rocket. Analysis of these test results will be available in the first quarter of FY 1999 and will determine the potential for autoignition of chemical agent-contaminated M55 rockets.

Safety of HD-Filled Ton Containers

A study of HD-filled ton containers was undertaken to examine potential storage and processing related safety issues. Previous experience with HD ton containers has shown that there is a potential for some pressurization within the enclosed container. The U.S. Army also wanted to gather more information on potential corrosion effects on ton container plugs. A study was conducted that hypothesized that the pressurization could be associated with the evolution of hydrogen gas. Physical testing is planned to verify the hypothesis.

The study also examined potential ton container plug and valve corrosion, and concluded that the risk associated with continued storage is very small. Leaks through the plug and valves continue to be very limited in number.

Risk Reduction Integrated Process Teams

The schedules for the destruction of the chemical stockpiles at Blue Grass Army Depot, Kentucky, and Pueblo Chemical Depot, Colorado, have been put on hold as a result of Congressional Direction in Section 8065 of Pubic Law 104-208, which has directed the demonstration of alternative technologies for destruction of the assembled chemical weapons. As a result, the Assistant Secretary of the Army for Research, Development and Acquisition directed the Program Manager for Chemical

Department Of Defense's Status Assessment For The Chemical Demilitarization Program

January 1997

- Design and development of mustard ton container pressure test equipment.

M55 Rocket Propellant Assessment. Since the *Interim Report* was published in April 1996, several analytical and experimental M55 rocket programs have been completed. These include: testing propellant Master Field Samples; exposing propellant to chemical agent in a laboratory environment; and collecting and analyzing field samples of propellant from confirmed leaking rockets. In addition, a comprehensive series of agent-propellant tests has begun. Each of these programs is discussed briefly in the following paragraphs.

The Master Field Samples of propellant obtained during the 1985 M55 rocket assessment program, and additional samples obtained in later years, are undergoing continued testing at the U.S. Army Armament Research, Development, and Engineering Center (ARDEC). Since the *Interim Report* was published, ARDEC has completed analyzing approximately one-third of the samples using the method developed by the Army to determine the safe storage interval. Results continue to show little degradation of the propellant that has not been exposed to agent. Based on these findings, ARDEC staff has recommended that the Master Field Samples, which were tested, do not need to be analyzed again for at least 5 years. The Army also conducted a statistical analysis considering the number of samples and the analytical results. This showed the samples stored at ARDEC are representative of the propellant at each of the sites where rockets are stored. These recommendations and results are consistent with the Army's 1995 prediction of a safe storage life for non-leaking rockets that extends well past the timetable for chemical demilitarization.

The Edgewood Research, Development and Engineering Center has completed preliminary laboratory studies on the effects of GB and VX on the stabilizer concentration in M55 rocket propellant. Propellant samples were exposed to agent vapor at elevated temperatures to accelerate the tests. This approach is believed to simulate the effects of long-term exposure to agent in storage over a shorter time period. Results of both the GB and VX tests show that stabilizer is depleted for agent-exposed propellant long before it is depleted in the unexposed control samples. A qualitative assessment of the data leads to the conclusion that, under test conditions, the rate of stabilizer depletion is accelerated due to agent interaction.

In 1995, a propellant sampling effort and test program was initiated to determine the extent of propellant degradation, if any, in confirmed leaking GB M55 rockets being demilitarized at the Johnston Atoll Chemical Agent Disposal System (JACADS). The analysis of those samples has now been completed. Of the 21 rockets sampled, 1 rocket showed evidence of degradation due to propellant exposure to agent. The original stabilizer was completely depleted from one end of the propellant. The other end showed a marked decrease in stabilizer content. These results are consistent with results of the laboratory testing in that they suggest agent contamination of propellant results in an accelerated rate of depletion of propellant stabilizer. Analyses of this sample also revealed that the nitroglycerine, one of two primary energetic components in the propellant, was depleted. This suggests that agent exposure of propellant may lead to the formation of an inert material. However, the rates at which stabilizer and nitroglycerin deplete has not yet been determined. If the stabilizer depletes more quickly, then autoignition is possible. On the other hand, if nitroglycerin concentration is sufficiently low when the stabilizer is gone, then autoignition would not be possible.

The Army convened a panel of propellant experts to review available data on propellant stability. These experts agreed that agent-exposed propellant probably became inert after some degree of agent exposure. However, they also questioned current knowledge of the chemical reactions taking place between stabilizer and propellant. Understanding these reactions is required to reliably assess the ultimate stability of agent-contaminated propellant. In response to this concern, the Army has initiated a comprehensive test program to develop data on the chemical composition and physical and thermal properties of M55 rocket propellant that has been exposed to nerve agent. The study is designed to systematically study these properties as a function of time and temperature. Data obtained from this study will be used to evaluate the stability of leaking M55 rockets. Exposure of the test samples and data collection has begun. The final results of the testing and analysis are expected in the fourth quarter of FY97.

The Army, in consultation with state environmental regulators, will use data obtained through the propellant testing to decide whether the Master Action Plan for M55 Rockets should be implemented. This is a contingency plan for reducing risk from the rockets in the event that accelerated deterioration is expected and autoignition is deemed a credible possibility. In that instance, depot staff in protective clothing would separate the warhead containing the chemical agent from the motor containing the propellant. This process involves significant risk and would only be implemented if the Army determined that the risk associated with continued storage of the propellant and agent together was unacceptable. The proposed process is not intended to be used as a means for handling a large number of rockets. It will only be applied to rocket lots exhibiting signs of significant deterioration. The final version of the Master Action Plan has been completed since the *Interim Report* was issued

Ton Container Survey. In 1993, a mustard ton container at the Tooele depot leaked approximately 78 gallons of mustard onto the ground. The leak occurred around one of the container plugs. No injuries occurred. As part of the ESSP, the Army has now completed a survey of the integrity of the mustard ton containers at the five depots where they are stored. As an indicator of integrity, specific data pertaining to agent leaks from the ton containers were analyzed. The data showed no particular trend toward frequency of leaks as a function of time or location in storage. Most leaks occurred around the ton container valve seats. Some leaks occurred at the plugs. Follow-up maintenance procedures included either replacing or tightening the leaking valve or plug replacement.

To further assess the integrity of the ton containers, the Army conducted random ultrasonic testing of ton container plugs at all five sites. Approximately 3 percent of all ton containers were inspected, a total of 2,964 plugs. The data indicate some plug

Stability of the Stockpile

Current Status

According to the April 15, 1996 "Department of Defense's Interim Status Assessment for the Chemical Demilitarization Program:"

- "..handling of the munitions to conduct a more thorough survey is also a source of risk that need not be incurred given the apparent <u>slow rate of deterioration</u>." (emphasis added @vii).
- 0.1% of the stockpile has leaked through its entire storage life. (@vii)
- "the rate of deterioration is not markedly increasing." (@viii)
- "<u>There is no evidence of immediate danger from stockpile storage.</u>" (emphasis added @viii).
- "..the rocket stockpile could continue to be safely stored." (@2-6)
- "The most recent evaluation performed by the Army in 1994 indicated that, with even the <u>most conservative assumptions</u>, the probability of a rocket auto-ignition is less than one in a million before 2013." (emphasis added @2-6).
- "..major problems with leaking bombs are not anticipated." (@2-13)
- "..no significant problems have been identified that would impact continued safe storage of GB in ton containers." (@2-13).
- "In general, the stockpile is considered stable." (@2- 4).

M-55 Master Action Plan: According to the same report:

The Master Action Plan for M-55 Rockets is a contingency plan for the rockets in the event of accelerated deterioration.

> "This plan outlines detailed activities for disposing of M-55 rockets in the event they become unsafe for continued storage. The plan calls for separating the warhead containing the chemical agent from the motor containing the propellant."

Public Law 104-106 directs the Secretary of Defense to make "recommendations for revision to the program including .....potential reconfiguration of the stockpile..."

Department Of Defense's Interim Status Assessment For The Chemical Demilitarization Program

April 15, 1996

ASSESSMENT OF THE CHEMICAL WEAPONS STOCKPILE

The Army routinely monitors the status of the chemical weapons stockpile. Inspections of the munitions are conducted on at least a quarterly basis. This inspection includes monitoring and analyzing the air inside of storage structures and physically inspecting the conditions of containers and munitions. The inspection frequency, equipment, and procedures are designed to identify leaking munitions before the work force or public are exposed to health or safety risks. Air monitors at the storage sites are available to detect any major leaks should they occur. Intrusive monitoring, which involves sampling the agent contents of the munitions to determine their serviceability, was discontinued in 1984, anticipating their disposal within the next 10 years. The Army has not resumed the systematic intrusive monitoring program. This decision was partially based on the understanding that handling of the munitions to conduct a more thorough survey is also a source of risk that need not be incurred given the apparent slow rate of deterioration. Recently, the Army sampled the contents of a representative number of bulk containers stored at Aberdeen, MD, and Newport, IN. Agent purity in these containers was determined to be slightly greater than 90 percent. This indicates that, at least in these containers, there has been little degradation of the agent.

As of March 1996, the Army had found just over 3,650 leaking items in the chemical weapons stockpile. This represents approximately 1 in every 1,000 items (0.1 percent). Within this number, items that contain the nerve agent GB (also called sarin) are found to have a considerably higher incidence of leakage. The largest single contributor, accounting for nearly one-third of all leaks, is the M55 rockets. To date, 1,336 M55 rockets have developed leaks in storage. This is approximately 0.4 percent of the GB rockets. Leaks have also been found in more than 0.15 percent of GB ton containers. The Army has determined that ton container leaks are principally the result of valve corrosion. A valve replacement program is ongoing and will be completed in August 1996. As part of the CSDP, the Johnston Atoll Chemical Agent Disposal System (JACADS) recently completed the disposal of nearly 2,600 GB-filled bombs. Nearly 3 percent of these munitions were leaking when they were removed from their overpack. Despite the relatively high incidence of leaks in items containing GB, the stockpile is reasonably stable and, with the possible exception of GB-filled M55 rockets, the rate of deterioration is not markedly increasing.

Continued storage of M55 rockets presents a potential concern. Earlier assessments had suggested that auto-ignition of aging propellant, leading to fires in the storage area, potentially represented a substantial risk for continued storage. In 1995, the Army, in conjunction with the propellant manufacturer, completed a reanalysis of the data used to develop these predictions. The conclusion of that study was that the likelihood of propellant ignition within the next 20 years was negligible. However, evidence suggests that leakage of GB from the rocket's warhead can accelerate the depletion of stabilizer from the propellant. One of the leaking GB rockets recently destroyed at Johnston Atoll was determined to have had most of the stabilizer depleted from part of the propellant. The Army has an ongoing effort to find out whether this is a significant concern with respect to safe storage. Contingency plans are also being developed to deal with rockets that may be determined to pose a substantial risk.

In response to recommendations made by the NRC, the PM-CD is performing new, detailed quantitative risk assessments for each of the eight stockpile sites within the CONUS. Stockpile storage risk is evaluated as part of these assessments. To date, assessments have been completed for the Tooele, Utah, and Anniston, Alabama, stockpile locations. Risk from earthquakes, large leaks from GB ton containers, and lightning strikes contribute most to storage risk. Lightning strike is of concern only with respect to storage of the M55 rockets and represents nearly [illegible]0 percent of the storage risk at Anniston.

There is no evidence of immediate danger from stockpile storage. However, the uncertainty associated with the stability of leaking M55 rockets requires immediate attention. Addressing this issue is one of the Army's high priority programs. Risk assessment results from the PEIS and the ongoing site-specific updates continue to indicate that storage risk is much larger than the risks associated with executing the

- The majority of leaking GB rockets contained agent with higher levels of impurities
- Agent that leaked from the warhead could contaminate the explosive and propellant components in the rocket.
- The safe and arm device in the fuze was inadequately designed in that it would not prevent ignition of the burster if the fuze were accidentally initiated.
- Explosive components in the rockets were no more sensitive than recently manufactured items.
- The shipping and firing tube did not adequately contain agent vapor or liquid.
- The M28 propellant, which naturally decomposes over time, had minimal loss of stabilizer and was therefore still stable.

The Army concluded that, although the M55 GB rocket was more prone to develop leaks, the rocket stockpile could continue to be safely stored. To identify and control leakage in the initial stages, the Army initiated routine low level air monitoring inside the shipping and firing tube of selected rockets.

Although the M28 propellant had exhibited minimal stabilizer loss, it was decided that continued surveillance of the propellant was appropriate. The data from the analysis of the propellant have been used as the basis for several M55 rocket storage life evaluations. The most recent evaluation performed by the Army in 1994 indicated that, with even the most conservative assumptions, the probability of a rocket auto-ignition is less than one in a million before 2013. Using less conservative assumptions, much

It was also determined that 72 of the 2,570 MK-94 bombs at Johnston Island were leaking GB when they arrived at the facility. The leaks were contained within the shipping container and were identified only after the containers were opened to process the bombs through JACADS. No leakers were found among the 3,047 MC-1 GB-filled bombs that were also destroyed in JACADS. Since most of the bombs stored in containers are now destroyed, and the remainder are readily inspected, major problems with leaking bombs are not anticipated.

2.4.3 Assessment from Reconfiguration and Maintenance Operations. More than 1.1 million 105-mm cartridges and 4.2-inch mortars are being reconfigured. The cartridge cases, primers, and propellant are being removed from the containers for 105-mm rounds, and the propellant wafers and ignition cartridges are being removed from the mortar round packages. This process enhances safety by removing fire and explosive hazards from the chemical agent and makes the reconfigured munition easier to process in the chemical demilitarization plants. No significant leakage problems have been encountered during reconfiguration operations to date.

Past visual inspections of GB ton containers showed potential leakage problems with brass plugs and valves used in the containers. The GB reacted with the brass and created small pathways for agent to leak from the container. All brass plugs and valves are being replaced with steel fittings to correct this problem. The replacement program is about 75 percent complete, and no significant problems have been identified that would impact the continued safe storage of GB in ton containers.

Tooele had an unusual occurrence in 1993, when it was discovered that about 75 gallons of mustard had leaked from a ton container. The leak was discovered during a quarterly inspection of the ton container yard. The contaminated earth from this leak was collected, packaged, and the plugs tightened to stop further leakage. It appears that abnormal pressures built up inside the container and forced agent to leak through one of the plugs.

conclusions regarding the risk of storage at each site will be available by the end of the year.

2.7 Summary and Conclusions

The experience gained through the various assessment and demilitarization programs such as SUPLECAM, and the M55 Rocket Assessment Program, as well as JACADS munition processing and non-stockpile experience, suggests that some stockpile deterioration has occurred over time but that it is not dramatic. Munition leakage is occurring, but with the possible exception of the GB-filled M55 rockets, the rate of leakage does not appear to be increasing at this time. In general, the stockpile is considered stable.

There is one potential stockpile deterioration issue under investigation that could be risk significant. The Army has evidence which suggests that exposure to nerve agent may accelerate the normally slow deterioration of the propellant in M55 rockets. The potential for an M55 rocket auto-ignition due to stabilizer depletion cannot be eliminated as a concern. The Army is aggressively studying this issue to determine whether there is a potential impact with respect to continued safe storage of the M55 rockets. Results are anticipated to be available in the first quarter of FY97.

The stockpile risk is generally controlled by unlikely events that could have significant consequences. Earthquakes have been found to be risk significant due to the potential for large agent releases. Lightning effects are uncertain but are estimated to be potentially risk significant for M55 rockets.

Leakage of GB nerve agent from ton containers was found to be risk significant at Tooele. The risk assessments have shown that the risk of the disposal process is very small compared to the continued storage risk. Continued storage risk will be eliminated by proceeding with the CSDP in an expeditious fashion.

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
TDD (503) 229-6993

Memorandum

DATE: November 15, 1999
TO: Environmental Quality Commission
FROM: Langdon Marsh
RE: Director's Report

Y2K Update: Year 2000 Status

As of November 15, 1999, DEQ has completed over 98% of our Y2K Readiness work. Most software applications are Y2K Ready. Contingency plans are in place for critical functions of emergency response, network & email services and agency reception. All equipment with microprocessor chips has been evaluated, fixed, replaced or had workaround developed. Millennium weekend plans are in place to verify proper functioning of business applications and computer and building infrastructures at facilities statewide.

A flaw in an upgrade of one of DEQ's application tools, which was used to develop five major systems, did not handle small numeric values correctly, and thus a November 15 completion date for all work was missed. This was not a Y2K problem. A solution has been found, but needs further testing prior to implementing it into a production environment.

Grande Ronde TMDL Completed

DEQ presented the final draft of the Upper Grande Ronde Total Maximum Daily Load (TMDL) to the Grande Ronde Water Quality Committee on November 4, 1999. This is the first subbasin level TMDL the Department is completing under its schedule for completing all subbasin level TMDLs by 2007. This TMDL is significant because it covers all water quality limited waterbodies in the entire Upper Grande Ronde subbasin and addresses pollutant loads from both point and nonpoint sources. Federal and private forest land, urban and rural nonpoint sources, and public and private point sources are all covered by the TMDL. The Committee will be finalizing the Water Quality Management Plan (WQMP) in November 1999. The WQMP describes what implementation actions, plans and mechanisms will be undertaken to meet the load allocations in the TMDL. DEQ plans to release both the TMDL and WQMP for public review and comment in early December 1999.

Stakeholder outreach for DEQ Strategic Plan

DEQ held three meetings with stakeholders during November (The Dalles, Eugene w/Medford videoconference, Portland). At the meetings, Lang Marsh discussed DEQ's future directions and solicited feedback and comment about stakeholder's issues and priorities. The feedback will be considered in modification of DEQ's Strategic Plan, particularly for the 2001-2003 period.

Ashland Spray Irrigation:
The Health Division sent DEQ several letters in September and October expressing concern about the City of Ashland's proposed spray irrigation of treated effluent. According to the Health Division, the project should be redesigned to redisinfect the effluent and use a lower pressure spray system (instead of "big gun" water cannons currently used). DEQ's interpretation of the rules is that once disinfection has been achieved, further disinfection is not needed. Furthermore, there is no evidence that water cannons produce a significant increase in aerosol generation. Discussions are underway between DEQ and the Health Division to resolve this matter.

Ashland also faces land use challenges. A group called Friends of the Creek appealed the LUCS to LUBA last year. LUBA ruled earlier this year that while this is a conforming use, there should have been a public comment/hearing process because the process of deciding that it is a conforming use constituted a land use decision. Ashland appealed this decision because they do not believe that public comment/hearing should be necessary for a conforming use. Upon hearing of the decision, Oregon Department of Agriculture and Department of Land Conservation and Development prepared to enjoin the suit on behalf of Friends of the Creek because they also believed that public comment/hearing should be required. DEQ has subsequently held discussions with ODA and DLCD and jointly issued a friends of the court brief agreeing that public comment/hearing should be held.

The City of Newport is in the process of designing a new sewage treatment plant to replace an old and poorly sited plant (surrounded by homes and motels). The outcome of facilities planning was that the best alternative was to build a new plant in South Beach. The raw sewage would come to the existing plant location, be pumped to the new plant through a forcemain (three miles, including under Yaquina Bay), treated, and then sent back by gravity to the existing Pacific Ocean outfall. The key issue is: "Where do we put the pipes that carry the sewage and effluent to and from the existing plant location?" The initial proposal was to located them in bedrock under the beach sand. DEQ viewed this as preferable over digging up city streets and the problems associated with other utilities, and were leaning towards approving. State Parks had to issue a permit for the beach alignment, and didn't think it should be allowed due to the precedent it would potentially set, as well as other technical problems regarding the geology of the beach/bluff interface. The City is now working on an alternative and could delay the project.

New Carissa update:
Work on the removal of the New Carissa has ceased for the year. A transition plan for addressing any issues during the winter months is being developed. The salvors will complete removal next spring.

Portland Harbor Cleanup:

A workplan for the first major phase of Harbor-wide work -- the sediment investigation -- is underway. This investigation addresses the nature and extent of contamination, and the risk posed by the contamination. Technical and policy workgroups representing EPA, natural resource trustees, environmental groups, tribes and industry are advising DEQ through this process, and will hold 18 meetings during workplan development. Site assessment work continues to identify additional responsible parties in the Harbor, and to advance the site-specific work at individual facilities. Also, discussions continue with the natural resource trustee agencies and interested tribes. EPA will not decide whether to list the site as an NPL until after March 2000.

Portland Considering CSO Amendment Proposals for EQC:

The City of Portland is considering asking the EQC to amend the 1994 Amended Stipulated Final Order (ASFO) to extend the implementation timeline for reducing combined sewer overflows (CSOs) into the lower Willamette River. The Portland city council and the Mayor were advised by letter October 28 that DEQ did not see a justification for such an extension. Since then, the city has held a council work session and another council meeting. They do not appear to be changing their position. The Commission has received a letter from the city's Bureau of Environmental Services director requesting an EQC appearance.

Approved_____
Approved with Corrections__X__

Minutes are not final until approved by the EQC

Environmental Quality Commission
Minutes of the Two Hundred and Eightieth Meeting

November 18-19, 1999
Regular Meeting

On November 18-19, 1999, the regular meeting of the Environmental Quality Commission (EQC) was held at the Department of Environmental Quality (DEQ) headquarters, 811 SW Sixth, Portland, Oregon. The following Environmental Quality Commission members were present:

Melinda Eden, Vice Chair
Linda McMahan, Member
Tony Van Vliet, Member
Mark Reeve, Member

Also present were Larry Knudsen, Assistant Attorney General, Oregon Department of Justice (DOJ); Langdon Marsh, DEQ Director; and other staff from DEQ.

Note: The Staff reports presented at this meeting, which contain the Department's recommendations, are on file in the Office of the Director, 811 SW Sixth Avenue, Portland, Oregon 97204. Written material submitted at this meeting is made a part of the record and is on file at the above address. These written materials are incorporated in the minutes of the meeting by reference.

At 12:30 pm on November 18, 1999, a reception was given for Carol Whipple, outgoing Chair of the Commission. The regular meeting was called to order by Vice-Chair Eden at 1:30 p.m.

Commissioner Van Vliet made a motion to elect Vice-Chair Eden as Chair of the Commission. It was seconded by Commissioner McMahan and carried with four "yes" votes.

Work Session: The Department will brief the Commission on Portland General Electric Company's Independent Spent Fuel Storage Installation at the Trojan Nuclear Power Plant site in Rainer.

Please see attached verbatim transcript.

A. Approval of Minutes

The following correction was made: on the top of page 6, the first line, the law firm of Stoel Rives is misspelled. A motion was made by Commissioner Reeve to approve the minutes as corrected. Commissioner Van Vliet seconded the motion and it carried with four "yes" votes.

B. Approval of Tax Credits

Maggie Vandehey, Tax Credit Coordinator for DEQ, presented tax credit applications for approval, denial and rejection.

Approvals

Willamette Industries' applications numbered 4789, 4927, 4934, 4978, 4979, 4986, and 5020, were removed from the agenda at this time. Commissioner Reeve had asked staff questions regarding hazardous waste versus hazardous materials at the October 1, 1999, Commission meeting as it related to application number 4801. The application was pulled from the October meeting and now is included in this agenda Item. Ms. Vandehey further explained that controlling hazardous waste is an eligible tax credit purpose but that controlling hazardous materials is not. Basically, the former is storage of pre-production supplies and the later is containment of post-production waste. The Department looks to the potential risk beyond the site not within the building structure. Commissioner Reeve asked if there was a separate law regarding air and water from hazardous waste. Ms. Vandehey answered, "yes, each type of tax credit has slightly different eligibility criteria." Dennis Cartier of SJO Engineering Consultants, a contractor for the Department, affirmed that hazardous materials used for production fall under a different set of codes. These are put in not because DEQ requires their installation but because the fire code requires their installation. Typically, they are inside the building where the floor itself would contain the material and you would n have a release to the environment. When asked if hazardous waste is temporarily stored on-site prior to being transported off-site for final disposal or treatment, Mr. Cartier responded that typically it could be stored in drums or on a pad. They are required by the hazardous waste rules to have a secondary containment.

Counsel indicated that this issue can come up in two contexts. One issue is in the sole purpose/principal purpose context. The other is, after meeting the purpose test, it still has to be a prevention, control or reduction facility. To prevent pollution by doing one of several of things, including disposal, and elimination of a waste.

In reference to Willamette Industries' application #4928, Commissioner Reeve questioned how staff determines there is no available or useful commodity referencing the wood waste recovery system, indicating medium density fiberboard (MDF) is very much a useful or salable commodity. Staff indicated that in general, the reviewer looks at the commodity market to verify the value of the commodity. In this case, the accounting firm considered the value of the commodity in the return on investment calculation. It did not impact the percentage allocable to pollution control on this particular application.

Commissioner Reeve asked if return on investment (ROI) is a separate issue from salable or useful commodity. Staff indicated this is one of the five factors the Commission must consider when determining the percentage allocable to pollution control – its implementation is ambiguous. Under the material recovery portion of the tax credit law, they are required to produce a useable and salable commodity. However, the value of the commodity must be considered in the return on investment calculations. Commissioner Van Vliet commented the facility was probably taking material out of the waste stream that would produce air pollution if it were burned.

Counsel clarified that the standards are different for recycling programs, and the Department uses recovery of the salable product differently. The Legislative decision grants a tax credit to this type of facility. Past Commissions thought it would be inappropriate to use the feed stock as a return on investment. The Department also uses this as an indicator to help determine if a facility is an integral facility.

Regarding Willamette Industries' application #5227, Commissioner Reeve indicated he was not aware that the rules required an open chip pile be covered for Principal Purpose eligibility. Lois Payne with SJO Consulting Engineers, the technical reviewer, said she needed more time for research. Counsel clarified that storm water permits are relatively new and industrial storm water sources are inching up on full coverage under the 402 program. This particular general permit was issued in 1997. With storm water permits, they incorporate individual plans for industrial facilities and it this may have been the plan. It was recommended that the application be removed from the agenda so staff could clarify the purpose of the facility and make the exact citation for eligibility.

Commissioner Reeve expressed concern over creating a secondary market for tax credits with Stafford Property Equipment Leasing's application #5257. He understood the applicant was a leasing company that is not operating the equipment. It was clarified that under the material recovery portion of the tax credit that either the lessee or the lessor may claim the facility. The party does not necessarily have to be the operator. When Commissioner Van Vliet asked if any leasing company that has a grinder in their possession could get a tax credit, Ms. Vandehey said that yes, if it were used in a material recovery process or if they were Pope & Talbot.

Chair Eden noted that on Boeing's application #4628 the number on the second page was missing a digit when compared to the number on the first page. Staff acknowledged the amount under the Director's Recommendation and as listed on the summary was the amount to be certified.

Chair Eden asked why the ductwork in Valmont Industries' application #4799 was not allowed if it was used to capture particulate and convey it. Staff indicated the ductwork was part of the enclosure system and the system a a whole was not allowable. Generally, ductwork is only allowable after it exits the building on its way to the scrubber.

Chair Eden asked if this was true even if the ductwork was installed specifically for this system. Ms. Vandehey said, "yes." Counsel said the theory is they would have to install the ductwork anyway to remove contamina*nants* from the building. It may be that it is specific to the pollution control equipment but they would have to have some kind of ductwork either way even if they were just discharging it to the outside atmosphere.

A motion was made by Commissioner Reeve to approve the tax credits listed in Attachment B to the Staff Report with the removals recommended by staff, with the corrections indicated by the Commission, and with the temporary removal of application #5227. Commissioner McMahan seconded the motion and it carried with four "yes" votes.

Denials

Maggie Vandehey asked the Commission to removed Willamette Industries' application #5167 and Sabroso's application #5197 from the denials.

Commissioner Reeve asked questions regarding the drain piping system on Mitsubishi's application #4834. If the pipe ruptures, is that hazardous waste that will run into the building? If the old pipe would have ruptured would that have presented a hazard to the environment? Mr. Cartier said Mitsubishi installed a single-walled pipe on the roof. A motion was made by Commissioner Van Vliet to approve the denials as presented in Attachment C with the removals requested by staff. Commissioner Reeve seconded the motion and it carried with four "yes" votes.

Rejections

Ms.Vandehey requested that applications #4570 and #4800 be removed from the rejections.

Commission Action

Action	App. No.	Applicant	Certified Cost	% Allocable	Value	Type
Approve	4628	Boeing Company	$ 3,704,836	100%	$1,852,418	Water
Approve	4799	Valmont Industries, Inc.	$ 109,876	100%	$ 54,938	Air
pprove	4928	Willamette Industries, Inc.	$ 723,654	100%	$ 361,827	SW
pprove	4966	Tokai Carbon U.S.A., Inc.	$ 554,310	100%	$ 277,155	Air
Approve	4977	Willamette Industries, Inc.	$ 640,186	100%	$ 320,093	Air
Approve	4987	Willamette Industries, Inc.	$ 45,872	100%	$ 22,936	Air
Approve	4996	Bushwhacker Saloon Corp.	$ 18,000	100%	$ 9,000	Water
Approve	5004	Widmere Brothers Brewing Company	$ 405,245	100%	$ 202,623	Water
Approve	5045	Mitsubishi Silicon America	$ 655,955	100%	$ 327,978	Air
Approve	5137	Intel Corporation and Subsidiaries	$ 192,077	100%	$ 96,039	HW
Approve	5138	Intel Corporation and Subsidiaries	$ 1,683,111	100%	$ 841,556	Water
Approve	5139	Intel Corporation and Subsidiaries	$ 1,858,452	100%	$ 929,226	Air
Approve	5156	JR Simplot Company	$ 757,749	100%	$ 378,875	Air
Approve	5174	Dynic USA Corporation	$ 511,501	100%	$ 255,751	Air
Approve	5178	Lamb-Weston, Inc.	$ 407,181	100%	$ 203,591	Air
Approve	5185	Cain Petroleum, Inc.	$ 197,978	94%	$ 93,050	USTs
Approve	5228	M&M Rentals Co	$ 126,288	92%	$ 58,092	USTs
Approve	5229	M&M Rentals Co	$ 169,962	87%	$ 73,933	USTs
Approve	5233	Hockema Coast Oil Co.	$ 133,477	90%	$ 60,065	USTs
Approve	5240	R Plastics, Inc. Inc.	$ 8,400	100%	$ 4,200	Plastics
Approve	5246	Mobile One-Stop/Dorothy Rofinot	$ 105,390	98%	$ 51,641	USTs
Approve	5249	BOWCO INC.	$ 105,000	100%	$ 52,500	Plastics
Approve	5254	Westmoreland Cleaners, Inc.	$ 2,500	100%	$ 1,250	Water
Approve	5257	Stafford Property Equipment Leasing	$ 510,000	100%	$ 255,000	SW
prove	5258	Ken's Dry Cleaning	$ 33,382	100%	$ 16,691	Perc
pprove	5259	Sharp Auto & Paint Works	$ 3,290	100%	$ 1,645	Air

Approve	5260	Capitol Recycling & Disposal, Inc.	$ 11,997	100%	$ 5,999	SW
Approve	5261	United Disposal Service, Inc.	$ 5,781	100%	$ 2,891	SW
Approve	5263	Capitol Recycling & Disposal, Inc.	$ 34,104	100%	$ 17,052	SW
Approve	5265	New China Laundry & Dry Cleaning	$ 3,381	100%	$ 1,690	Water
Approve	5266	Happy Hangers Cleaners	$ 3,300	100%	$ 1,650	W
Approve	5268	Clemens Automotive, Inc.	$ 4,399	100%	$ 2,200	Air
Approve	5272	Clarence Simmons Farm, Inc.	$ 55,628	100%	$ 27,814	Burning
Approve	5273	Roger Eder	$ 44,601	100%	$ 22,301	Burning
Approve	5275	Mars Enterprises, Inc.	$ 149,753	100%	$ 74,877	Burning
Approve	5277	Don Worthington	$ 49,820	100%	$ 24,910	USTs
Approve	5157	T. W. D., Inc.	$ 165,596	93%	$ 77,002	USTs
Deny	4801	Valmont Industries, Inc.	$ 407,722	100%	$ 203,861	HW
Deny	4834	Mitsubishi Silicon Amercia	$ 158,667	100%	$ 79,334	Water
Deny	4980	Willamette Industries, Inc.	$ 18,041	100%	$ 9,021	Air

An EQC phone meeting was scheduled for 9:00 a.m. on December 20, 1999. The Commission adjourned for the evening at 3:25 p.m. At 8:00 a.m., November 19, 1999, the Commission held an executive session in Room 3B of DEQ Headquarters regarding EZ Drain Company v. State of Oregon, Department of Environmental Quality, Case No. 9809-06683. The regular meeting was resumed at 8:40 a.m.

C. Informational Item: Update on the General Air Contaminant Discharge Permits (ACDP)

Andy Ginsburg, Acting Air Quality Division Administrator, and Scott Manzano, Acting Program Development Manager, provided the Commission with the update based on the Commission's request at the time the General ACDP rule was adopted in August 1998. These rules allow the Department to permit a large number of sources under one permit. This process eliminated the standard practice of permitting each source one permit at a time, and has likely saved hundreds of hours of permitting staff time. To date, the Department has written permits for two source categories: Chrome Electroplaters, and Halogenated Solvent Degreasers. The Department received no public comment or request for hearing during the public comment process, and has had no complaints regarding any of the sources that have signed on to these permits. These sources are treated no differently than other individually permitted sources with respect to enforcement and complaint response. The public can review the list of sources that have these general permits via the Department Internet. The Department was looking for other opportunities to use general permits in conjunction with a current initiative to re-evaluate how fees are charged to all ACDP sources. Historically, the Department has successfully used general permits to permit over 3000 sources through the Division of Water Quality, and Air Quality is very pleased with the use of this permitting vehicle thus far.

D. Action Item: Appeal of Hearing Order Regarding Assessment of Civil Penalty in the Matter of Cascade General, Inc., Case No. HW-NWR-97-176

A Notice of Assessment of Civil Penalty was issued to Cascade General on November 18, 1997 for two violations. The first was for failure to make a hazardous waste determination. The second was for the failure to properly manifest hazardous waste transported for disposal. The civil penalty amount was $14,500. On December 15, 1997, Cascade General appealed the Notice and a hearing was held on January 28, 1999.

The Hearing Officer held that Cascade General was required to complete a Hazardous Waste Manifest. He also concluded that independent tests done by Cascade General qualified as a Hazardous Waste Determination. Cascade General was liable for a civil penalty for the failure to properly manifest the waste transported for disposal but he reduced the civil penalty by changing the "P" factor and refusing to consider evidence of economic benefit.

Cascade General was represented before the Commission by John Schultz and Lori Irish Bauman. The Department was represented by Larry Shurr, an Environmental Law Specialist. The Department argued that:

(1) there was evidence in the record that Cascade General had four prior class two violations, which, according to law, is equivalent to two class one violations, and

(2) the hazardous waste rules set forth the procedures that must be followed to perform a hazardous waste determination. Cascade General failed to follow these requirements. The Department also requested the evidence regarding the economic benefit be allowed into the record.

scade General argued that the failure to make a hazardous waste determination does not mean the failure to make a correct determination and regardless of this, the product should be classified as 'used oil' and thus would be exempt from the requirements regarding hazardous waste. Cascade General requested the Commission allow into evidence an affidavit that provided proof that a significant amount, if not all, of the product was used prior to disposal. Cascade General agreed there was sufficient evidence in the record to support the "P" factor of +3 as originally set by the Department.

Commissioner Reeve made a motion for the Commission to uphold the hearing officer's decision in that the testing done by Cascade General did qualify as a hazardous waste determination and Cascade General was liable for a civil penalty for failing to properly manifest the waste transported for disposal. The civil penalty set by the hearing officer is to be changed to reflect the change in both the "P" and "EB" factors. Commissioner McMahan seconded the motion and it carried with four "yes" votes. Counsel was directed to prepare the Order.

Public Comment:

Two citizens signed up for public comment. They could not testify as it involved a rule adoption on the agenda. Andy Ginsburg and Lang Marsh presented Spence Erickson with a plaque on behalf of the Commission for his 25 years of service to the Department.

E. Rule Adoption: On site Sewage Disposal Fees

Stephanie Hallock, Interim Administrator for the On-Site Sewage Disposal Program and Dennis Illingworth, DEQ On-site Program, presented this item. The 1999 legislature gave the Department authority to increase staff resources in the on-site program. These new resources would be primarily used for compliance and enforcement efforts as requested by the on-site industry. Since the program does not receive state general or federal funds, an increase in fees is necessary to provide for the additional staff. The fees have not increased since 1994; and, therefore, inflation factors were also added into the proposed rule package. The proposed rule package would increase fees for a meowner applying for a standard septic permit by approximately 38 percent. Fees for installer and pumper licenses ould more than double. The legislature had been informed during the session fees would need to be raised if the additional resources were allocated. In addition to the fees, the rule package contains technical rule changes relating to new terminology and definitions; disposal trench installation in relation to groundwater depths and delaying implementation of examination for sewage disposal workers from January 2000 to January 2002.

There was discussion in regards to the proposed fee for innovative or alternative technology or material review (related to agenda item F). Staff explained with the few "innovative" products that have needed Department review, the proposed fee only begins to cover the costs. It was further explained that many products are not considered "innovative" or "alternative" technologies and therefore would not be subject to the fee.

A motion was made by Commissioner Van Vliet to adopt the rule package. It was seconded by Commissioner Reeve and carried with four "yes" votes.

F. Rule Adoption: Rules Establishing Review and Acceptance Criteria for New or Innovative Technologies and Materials for Application in the On-site Program

Just prior to presentation of the staff report, Counsel requested the Commission consider re-opening the public comment period to allow the opportunity for persons to submit additional comment on the proposal for rulemaking. Stephanie Hallock, Interim Administrator for the On-Site Sewage Disposal Program, presented a summary of the staff report. The Commission asked several questions about the alternatives and the performance testing protocol. It expressed that the performance testing should be conducted by other than the Department. After discussion, a motion was made by Commissioner Reeve to extend the public comment period through December 10, 1999, in order that additional written comment might be received and made a part of the record. It was seconded by Commissioner Van Vliet and carried with four "yes" votes. The Commission agreed to consider taking final action on the proposed rulemaking at their phone meeting scheduled for December 20, 1999.

G. Action Item: Reopen the Permit at the Umatilla Chemical Agent Disposal Facility (UMCDF) for Modifications with Respect to the Inclusion of the Carbon Filter System as Part of the Pollution Abatement System

Wayne C. Thomas, Umatilla Program Manager introduced the staff and summarized the issue. Larry Edelman, Assistant Attorney General, Department of Justice, presented the legal framework for causes of unilateral modificat of a hazardous waste treatment permit and any findings the Commission may issue. The presentation was based on an August 4, 1999, memorandum to Chair Whipple. Ken Chapin, Environmental Engineer, was present to respond to any technical questions from the Commission.

Sue Oliver, Senior Hazardous Waste Specialist, presented the staff report which summarized the public comments into the following areas: completeness of the pollution abatement system/carbon filter system (PFS Design); use of a "fixed bed" design, The ability of carbon to adsorb chemical agent, PFS safety risks; operation of the PFS during "upset" conditions; the use of a five stage pollution abatement system; and exhibit "74".

The Department stated two recommendations:
1. The PFS be retained as part of the UMCDF design, and
2. The Commission send a letter to the Governor requesting OR-OSHA coordinate with Federal OSHA on the issue of worker safety as it applies to the carbon filters system.

The Commission asked several questions about chemical agent monitoring upstream and downstream of the Carbon Filter System.

Commissioner Van Vliet made a motion to accept the Department's report. It was seconded by Commissioner Reeve and carried with four "yes" votes. The Department will prepare a letter for Chair Eden's signature for transmittal to the Governor.

2:00 p.m. – Public Comment for this Agenda Item Only: UMCDF Permit Revocation Request Dated December 14, 1998 from GASP, et al.

Karyn Jones (GASP), Dr. Robert J. Palzer (Sierra Club), Stu Sugarman, and Richard Condit presented comments ir support on the revocation request. Many of the comments focused on the September 15, 1999, industrial accident. The commenters expressed several concerns that if this could happen, how can the State of Oregon have confidence in the Army and Raytheon for the handling of chemical agent disposal operations.

Dr. Palzer commented on the availability of alternative technologies, particularly for the bulk mustard ton containers, which constitute 65 percent of the stockpile stored at the Umatilla Chemical Depot.

Loren Sharp, Raytheon Demilitarization Company Plant Manager, commented on the September 15, 1999 industrial accident that the cause currently under investigation is pepper spray. The FBI and the Army Criminal Investigation Division (CID) are now leading the investigation.

The public comment period will be open until December 17, 1999. No decision was reached on when the Department will return to the Commission with a staff report and recommendation

H. Commissioners' Reports

There were no reports from Commissioners.

I. Director's Report

As of November 15, 1999, DEQ has completed over 98 percent of the Y2K Readiness work. Contingency plans are in place for critical functions of emergency response, network & email services, and agency reception. All equipment with microprocessor chips has been evaluated, fixed, replaced or had work-around developed. Millennium weekend plans are in place to verify proper functioning of business applications and computer and building infrastructures at facilities statewide.

DEQ presented the final draft of the Upper Grande Ronde Total Maximum Daily Load (TMDL) to the Grande Ronde Water Quality Committee on November 4, 1999. This is the first subbasin level TMDL the Department is completir under its schedule for completing all subbasin level TMDLs by 2007. This TMDL is significant because it covers all water quality limited waterbodies in the entire Upper Grande Ronde subbasin and addresses pollutant loads from both point and nonpoint sources. Federal and private forest land, urban and rural nonpoint sources, and public and private point sources are all covered by the TMDL. The Committee will be finalizing the Water Quality Management Plan (WQMP) in November 1999. DEQ plans to release both the TMDL and WQMP for public review and comment in early December 1999.

DEQ held three meetings with stakeholders during November (The Dalles, Eugene, and Portland). At the meetings, Lang Marsh discussed DEQ's future directions and solicited feedback and comment about stakeholder's issues and priorities. The feedback will be considered in the modification of DEQ's Strategic Plan, particularly for the 2001-2003 period.

The Health Division sent DEQ several letters in September and October expressing concern about the City of Ashland's proposed spray irrigation of treated effluent. Discussions are underway between DEQ and the Health Division to resolve this matter.

The City of Newport is in the process of designing a new sewage treatment plant to replace the old, poorly sited plant surrounded by homes and motels. The outcome of facilities planning was that the best alternative was to build a new plant which is in South Beach. The raw sewage would come to the existing plant location, be pumped to the new plant through a three mile long forcemain under Yaquina Bay, treated, and then sent back by gravity to the existing Pacific Ocean outfall. The key issue is: "Where do we put the pipes that carry the sewage and effluent to and from the existing plant location?" The initial proposal was to locate them in bedrock under the beach sand. DEQ viewed this as preferable to digging up city streets and the problems associated with other utilities, and were leaning towards approval. State Parks had to issue a permit for the beach alignment and did not think it should be allowed due to the precedent it would potentially set, as well as other technical problems regarding the geology of the beach/bluff interface. The City is now working on an alternative and could delay the project.

A Portland Harbor Cleanup workplan for the first major phase of Harbor-wide work -- the sediment investigation -- is underway. This investigation addresses the nature and extent of contamination, and the risk posed by the contamination. Technical and policy workgroups representing EPA, natural resource trustees, environmental groups, tribes, and industry, are advising DEQ through this process and will hold 18 meetings during workplan development. Site assessment work continues to identify additional responsible parties in the Harbor, and to advance the site-specific work at individual facilities. Also, discussions continue with the natural resource trustee agencies and interested tribes. EPA will not decide whether to list the site as an NPL until after March 2000.

The City of Portland is considering asking the EQC to amend the 1994 Amended Stipulated Final Order (ASFO) to extend the implementation timeline for reducing combined sewer overflows (CSOs) into the lower Willamette River. The Portland City Council and Mayor Vera Katz were advised by letter on October 28, 1999, that DEQ did not see a justification for such an extension. Since then, the City has held a council work session and another council meeting. The Commission has received a letter from the City's Bureau of Environmental Services.

There being no further business, the meeting was adjourned at 3:05 p.m.