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CHEMICAL STOCKPILE DISPOSAL PROGRAM EVALUATION OF THE  
DRAFT PROGRAMMATIC (U) UNATILLA COUNTY SOIL AND WATER  
CONSERVATION DISTRICT PENDLETON  
SAPEO-CDE-15-87016 DAAA15-87-Q-0086

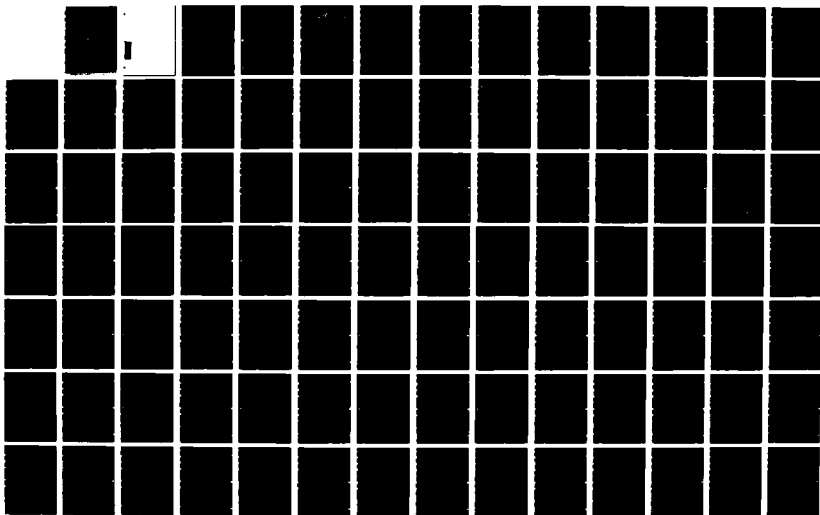
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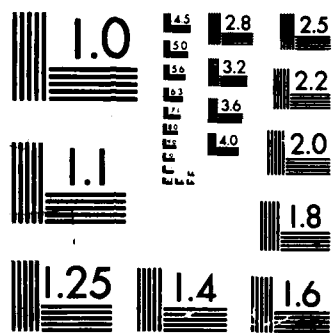
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NN. The maximum amount of material that can be in any "compartment" of the handling and demil process should be determined. This information provides a basis for an immediate worst case estimate of the concentration of material at any point away from the source, according to the dispersal model employed.

OO. The dose-response relationship for the earliest and most sensitive responses to all agents should be determined. When incorporated with the dispersal/concentration model the product is an immediate estimate of the location of the expected most sensitive response.

#### DISCLAIMERS

The views, opinions and/or findings contained in this report should not be construed as an official Department of the Army position, policy, or decision, unless designated by other documentation.

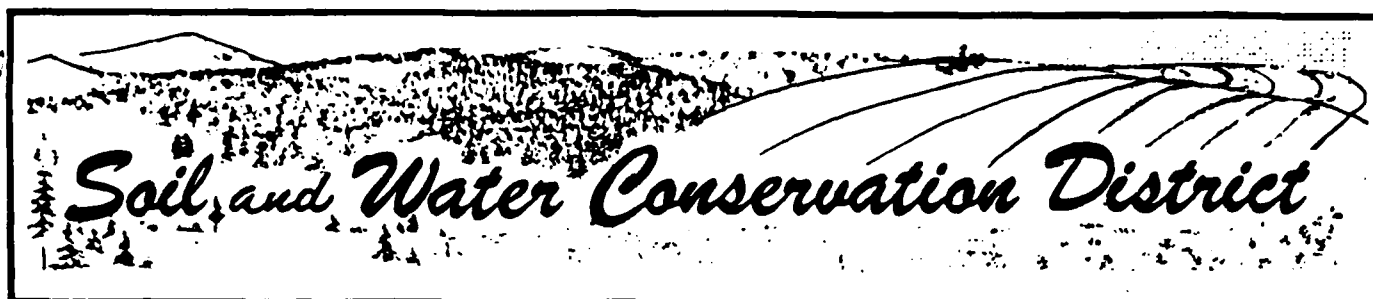
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## REPORT DOCUMENTATION PAGE

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UMATILLA COUNTY • 1229 S.E. THIRD • PENDLETON, OR 97801

## FINAL REPORT FOR U.S. ARMY

CONTRACT DAAA15-87-Q-0086

**EVALUATION OF THE DRAFT PROGRAMMATIC  
ENVIRONMENTAL IMPACT STATEMENT FOR THE  
DESTRUCTION OF CHEMICAL MUNITIONS  
STORED AT THE UMATILLA ARMY DEPOT AND  
OTHER ARMY FACILITIES**

**CONTRACTOR  
UMATILLA COUNTY SOIL AND WATER  
CONSERVATION DISTRICT  
PENDLETON, OREGON  
SEPTEMBER 30, 1987**

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## EXECUTIVE SUMMARY

The Umatilla County Soil and Water Conservation District submits this report in fulfillment of its contract with the U. S. Army, DAAA15-87-Q-0086. The study team formed by the District recommends that the alternative chosen for disposal of the chemical stockpile is onsite incineration. The Hazardous Waste RCRA permit, filed with the Oregon Department of Environmental Quality, should be approved as soon as it is declared complete. The atmospheric emissions, under normal operation, are within permitted levels and the Air Quality permit should also be approved. Time is of the essence for their approvals because negotiations, design, and construction and operation must proceed, even for the recommended Phase I Option.

Delays in approval, or any holdups, will extend the termination date of the project. With time, the rocket propellants continue to degrade at an increasing rate while agent leakage from the rockets also increases. This is coupled with the ever-present risks of continued storage. Any delays that cannot be justified as a net benefit to public safety will place the project at greater risks; such risks can be expected to accelerate with time.

The study team feels that the operation in the demil facility are well thought out and should be as risk free as possible. On the other hand, the risk assessment for the operations and handling of the weapons between their present

storage sites and the demil facility needs study and development to assure maximum safety.

The risk analysis is still open to questions, particularly with regards to accidents caused by internal or operational events. The mitigation analyses, however, is very realistic and this on-going study is to be commended.

The onsite emergency planning is good but the off-post emergency planning needs much more study and improvement. The citizens of the area are supportive of the Army, but they feel that a great deal more effort needs to be put forth to insure their safety.

There is a need for much more research activity on the M55 rockets. This should cover the areas of propellant degradation, leakage of agent, accidental propellant ignition, and accident scenarios involving single and multiple rocket ignitions both inside and outside of containment areas.

There is a need for continuing information exchange among all persons interested in, or connected to, the chemical munitions disposal system. A free exchange of information can be a large factor in increased safety.

A listing of the specific recommendations of the study team concludes this summary. Detailed information concerning findings, observations, conclusions, and recommendations will be found in the body of the report.

## CONCLUSIONS AND RECOMMENDATIONS

- A. The preferred alternative is onsite incineration.
- B. A task force group (outside consultants and Army) should meet every six months to discuss the progress, and problems of the Chemical Stockpile Disposal Program.
- C. The off-post emergency response, and onsite handling operations programs, remain weak.
- D. The Army should institute a monthly report (newsletter) to all concerned persons (not classified) reporting on successes, events, incidents and accidents. This would stop the circulation of rumors and false information.
- E. There needs to be developed a more thorough description of the proposed training evaluation. Will certification be required for some, or all, positions? What is proposed for simulated emergency situations?
- F. A total airspace restriction needs to be implemented over the chemical weapons storage and demil area plus three miles on all sides. This should be done immediately to eliminate an avoidable risk.
- G. The agent storage tanks, transfer lines, and valves must be designed to resist any possible seismic load without rupturing or spilling. They must be contained in a room designed to Nuclear Regulatory Commission (NRC) Seismic standards.
- H. The State of Oregon has an approved plan, which the EPA has accepted for complying with SARA Title III. This plan deserves acceptance and support by the Army.
- I. The chemical munitions handling operations, prior to entering the demil facility, are not as thoroughly developed as they should be. Since the rockets are considered as hazardous waste by the State of Oregon, the proposed handling of the rockets throughout the entire process should be detailed in the Part B Permit application.
- J. The incineration (demil) permit is thorough and should be approved. The projected atmospheric emissions are attainable and not hazardous to human health.
- K. There needs to be developed, and made available to those concerned (consultants, emergency response teams, etc.), accurate data on stocks and throughput for all handling and transportation steps to avoid operational disruptions and dangerous "pile ups."

- L. There needs to be a single command center for dealing with events, incidents, and accidents. The organizational planning must all be coordinated through this single center. It alone should be responsible for any notification of the public, outside the facility.
- M. The plan referred to as Option I, the phased approach, is recommended. Tooele continues with the research program, JACADS proceeds with the operational demilitarization, and the CONUS facilities follow on a schedule about three years behind JACADS. If a failure occurs at JACADS, the CONUS facilities are put on hold until the problem is solved.
- N. There needs to be additional studies to investigate the accidental ignition of the rockets.
- O. The risk analysis study must recognize that internal events can cause just as serious an accident as external events.
- P. A full-time atmospheric scientist should be employed on the day shift. This employee would be responsible for analyzing real time meteorological data and assuring proper application of the computer model used to estimate agent release from an incident/accident.
- Q. The D2PC dispersion model, in its present form, is inadequate for predicting far downwind, worst case agent concentrations due to accidental releases. The revised model, now developed, needs to be subjected to rigorous technical review before being considered adequate.
- R. The quantities of material accidentally released from malfunctions of the incinerators or air pollution abatement systems need to be considered for input to the D2PC model.
- S. The site specific study for UMDA needs to consider emergency response to accidental spills and mitigation for both ground water and surface runoff situations. Ground water monitoring should also be considered.
- T. The revised D2PC model should be run for a spectrum of possible accidental releases of agent, including worse cases. These results can be used as default predictions of downwind hazard for emergency response purposes in cases where source term information is ambiguous, where injury to personnel has occurred precluding rapid characterization of source term information, or when inadequate time is available to make model runs on the computer.

- U. All known toxicological impacts of the various agents or combustion products should be considered in developing a risk analysis. The earliest and most sensitive responses are most important.
- V. The toxicological impacts on the agriculture of the area should be considered along with the human health effects.
- W. The FPEIS should include a simple discussion of the irreversible effects such as reproductive and genetic injury, and cancer, and a discussion of the nature of biological risk.
- X. The Army has an excellent safety record when handling chemical munitions. We are impressed with the degree of expertise they have put into this project to assure that this record continues.
- Y. Preoperational surveys involving simulated operations should be conducted for all operations including onsite storage, handling, and transportation.
- Z. A single document should be prepared describing the overall operational command and control requirements. These requirements should be independently reviewed and tested through preoperational surveys and drills. Command and control proposals should be independently reviewed and updated in the early phases of the program.
- AA. All information relevant to the possible kinetic-ignition of the M55 rocket (including data on similar rockets) should be assembled and reviewed in a single document; plausible mechanisms for accidental ignition should be developed.
- BB. The influence of "dynamic crush forces" and "undue mechanical forces" on the risk of rocket ignition should be reviewed and made to be more consistent with the handling of burster detonation in rail accidents.
- CC. The use of conditional probabilities (frequencies) developed on a per munitions basis to determine accident probabilities should be incorporated in the risk analyses.
- DD. The design and testing of the internal dunnage of the transport containers should be considered with greater emphasis given to the ignition of the rockets within the container as a result of accident and the "cleanup" operations after an accident.

- EE. The accidental ignition within a transport container should be considered as a credible accident with extremely serious consequences; the extent of such consequences should be examined and mitigation steps taken.
- FF. Computer simulation studies should be conducted to examine propellant destabilization and the risks of autoignition as a function of time.
- GG. An appropriate atmospheric dispersion model needs to be on-line to calculate chemical agent plumes in the event of accidental releases from the demilitarization facility.
- HH. Fundamental assumptions of all models should be clearly specified, such as the dispersion technique, computational algorithm (numerical vs. explicit solution), and fixed parameter values with rationale for value selections.
- II. For any model employed, specific conditions for which the model calculations are considered valid as well as limiting conditions of the model should be clearly listed.
- JJ. If further unique modeling techniques are developed for agent dispersion calculations for the chemical weapons disposal program, the predicted concentrations and plume profiles should be validated by making comparative runs with at least two generally accepted air dispersion modeling programs (e.g., EPA ISC and similar models). In addition, tracer studies should be performed to validate the model using site-specific data and real-time meteorological information.
- KK. The dispersion model used for accidental atmospheric releases of chemical agents should be tested under simulated emergency conditions. The model input data requirements and computational algorithm must be kept simple enough such that output is generated within time limits imposed by emergency response protocols.
- LL. Dispersion model calculations (program output) should be based on criteria other than (or in addition to) lethality to humans. Distances at which sublethal effects concentrations are realized should be predicted and used as a basis for varying levels of emergency response.
- MM. Individuals or job positions with specific responsibility for reporting emergency response information need to be identified. The lines of communication and direct receptor of the information needs to be clearly specified. The information required to characterize the release and quantify the source term for modeling predictions should have priority. A standard format should be developed for reporting accidental release information.

- NN. The maximum amount of material that can be in any "compartment" of the handling and demil process should be determined. This information provides a basis for an immediate worst case estimate of the concentration of material at any point away from the source, according to the dispersal model employed.
- OO. The dose-response relationship for the earliest and most sensitive responses to all agents should be determined. When incorporated with the dispersal/concentration model the product is an immediate estimate of the location of the expected most sensitive response.

CHAPTER 1  
INTRODUCTION

The contractor of this project is the Umatilla County Soil and Water Conservation District (SWCD). There are seven directors elected from different regions of this Northeast Oregon county.

The SWCDs are charged with the protection and proper use of our natural resources. Any project that may have an effect on these resources must be approved by the SWCD.

Umatilla County is located in the "Columbia River Plateau," becoming one of the most diversified agriculturally based areas in the United States. Agriculture, as a whole, is the biggest employer of this area.

Since Oregon is blessed with a land grant college (Oregon State University), the SWCD Board of Directors contacted them for assistance with this project.

Initially they contacted Dr. Frank Dost, Extension Toxicologist of Oregon State University (OSU). He put together the team of consultants to handle this study. Dr. Richard Boubel, Professor Emeritus, Mechanical Engineering, OSU was selected as the Project Director, with Dr. Dave Bella, Professor of Civil Engineering, Dr. Pete Nelson, Associate Professor of Civil Engineering and Dr. Frank Dost, Extension Toxicologist, all from OSU assisting on this project.

Each Consultant has an area of expertise. Dr. Bella studied

the problems of handling the rockets from the storage bunkers to the incinerator. Dr. Boubel studied demilitarization, incineration and monitoring. Dr. Pete Nelson studied atmospheric dispersion and Dr. Frank Dost studied the toxic effects of possible release of the agent.

After the initial reading of the Draft Programmatic EIS dated July 1, 1986, and seeing the deficiencies of the study, it was decided by the consultants that rather than just comment on the EIS, they would make specific recommendations in specific areas that were deficient.

To be sure concerns of the area citizens surrounding the Umatilla Depot were addressed, two advisory groups were formed.

The Citizen Advisory Committee is made up of citizens of the area concerned with the impact of the disposal process in this area. The other group was known as the Technical Advisory Committee. These were citizens of the area with occupations in the scientific field such as engineers with private companies, doctors, college science professors, etc.

We feel you will find our report to be as precise as possible, positive and helpful in preparing the Final Draft Programmatic EIS and Site Specific EIS for the Umatilla Depot. We commend the Army, William Brankowitz, and staff for their cooperation and assistance in getting the information to us, even though they were sometimes late getting it. Sometimes they questioned why we wanted some information, but nevertheless, if it was available, they sent it. We would like to commend Colonel

Jerry Pate, past commander of the U.S. Army Depot Activity Umatilla; Colonel Everette Gray, new commander U.S. Army Depot Activity Umatilla; Bill Thomas, Public Affairs Officer and others who went out of their way helping us with this project.

This report is the culmination of the contract between the U.S. Army and the Umatilla County Soil and Water Conservation District. It was written by the Program Manager, the Project Director, the consultants, and the chairmen of both advisory committees. Any opinions expressed are those of the specific author and do not represent the position of the U.S. Army or the Umatilla County Soil and Water Conservation District.

We encourage the Army to continue this contract with the SWCD. We feel the Army has received more than their money's worth and would continue to do so in the future as this disposal process continues.

## CHAPTER 2

### STUDY OBJECTIVES AND AREAS OF CONCERN

The contract awarded to the Umatilla County Soil and Water Conservation District instructed them to perform an independent analysis of the draft EIS with particular emphasis on risks associated with each alternative and to make recommendations to the Army.

The following is the Statement of Objectives and Work Descriptions from the contract:

OBJECTIVES: The contractor shall be responsible to meet the following basic requirements:

- a. Study the July 1986 Chemical Stockpile Disposal Program Draft Programmatic Environmental Impact Statement, and the drafts (as determined by the study group) of ongoing studies being conducted by the Army and its contractors.
- b. Perform independent studies as necessary to address the areas of concern.
- c. Prepare a report summarizing the areas of concern and the results of the studies.

#### WORK DESCRIPTIONS:

- a. Phase #1 - Documentation Review and Study Direction:

The contractor shall, upon contract award, propose a team of qualified personnel to review the government's material and to perform or direct studies in areas of concern in the Chemical Stockpile Disposal Program Draft Programmatic Environmental Impact Statement. The proposal of team members shall be made in writing (DD 1423, Sequence No. 0001). If, during the remainder of the contract, additional team members are desired to cover further identified problem areas, they shall be proposed to the government in the same manner.

The contractor shall also, upon contract award, publish locally a notice of the contract's award, a description

of the intended scope and an invitation for local participation by qualified people. This shall include local participation by suggestion of potential study areas, as well as participation by representation on the contractor's team.

Following the government approval of the contractor's team, the contractor shall review the Chemical Stockpile Disposal Program Draft Programmatic Environmental Impact Statement (DEIS).

The contractor shall also have the opportunity to review current studies which are being conducted by the Army and its contractors and participate in finalization of these studies. The studies include, but are not limited to:

| <u>Study Title</u>              | <u>Approximate Date Available</u> |
|---------------------------------|-----------------------------------|
| Monitoring Description          | April 87                          |
| Technology Addendum             | April 87                          |
| Transportation Studies          | April 87                          |
| Mitigation Studies              | April 87                          |
| Alternative Selection Criteria  | April 87                          |
| Risk Analysis                   | April 87/Jun 87                   |
| Emergency Response Concept Plan | May 87                            |

Review meetings will be scheduled by the Government for each of the above studies and the dates made available to the contractor approximately 30 days in advance.

At least 2 weeks notice shall be provided by the contractor of meetings which he wishes to attend. A written report of participation and comments shall be provided for each review meeting at which the contractor participates with the Government.

The contractor shall also direct and coordinate his team members/subcontractors as a part of this work. The Government will fund trips to Aberdeen Proving Ground, trips to MITRE and trips to Oak Ridge National Laboratory under this work, assuming that each trip involves the study director and/or members of his team or consultants.

Lastly, the contractor shall under this task provide a monthly report of expenditures and man hours (DD 1423, Sequence No. 0002).

b. Phase #2 - Data Collection, Evaluation, and Reporting:

Upon receipt of a notice to proceed from the Contracting Officer, the contractor may initiate a study using approved team members and consultants as required.

The contractor shall develop his studies using the material provided by the Government under Phase #1, the material gathered in the Government reviews of the ongoing studies and from other materials provided by the research of team members or other sources.

A written report detailing each effort shall be provided to the Government within 30 days after completion of the effort (DD 1423, Sequence No. 0003).

c. Phase #3 - Final Report:

The contractor shall, upon the completion of all studies, convene his team and thoroughly review the studies for findings, conclusions, and recommendations. The contractor shall then write a Final Report (DD 1423, Sequence No. 0003) which summarizes the principal findings, states conclusions which may have been arrived at, and makes recommendations to the Government based on these conclusions. The contractor shall also prepare a formal briefing of these findings, conclusions, and recommendations and shall travel to Aberdeen Proving Ground, Maryland, or a Washington, D.C. location as directed by the Contracting Officer to present this briefing to the Army. The contractor shall submit a draft of the final report on or before 30 Aug 87, and the final report shall be submitted on or before 30 Sep 87.

(NOTE: The formal briefing was held at the Umatilla Army Depot on September 1, 1987.)

## CHAPTER 3

### SCOPE OF EFFORTS IN THESE STUDY AREAS

The critique of the Draft Programmatic Environmental Impact Statement (DPEIS) was accomplished by the study team in the first few weeks of the contract. This document was found to be unacceptable because of poor analyses, improper site specific information, errors in observations and findings, lack of detailed procedures, etc. The list could continue for pages. Rather than spend the time to pick apart the DPEIS, line by line, or subject by subject, it was agreed to proceed positively and give the Army information they could use to prepare the Final Programmatic Environmental Impact Statement (FPEIS) along with any information needed to prepare the site specific, National Environmental Policy Act (NEPA) documentation. Probably about fifteen percent of the total effort was spent on the critique of the DPEIS.

About fifteen percent of the total effort was spent obtaining information for the site specific EIS. This included reviewing meteorological information, reviewing the Army Part B Hazardous Waste Permit and Air Quality Permit, both of which were submitted to the Oregon Department of Environmental Quality (DEQ), reviewing all phases of the emergency response programs, and contacts and visits with personnel at the Umatilla Army Depot.

Independent studies by the consultants and staff constituted

about twenty percent of the total effort. These consisted of review of the open literature, attending professional meetings, contacts with other consultants and colleagues, and calculations to verify or reject findings and conclusions presented in the DPEIS.

A great many Army studies were reviewed by the study team. Some of these were final reports on complex studies while others were unreferenced chapters or even single pages from draft reports still in preparation. In many cases, it took one or more telephone calls to obtain the information and then additional telephone calls to follow up on undated and unreferenced statements in the material. About twenty-five percent of the total effort was spent reviewing these Army documents.

About ten percent of the study team's time was spent attending meetings where the Army or their contractors reported on specific subject areas. These included meetings on technical subjects, draft report presentations by other concerned citizens' groups, and a meeting at the Chemical Agent Munitions Disposal System (CAMDS) at Tooele Army Depot, Utah.

The preparation of the draft report and final report, along with the required Army briefing September 1, 1987, took about fifteen percent of the total effort. It is hoped that these reports reflect the level of effort put into the study by all the staff, consultants, and concerned citizens involved.

## CHAPTER 4

### APPROACH AND METHODOLOGY UTILIZED

The study team relied heavily on the expertise of the individual consultants to develop their efforts in this project. The following outline summarizes the methodology used for this study:

- A. DPEIS evaluated and assigned to consultants according to their interests.
- B. Consultants reviewed Army and contractor documents in their area of interest.
- C. Consultants attended Army meetings in their area of interest.
- D. Consultants performed independent studies of literature, public agencies, other consultants, technical organizations, etc.
  - 1. Oregon Department of Environmental Quality (DEQ) (various offices).
  - 2. Oregon State Fire Marshall.
  - 3. CH2M-Hill (various offices).
  - 4. U. S. Environmental Protection Agency (EPA) (various offices and Region X).
  - 5. Oak Ridge National Laboratory (ORNL).
  - 6. Office of the Secretary of Defense (OSD) Environmental Policy/Environmental Engineering.
  - 7. Communicable Disease Center (CDC).

E. Critical examination of the engineering of the process.

1. Materials handling.
2. Combustion systems.
3. Emission control.
4. Emission monitoring.
5. Plume modelling.
6. Ultimate waste disposal.

F. Critical examination of the organization of the operations and the control of such operations.

1. Communications.
2. Responsibility.
3. Actions.

G. Assessment of the proposed exposure and risk estimates.

1. Dispersion models.
2. Risk analysis.
3. Emergency response.

## CHAPTER 5

### EXTENT OF COMMUNITY INVOLVEMENT

From the beginning of this project, community involvement has been top priority. The citizens living in the area of the Umatilla Army Depot have always been concerned about the activities of the Depot. They have generally been supportive of the Depot and feel that the Army is a responsible and creditable neighbor.

Two committees were formed in the project area, a Citizen's Advisory Committee and a Technical Advisory Committee. Newspaper advertisements solicited citizens to apply for membership on the committee of their choice. The selection of committee members was made by members of the Board of Directors of the Umatilla County Soil and Water Conservation District. Each committee had scheduled monthly meetings at which one or more of the consultants attended as resource persons. In addition, other meetings were called for specific purposes as they occurred. Both committees have submitted sections which are included in this report.

Through the efforts of Mr. Dwight Wolfe, Project Manager, thorough coverage was made of this project by the local radio and television stations as well as local and statewide newspapers. Coverage of the Citizens Advisory Committee meetings was reported as well. The Appendix contains sample newspaper articles concerning the study.

Contacts were made with U. S. Congressional offices con-

cerned with the Umatilla Army Depot. Also, local elected officials were contacted and invited to participate in discussions involving the project. Letters from some local officials are included in the Appendix.

Local and state police, fire departments, hospitals, and paramedics were contacted and asked to submit their input to the study. Verbal and written reports were submitted to the Citizens Committees and the study team.

## CHAPTER 6

### FINDINGS, OBSERVATIONS, AND CONCERNS

Much of the material that normally would be covered under this heading has been combined with other material under individual subject areas. This is because the individual subject areas are so complex, and complete in themselves, that it did not seem efficient to separate them into Findings, Observations, and Concerns, and then Rationale/Presentation of Conclusions and Recommendations.

Some general findings, observations, and concerns can be discussed. One of the most important is the concern the public has about its health and welfare. The questions continually asked were, "How will the demil/incineration project affect me?"; "Will my health be threatened?"; "How will I know if a dangerous cloud is coming my way?"; "What should I do if a dangerous cloud is coming my way?" The public needs these questions, and others, answered before they support the project one hundred percent.

This study did go a long way toward lessening citizen concerns. The media coverage was directed toward answering their questions and concerns. The citizen committees and the consultants tried to pass information and facts on to the public to keep them informed about the project. As the public became more knowledgeable about the project, their fears lessened. The public's biggest fears are still in the area they know the least about.

The majority of the citizens strongly support the concept of onsite incineration. They realize that the chemical munitions cannot be stored indefinitely and that transportation off the site would incur additional risks. The Army Depot has been a part of the community for over forty-five years, so people know the facility, its mission, the employees, and the problems. The Army Depot personnel have leveled with them in the past and they accept the credibility of the Army concerning this expanded operation.

The citizens feel the need for adequate, assured emergency programs. They want to know that emergency personnel are trained and competent should an accident occur at the Depot which would allow a release of toxic gas off the site. They want to know that plans are in place for any foreseen emergency and that proper medical services will be ready.

The financing of emergency services is of as much concern to the citizens as the availability of the emergency services. The citizens feel that this is an Army project and the Army should provide the financing for the emergency services. They do not feel that they should pay more taxes to provide their own protection. An example of the concern about finances is contained in a letter in the Appendix which requests funds for emergency supplies and equipment.

A general observation must be made about the material supplied to the study team by the Army. The Army was very cooperative in obtaining pertinent material that the study team

requested. However, the information supplied was of varying degrees of usefulness. Some of the material was actual final drafts of Army or consultant studies. We have been able to reference these so readers of this report can get the original information if they desire. Other papers sent to the study team were what appear to be sections from some unreferenced report. When these were used as a resource by the study team, they were impossible to reference because of lack of dates, names of the report, authors, etc.

Some of the information developed by the Army was extremely thorough and very useful. An example of such a study is the material on Mitigation. This was an ongoing study which supplied the consultants with much valuable, current information. Other good examples are the reports on accident analysis for the various incinerators.

## CHAPTER 7

### THERMAL DESTRUCTION OF CHEMICAL MUNITIONS

Onsite thermal destruction by incineration is one of the alternatives which should always be considered for hazardous waste destruction.

A recently published review, "Incineration of Hazardous Waste; A Critical Review," (Journal APCA, Vol. 37, Number 5, May, 1987) covers both the advantages and disadvantages of hazardous waste incineration. Many of the points of this review apply to the proposed incineration for chemical demil:

Of all of the "terminal" treatment technologies, properly designed incineration systems are capable of the highest overall degree of destruction and control for the broadest range of hazardous waste streams. Substantial design and operational experience exists and a wide variety of commercial systems are available. Consequently, significant growth is anticipated in the use of incineration and other thermal destruction methods.

The provisions of the final incinerator standards, which are of most importance to this paper, are the performance standards which are now listed in the Code of Federal Regulation (CFR) under 40 CFR 264.343. These standards require that in order for a facility to receive a RCRA permit, it must attain the following performance levels:

- (1) 99.99 percent destruction and removal efficiency (DRE) for each principal organic hazardous constituent (POHC) in the waste feed where:

$$DRE = ((Win - Wout) / Win) \times 100$$

where:

Win = mass feed rate of the principal organic hazardous constituent (POHC) in the waste stream fed to the incinerator, and

Wout = mass emission rate of the POHC in the stack prior to release to the atmosphere.

- (2) At least 99 percent removal of hydrogen chloride from the exhaust gas if hydrogen chloride stack emissions are greater than 1.8 kg/h.
- (3) Particulate matter emissions no greater than 180 mg/standard m<sup>3</sup> corrected to 7 percent oxygen in the stack gas. The measured particulate matter concentration is multiplied by the following correction factor to obtain the corrected particulate matter emissions:

$$\text{Correction factor} = 14/(21 - Y)$$

where:

Y = measured oxygen concentration in the stack gas on a dry basis (expressed as a percentage).

Facilities which incinerate hazardous wastes containing significant ash or halogen content will generate combustion chamber bottom ash and various types of residues collected by subsequent air pollution control equipment. Under RCRA, these ashes and residues are generally classified as hazardous waste also. Thus, facility operators must assess the characteristics of these materials to determine the proper method of disposal. The principal contaminants of interest are heavy metals and any undestroyed organic material.

#### 7.1 Environmental and Public Health Implications

Regardless of the apparent capabilities of hazardous waste incinerators to meet or exceed the RCRA performance standards, the ultimate public test involves demonstration that there is no unacceptable increase in public health risk from the emissions to the environment. While any of the emissions from an incinerator may potentially be of environmental interest, most attention has been directed toward air pollution emissions. This is because

they appear to represent the emissions with immediate health implications.

### 7.2 Risks from Single-Event Emissions

As with any industrial facility, there are risks from potential accidents at incineration facilities such as fires, explosions, spills of raw waste and similar single-point events. These events are probabilistic in nature and their evaluation in a risk assessment is handled differently from continuous pollutant emissions from stacks.

Little specific information on these types of accidents is available for hazardous waste incineration facilities. EPA has also recently examined transportation and spill related risks for ocean-based incineration and found that these risks were greater than risks from incineration. In the absence of accident data specific for incineration facilities, statistics from related industrial practice are probably adequate in assessing these risks.

### 7.3 Methods for Assessing Risks from Recurring Emissions

The major concern of this discussion is the risk associated with recurring air pollution emissions from incinerators. The assessment of risk to human health, rather than environmental damage, is generally believed to be of greatest interest. Four general steps are involved in assessing the impact on public health from stack emissions from incineration.

- Identify the health effects of constituents of concern as a function of concentration level.
- Predict the concentrations of these constituents to which the public may be exposed.
- Estimate the health impact of these concentration exposures.
- Conduct an uncertainty analysis.

Identification of the constituents of concern in stack emissions and the health effects of these constituents, is, of course, a function of the waste streams and incineration facility of interest. In general, any of the constituents of Appendix VIII of the RCRA standards are of possible interest. However, other organic compounds frequently found in combustion emissions (certain polynuclear aromatics and polycyclic aromatic compounds) may be of concern also. The major health effects of concern are for low-level chronic exposure to these materials. These effects are generally carcinogenicity, mutagenicity, teratogenic or target organ toxicity (e.g., sterility, behavioral effects).

#### 7.4 Conclusions and Recommendations

The body of knowledge concerning hazardous waste incineration has been expanding rapidly since 1980. This review has examined some of the most significant aspects of this information. A number of conclusions may be drawn on the status of incineration technology, current practice, monitoring methods, emissions and performance, and public health risks. Beyond these, a number of remaining issues and research needs can also be identified.

Based on this review, the following conclusions may be drawn:

1. Incineration is a demonstrated, commercially available technology for hazardous waste disposal. Considerable design experience exists and design and operating guidelines are available on the engineering aspects of these systems.
2. A variety of process technologies exist for the range of hazardous wastes appropriate for thermal destruction. The most common incinerator designs incorporate one of four major combustion chamber designs: liquid injection, rotary kiln, fixed hearth or fluidized bed. The most common air pollution control system involves combustion gas quenching followed by a venturi scrubber (for particulate removal), a packed tower absorber (for acid gas removal) and a mist eliminator. However, more than half of the existing incinerators employ no air pollution control equipment at all.
3. The technology of stack sampling for trace organic compounds is relatively sophisticated. Considerable experience and attention to quality assurance and quality control are needed. Documented sampling and analysis methods are available for most of the parameters of interest in incineration performance assessment. Methods have been validated for a number of compounds. With proper planning of test activities, detection limits are not a limiting factor in assessing incinerator performance.
4. Continuous emission monitors are available with adequate operating ranges for many of the combustion emissions of interest ( $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{O}_2$ , TUHC,  $\text{NO}_x$ ). The Army has developed continuous monitors for GB, VX, and mustard. No real-time monitor exists for measuring destruction and removal efficiency (DRE).
5. Limited data on incinerator ash and air pollution control residues suggest that organic compound levels are low and that thermal destruction is the primary reason for high destruction and removal efficiencies, not removal. Metal concentrations in ash and residues vary widely, depending upon metal input rate to the incinerator and process operation (e.g., scrubber water recycle and make-up rates).
6. There appears to be little increased human health risk from hazardous waste incinerator emissions, based on

assessments done to date. Metal emissions appear to be most significant in the risk values which have been derived. However, a complete assessment of all of the potentially hazardous materials in incinerator emissions has not been completed. This information is needed to enable a comprehensive risk assessment of incinerator emissions.

7. In spite of the demonstrated destruction capabilities of hazardous waste incinerators and the apparent low incremental risk of emissions, there is considerable public opposition to the siting and permitting of these facilities. Permits require three years to finalize, on the average. Uncertainty over permitting and public acceptance will likely result in a near-term short-fall in needed capacity, particularly for commercial facilities which could incinerate solids and sludges.

As a hazardous waste disposal technology, thermal destruction techniques offer several advantages: (1)

- Toxic components of hazardous wastes can be converted to harmless compounds or, at least, to less harmful compounds.
- Ultimate disposal of hazardous wastes eliminates the possibility of problems resurfacing in the future.
- The volume of hazardous waste is greatly reduced.

The problems involved with hazardous waste incineration are few compared to the advantages obtained. However, they should be listed:

- EPA is still evolving the permitting guidelines while the permits are being applied for. For the case of the Army Part B Permit for Umatilla, Oregon, this means that many of the go or no-go decisions must be made by the Oregon DEQ (the permitting authority) based on their own judgments.
- Fundamental kinetic studies, in which individual reaction steps are identified and each of their rates measured, would not be useful at this time, because in practical incineration, turbulence so restricts the rate of the chemistry that it controls the conversion rate. Also, the combustion chemistry of large organic

molecules is a very complex subject and detailed mechanisms have not been identified as yet.

- Pre-combustion, combustion, and post-combustion reactions can occur between the hazardous waste being incinerated and the fuel used which can produce great varieties and quantities of both the Principle Organic Hazardous Constituent (POHCs) and Products of Incomplete Combustion (PICs).

The Army has been conducting research on hazardous waste incineration for many years. More recently they have concentrated on disposal of chemical munitions by incineration at their CAMDS, research incineration facility, at Tooele Army Depot, Utah. The Army's experience and safety record are excellent. In fact, the same can be said for all of the systems involved in the proposed incineration of chemical munitions at Umatilla Army Depot:

- The U. S. Army, and its contractors, have excellent experience, credibility, and safety records concerning all aspects of Chemical Munitions.
- CH2M-Hill prepared the Part B application for the Hazardous Waste Incinerator Permit. They also prepared the required air permits. CH2M-Hill has a vast amount of experience along with an excellent reputation.
- The Oregon Department of Environmental Quality (DEQ) is serving as the lead agency for review of these permits. The experience and credibility of the DEQ assures that the interests and health of the citizens of Oregon will be protected.
- Region X of the U. S. Environmental Protection Agency is cooperating with the Oregon DEQ in all phases of this project.

The Army has submitted a RCRA Part B Permit Application (2) to the Oregon Department of Environmental Quality in anticipation that onsite incineration will be the selected disposal system at

the Umatilla Depot. This permit application is very thorough in nearly all respects. The figure on the following page shows the proposed facility. The discussion on the incineration system, as summarized in the permit application states:

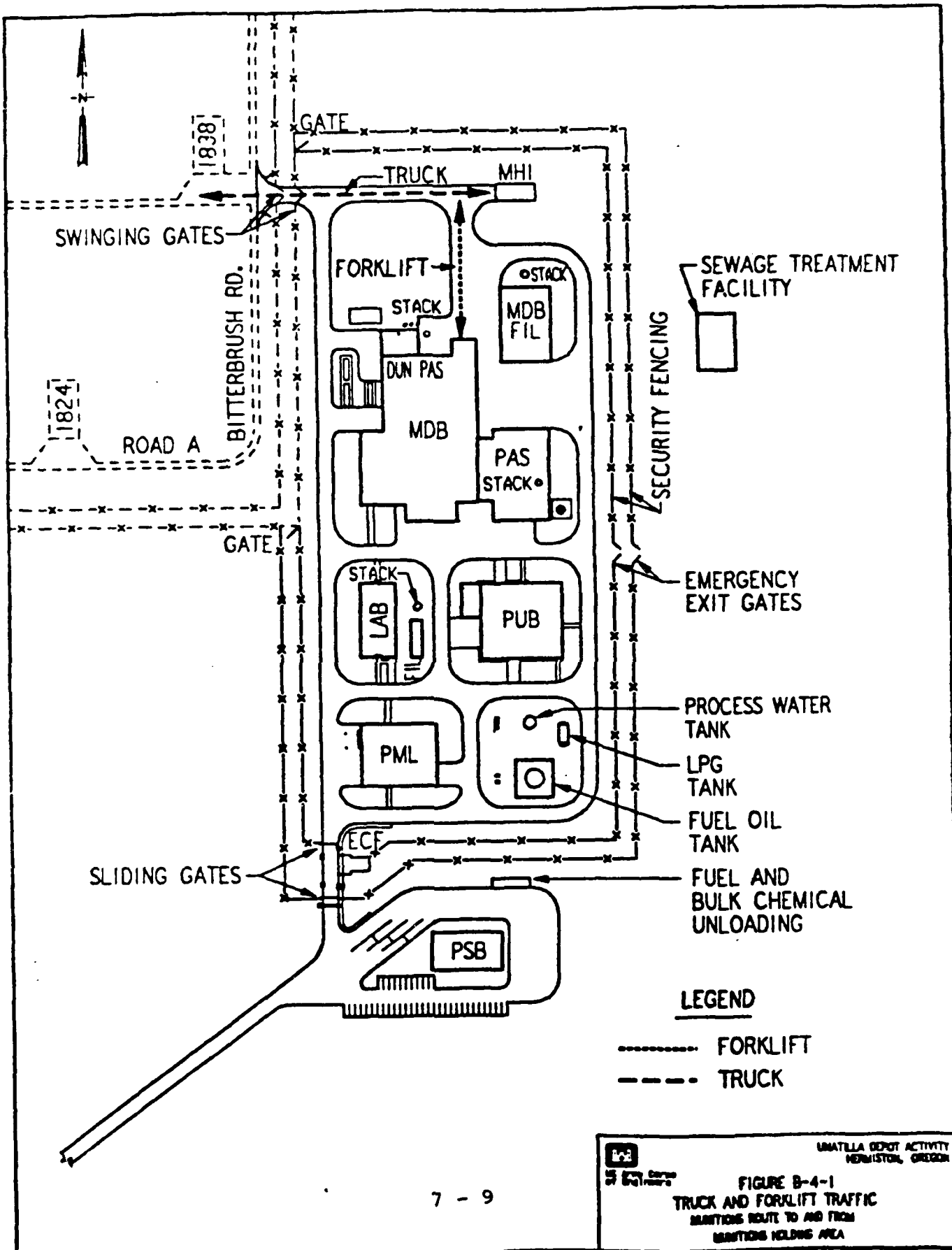
#### Incineration

Four incinerators are used to deactivate and detoxify the components of the waste: the Liquid Incinerator, the Metal Parts Furnace, the Deactivation Furnace System, and the Dunnage Incinerator. Only the Deactivation Furnace System, Liquid Incinerator, and Dunnage Incinerator are used to process rockets and mines. Processing empty bombs, spray tanks, and ton containers does not require use of the Deactivation Furnace because they do not contain any explosives or propellants. The processing of projectiles requires the use of all four incinerators. Agent is drained from munitions and collected in tanks. Spent decontamination solution is collected and pumped into tanks. Liquid laboratory wastes are collected at the Laboratory and also pumped into the spent decontamination solution tanks. Agent and spent decontamination solution are pumped continuously to the Liquid Incinerator. Explosives and propellants are fed continuously to the Deactivation Furnace, if explosively configured munitions or rockets are being demilitarized. Metal parts are fed to the Metal Parts Furnace in batches on a timed cycle, depending on the particular munition. The Metal Parts Furnace operates continuously. Dunnage is fed to the Dunnage Incinerator in batches on a timed cycle with a ram feeder. The Dunnage Incinerator operates continuously.

The Pollution Abatement Systems (PAS) for the incinerators operate continuously. Brine is continuously pumped from the Pollution Abatement Systems for the Liquid Incinerator, Metal Parts Furnace, and the Deactivation Furnace to the Brine Reduction Area.

Brines are accumulated in two tanks at the Brine Reduction Area. One tank is being filled as the second tank is being forwarded to the brine evaporator and dryer. When the first is full, it is switched to feed the evaporator and dryer and the second tank is switched to receive brine from the Pollution Abatement Systems (PAS). The evaporator and dryer operate continuously.

Ash from the Dunnage Incinerator is removed on a timed cycle using a ram. Ash from the Deactivation Furnace is removed continuously. Metal parts from the Metal Parts Furnace are removed on a timed cycle. Salts are removed continuously from



the brine driers. All the solid residuals are collected in containers.

### Liquid Incinerators

The Liquid Incinerator system is a two-stage, refractory lined incinerator. It is designed to incinerate all three chemical agents (GB, VX, and mustard) as well as wastes (spent decontamination solutions) generated in the Chemical Agent Destruction System and liquid wastes generated during closure procedures. The liquid agent is injected into the primary chamber and incinerated at approximately 2500F. The agent feed rate to the system is measured by a mass flowmeter with an accuracy of +0.4 percent of actual flowrate. Natural gas is also combusted in the primary chamber to assure uniform and constant flame characteristics. The resultant combustion flue gas flows into the afterburner, where spent decontamination solution is injected.

The after burner is designed to completely combust any agent and/or spent decontamination or closure wash water solution. The afterburner is designed for normal operation at 2000F. A natural gas fired burner is provided in the afterburner to assure that the 2000F operating temperature is maintained. The overall gas residence time is a minimum of 2 seconds. Sufficient excess air is provided in both chambers to assure complete combustion. From the afterburner, the flue gas flows to the Liquid Incinerator Pollution Abatement System.

Salts generated from incinerating spent decontamination solution collect in the afterburner base and are transferred as a slurry to the brine solution storage tanks.

### Metal Parts Furnace

The Metal Parts Furnace is used to thermally decontaminate drained munition bodies that do not contain explosive or propellant and bulk containers that previously held the lethal chemical agent. It is also used to decontaminate scrap metal resulting from facility maintenance or closure. This furnace can be used to incinerate Demilitarization Protective Ensemble suits, charcoal, charcoal canisters, HEPA filters and prefilters in the ventilation system, and other miscellaneous solid waste from facility operation.

The Metal Parts Furnace consists of two major sub-systems: The furnace (which includes the charge airlock, the burnout chamber, and discharge airlock), and the afterburner.

The charge airlock is composed of:

- A steel enclosure, with a vertical-lift feed door, which is a gas-tight welded extension of the burnout chamber.
- A heavy drive roller conveyor used in the transport of pallets carrying munitions.

Temperature inside the burnout chamber is maintained around 1600F by firing natural gas through burners located throughout the length of the chamber. This chamber is designed to heat and maintain metal parts to at least 1000F for a minimum of 15 minutes. This effectively destroys any residual lethal chemical agent contamination on the metal and incinerates any combustible residue on the metal.

The purpose of the afterburner is to complete the incineration and detoxification of gases from the charge airlock, discharge airlock, and burnout chamber. The afterburner is a horizontal, refractory-lined, cylindrical unit and operates at a temperature of 1800F, with a minimum retention time of 0.5 second. The afterburner is fired by natural gas. Gases leaving the afterburner enter the Metal Parts Furnace Pollution Abatement System.

#### Deactivation Furnace System

The Deactivation Furnace System is designed to process drained rockets and mines that contain residual lethal chemical agent and explosive components. The Deactivation Furnace System deactivates the energetic components of these munitions and decontaminates their hardware. During the processing of projectiles, the Deactivation Furnace System thermally deactivates all fuzes, burster charges, and boosters. During agent changeover or in preparation for maintenance on the feed chutes, retort, cyclone, and/or afterburner, the feed chutes will be decontaminated. The procedure for decontamination will be to spray decontamination solution onto the walls of the feed chutes while the Deactivation Furnace System is operating at low fire in the retort and the afterburner is at normal operating temperature. The spent decontamination solution will flow off the walls of the feed chute and directly into the Deactivation Furnace System retort. The water and any organics that may be in the water are evaporated in the retort and combusted in the retort and afterburner. The spent decontamination solution resulting from decontaminating the feed chutes is neither collected nor stored, but is treated immediately.

The Deactivation Furnace System consists of three separate sections: the rotary retort, the cyclone, and the slagging afterburner.

The rotary retort section consists of two slide chutes each with two blast gate valves, a charge end subassembly, a furnace retort with shroud, a furnace drive mechanism, a discharge end subassembly, and a heated discharge conveyor. Feed to the retort is accomplished via two blast gate valves, which isolate the retort from the Explosive Containment Room.

Pieces enter through the blast gate valves and slide down a chute into the furnace retort. Pieces move through the retort as thermal processing occurs. The furnace retort is fabricated from flanged fabricated alloy steel sections and operates with a gas temperature of 1100F to 1850F. The furnace drive mechanism rotates the retort at a preselected constant speed, which is adjustable in a narrow range to ensure complete incineration of all combustibles. Work pieces exit the furnace retort at the discharge end subassembly. At this point, they transfer to the heated discharge conveyor, which conveys the material while providing sufficient holding time (15 minutes minimum) at an elevated temperature of 1000F (XXXXX) to ensure decontamination. The discharge conveyor is a steel enclosure containing an endless herringbone-weave conveyor belt.

Flue gas from the retort exits through a blast-attenuating duct and then enters the cyclone that separates large particulate matter from the gas stream. The cyclone is a cylindrical vessel with a cone-shaped bottom. Large particles removed from the flue gas drop into a container below the cyclone. The particulates are handled as hazardous waste, and are placed in interim storage awaiting ultimate disposal.

Flue gas from the cyclone then passes into the slagging afterburner, which is a refractory-lined fume incinerator. The afterburner operates at 1800F providing a minimum of 0.5 second retention time. The afterburner ensures complete combustion of agent vapor, hydrocarbons, and organic vapors from incineration of fiberglass. (Fiberglass is present only during rocket processing.) The afterburner is the final thermal process step before the flue gas enters the Deactivation Furnace Pollution Abatement System.

#### Dunnage Incinerator

The Dunnage Incinerator is a system designed to incinerate a combination of wooden pallets, laboratory solid wastes, Demilitarization Protective Ensemble suits, charcoal, charcoal canisters, HEPA filters and prefilters from ventilation systems, rubber boots, metal packaging material, combustible dunnage and residue resulting from facility closure, and any other miscellaneous wastes that may potentially be contaminated with agent. It consists of a primary combustion chamber and an afterburner.

The primary combustion chamber is a horizontal refractory-lined chamber operating at approximately 1600F. Feed enters the system through an airlock that leads to the primary combustion chamber. The gaseous products of combustion travel from the primary combustion chamber to the afterburner, which is a refractory-lined unit operating at approximately 2000F with a minimum retention time of 2 seconds. The afterburner incinerates all remaining combustible material from the primary combustion chamber. Both chambers are independently fired with natural gas and air. Excess air is provided to incinerate combustibles within the afterburner. Gases leaving the afterburner enter the Dunnage Incinerator Pollution Abatement System.

#### Pollution Abatement Systems for Incinerators

The purpose of the pollution abatement system is to control emission of acidic gases and particulates in the flue gas. Pollution abatement consists of four independent systems, one for each incinerator system. The system for the Dunnage Incinerator is different from that for the other three. The pollution abatement systems for the Metal Parts Furnace, Liquid Incinerator, and Deactivation Furnace System each have a quench tower, a venturi scrubber, a packed bed scrubber tower, a demister vessel, and associated pumps and blowers. The three incinerator pollution abatement systems share a common stack.

The Dunnage Incinerator Pollution Abatement System consists of a quench tower, baghouse, blower, and a stack.

#### Brine Drying

The process brines produced in the secondary chamber of the Liquids Incinerator and by the pollution abatement systems for the Metal Parts Furnace, Liquid Incinerator, and Deactivation Furnace System are dried to salt in the Brine Reduction Area. Two brine storage tanks serve as storage for the brine prior to being fed to the evaporator. The brine is concentrated in the evaporator prior to final drying in the dryers. The steam-heated, rotary, double drum dryers each incorporate a container filling and loading station. Flow into the drum dryers is regulated by level controllers. Salt generated in the final drying of the brine is packed in containers and handled as hazardous waste. Containers of salt are stored at the facility prior to disposal at an approved offsite hazardous waste management facility.

#### Personnel Protection Summary

Personnel are required at times to enter agent-contaminated areas. To do so, even for limited periods of time, requires the

use of protective clothing. Entry into areas with potential liquid contamination requires the use of Demilitarization Protective Ensemble. This suit is supplied by an air hose connected to a Life Support System. A radio headphone and microphone are provided to allow continuous communications with the control room and support personnel.

#### Incinerator Trial Burns

The Oregon DEQ has indicated that trial burns would have to be conducted on all incinerators at the Umatilla Depot for all POHCs. Just doing trial burns on similar incinerators, i.e., burning similar POHCs, at Johnston Atol (JACADS) would not satisfy the requirements. Many references exist which discuss the conduct of trial burns (3)(4). A recent publication (5) contained a table which summarized trial burn planning:

##### Test 1: (as applicable to the system)

- Lowest POHC heating value
- Maximum heat input to each chamber
- Maximum feedrate to each waste stream
- Maximum ash and halide feedrate
- Maximum solid loading to the kiln
- Maximum O<sub>2</sub> concentration in the stack
- Maximum size of containerized solids to PAS
- Maximum volatile content of containerized solids
- Minimum differential pressure across venturi
- Minimum water/liquor flowrate and pH to absorber
- Minimum KVA settings for ESP or ionized scrubber
- Minimum pressure drop ( $\Delta P$ ) across baghouse
- Minimum scrubber blowdown rate

Rationale: Test 1 defines performance at system heat input capacity and mass throughput capacity. Compliance with particulate and HCl emissions will establish permit settings on all Group C parameters and Group B parameters for air pollution control equipment.

##### Test 2 to N-1:

- Same conditions as Test 1 but progressively reduce PC and SCC gas temperatures with either primary fuel (preferably) or waste (if necessary)

- Maintain gas flowrate approximately the same as Test 1 with combustion air adjustments (if practical)

Rationale: Worst case conditions are achieved with lowest chamber temperatures at conditions equal to those in Test 1 (except for heat input).

#### Test N

- Minimum PCC and SCC temperature from Tests to N-1
- Minimum excess combustion air as desired

Rationale: Final test condition establishes maximum CO emissions at most economic excess air levels. Compliance may result in higher CO permit levels. Performance failure may result if minimum excess O levels imposed in the permit.

The Army has done an excellent job on preparation of the RCRA permit for the incineration of chemical munitions. A recent document covers just about all aspects of risk analysis for the proposed facility (6). While the Army has not submitted a perfect proposal and permit application it is probably as close as is humanly possible.

#### RECOMMENDATION

The preferred alternative is onsite incineration.

Although our studies have led us to choose the onsite disposal for the CSDP, and we strongly support this alternative, the final decision must be made by the Secretary of the Army (7). By law, the Secretary of the Army will use the FPEIS as an aid in reaching his decision, but he is not bound to select the environmentally preferred programmatic alternative(s) as his decision; he may, and likely will, use other criteria for making his decision.

### THERMAL DESTRUCTION REFERENCES

1. Binder, M. J. and Streklow, R. A., "Research Planning Task Group Study--Thermal Destruction Final Report," EPA-600/52-84-025, Industrial Environmental Research Laboratory, Cincinnati, OH, July, 1984.
2. UMDA RECRA Permit Application to Oregon Department of Environmental Quality, August 15, 1986.
3. Gordon, P., Hathaway, R., Wallace, D., and Trenholm, A., "Practical Guide--Trial Burns for Hazardous Waste Incinerators," EPA/600/52-86/050, Hazardous Waste Engineering Research Laboratory, Cincinnati, July, 1986.
4. Cudahy, J. J. and Busmann, T. G., "RCRA Trial Burn Considerations," Environmental Progress, February 1987, pp 13-77.
5. Castaldini, C. and Lee, C. C., "Guidelines for Setting Incinerator Permit Conditions," Paper 87-22.6, Proceedings of the 80th Annual Meeting APCA, New York, June, 1987.
6. "Plant Operations, Sensitivity, and Human Factors Risk Analysis Data Package," GA Technologies, Prepared under contract DAAA15-85-D-0022 for U. S. Army OPMCM, Aberdeen Proving Ground, MD, May, 1987.
7. "Approach for Selecting the Environmentally Preferred Alternative for the CSDP FPEIS, Draft Copy received from Army, August, 1987.

## CHAPTER 8

### PERSONNEL TRAINING

The training plan developed for the demil facility is a part of the RCRA Part B permit application (1). It covers classroom courses, simulations, manuals, and hands-on experience. Paragraph G on page H-2-2 of the permit application states:

Each training course will have its own unique set of objectives (that is, knowledge the student must master to pass the course). Training aids, including handouts, reference materials, lectures, models, or actual pieces of equipment, are used. At the completion of the classroom portion of each course, written exams are conducted. Where equipment is available in the Central Training Facility for actual hands-on practice, another exam that verifies hands-on skills is conducted. Certificates of completion are issued to all students who demonstrate mastery of the course materials. A separate certificate is issued for each course conducted. Where the Central Training Facility does not contain equipment for hands-on practice (such as furnaces and pollution control equipment), final certification of employees is conducted during the systemization of the actual demilitarization plant. Certification is by the training staff. (Note: Final certification of quality control, laboratory, and monitoring personnel includes an onsite demonstration by the students that the required precision and accuracy can be established and maintained on the equipment, using actual agent samples.)

Note that this paragraph contains several different terms to indicate that a student has performed satisfactorily (underlined portions), but no set goals or grades are stated. It does appear that only certified employees will be allowed in the demil facility but is this required for other employees handling the chemical munitions outside the demil facility?

#### RECOMMENDATION

There needs to be developed a more thorough description of the proposed training and its evaluation. Certification should be required for all positions, not just those in the demil facility. Simulated emergency situations should be included in the training programs.

#### TRAINING REFERENCES

1. UMDA RCRA Permit Application to Oregon Department of Environmental Quality, Section H, Personnel Training, August 15, 1986.

## CHAPTER 9

### COMMENTS CONCERNING THE REVIEW OF THE RCRA HAZARDOUS WASTE PERMIT FOR THE UMATILLA DEMIL FACILITY

Selected sections of interest from the RCRA permit filed with the Oregon DEQ (1) were examined. These are as follows:

In the plans a sheet is entitled Chemical Stockpile Disposal Program, Entry Control Facility. This is essentially the guard house that controls the entry of all personnel in and out of the secured area. This house is quite similar to the one at the secured area at Umatilla, in that it has turnstiles to let one person through at a time, etc. A couple things of interest. The day room where the guards are has windows equipped with gun ports underneath and bulletproof glass in all windows. It seems that this is designed to prevent possible terrorist attack on the facility and the Army is considering terrorism. It has been mentioned a couple of times, maybe passed over, but it is just possible that this is something that should be given more attention when we talk about risk analysis or emergency response. This information is being developed by the Army which is conducting an analysis of sabotage and terrorism threats to the CSDP. This is a classified study.

In the description of Automatic Waste Feed Cutoff System for the liquid incinerator, the following events define what conditions will cause the incinerator system to be immediately shut down rather than shut down in a staged manner. An immediate shutdown restores the incinerator to a safe condition while a

staged shutdown will restore the incinerator to a normal operating condition. The purpose of any shutdown is to prevent the release of agent. Events causing an immediate shutdown include:

- ACAMS or control panel indications of furnace/afterburner upset readings in most foreseeable circumstances.
- Agent in furnace or filter housing stack, (there are high level readings in the bubbler and automatic continuous air monitoring system monitors.)
- Pressure high high alarms in furnace, afterburner, or ducts. (This condition threatens a release of uncombustive agent.)
- Temperature low low alarms in the afterburner. (Threatening the release of uncombustive agent.)
- Flame out of furnace burners or burner failure.
- Detonation in a contained area causing a release of agent.
- Induced draft fans fail or an induced draft fan alarm condition causes the loss of negative pressure in the toxic processing area.
- Fire in toxic areas that cannot be controlled by operating personnel.
- Fire in non-toxic area that cannot be controlled by extinguisher.

The events causing a staged shutdown include:

- A major spill in process areas of the munitions demilitarization building, such as the explosion containment room which shuts down the liquid incinerator.

The natural gas burner system includes an internal innerlock system that prevents or stops the flow of natural gas and/or agent to the burner nozzle (flame safeguard system) if any one of the following occurs:

- A flame is detected during pre-ignition.
- Pilot fails to ignite.
- The burner fails to ignite.
- There is a loss of flame after ignition.

If there is a shutdown of the afterburner there is an automatic shutdown of all feed streams. This is for the liquid incinerator.

#### 9.1 Stack Gas Monitoring and Pollution Abatement System (PAS)

The stack gas is monitored continuously during the operation for carbon dioxide, CO, oxygen, and agent GB, VX or mustard. These are permanently installed monitors located in various places in the system.

The incinerator information seems to be well worked out with advanced state-of-the-art equipment and good quality checks on the data all the way through; a required daily calibration of instruments and careful measurements, etc. There should be absolutely no problem with using what has been supplied to Oregon DEQ for trial burns procedures and quality control. The metal parts furnace and the deactivation furnace have essentially the same conditions to cause an immediate shutdown or staged shutdown as does the liquid incinerator. The metal parts furnace also uses the same stack gas monitoring and pollution control equipment as does the liquid incinerator.

Looking at the deactivation furnace system and PAS, again we note the events which would cause an immediate shutdown or the events that would cause the staged shutdown are very similar to those for the liquid incinerator. For the dunnage incinerator,

the conditions which would cause an immediate shutdown and conditions which would cause a staged shutdown are about the same as they are for the liquid incinerator.

The operating instructions for the system as submitted by the Army in their Part B permit go through all the necessary methods to calibrate, check out, determine and arrange operations, etc., such as: level indicators, the computerized system, and checking wiring, etc. This is very thorough. If these procedures are obeyed there should be no problem with the incinerator. Examples of operating instructions are:

### 9.2 Tank Inspection

Each Tank System is thoroughly inspected on at least a daily basis. Inspection addresses overfill control equipment, above ground portion of the tank system, data gathered from monitoring and leak detection equipment, construction materials and area immediately surrounding the external access portion of the tank system as well as the secondary containment system. Overfill controls are inspected at least once per eight-hour operating period.

The inspection consists of a visual observation of the external overfill controls. An operational check of the mechanical devices, such as level switches and transmitters, is performed when installation personnel enter the toxic cubicle for routine operation and maintenance activities at least once per operating week.

### 9.3 Incineration Inspection

The incinerator and associated equipment is visually inspected daily for leaks, spills, fugitive emissions, and signs of tampering. Routine daily visual inspections of the incinerators and their associated equipment will be conducted by operations personnel through the use of remote closed-circuit television cameras strategically located in these areas. The emergency waste feed cut-off system and associated alarms is tested weekly to verify authority. Positive indications that the waste feed cut-off system and associated alarms are operable can be conducted from the control room by manual activation by the cut-off

valve and cross checking the waste feed flow meters.

The inspection schedule for the transfer munitions holding incinerator facility lists the items of the frequency and the types of problems they are looking for. Inspection is carried out for the munitions holding igloo, the ash/salt interim container storage area and brine reduction area.

Attachment F-2, Log Sheets, are the forms that will be used in checking and operating the facility. There are approximately 75 pages of these blank log sheets at the back of this volume. They are essentially the inspection sheets that must be completed every time an inspection is made.

#### 9.4 Potentially Hazardous Waste

In addition to lethal chemical agent and munition waste there are potentially hazardous waste generated during the facility operation that may require either storage, further onsite treatment, or shipment offsite to an approved hazardous waste management facility. These waste include:

- The brine generated from the incinerator pollution abatement systems and the liquid incinerator.
- Dry salts formed by evaporation of the brine.
- Dry residues collected from the cyclone in the deactivation furnace system.
- Ash from the operation of the dunnage incinerator, metal parts furnace and deactivation furnace.
- Residues from the dunnage incinerator pollution abatement systems (baghouse).
- Ventilation system filters (HEPA filters, prefilters, and spent charcoals).
- Laboratory waste generated from onsite chemical analysis.

Two agent collection tanks with a complying capacity of 1800 gallons hold the agent. Under normal operation these tanks will not be pressurized and will be operated with an open vent. The two agent collecting system storage tanks are both listed as having the maximum height of liquid in the tank, as 80 percent of the height from the bottom of the tank. These tanks are vertical cylinders. When the tank is "full" it has a 20 percent air space over the top of it. A description of the components of the tanks states that all of the tanks have one inlet and one outlet, one vent, a level transmitter connected to both height level alarms and the process data acquisition and recording system. A listing of the instruments for the tanks piping and valving is as follows:

1. Tank level transmitters indicating an alarm at low level, low low level, high level and high high level.
2. Valve position switches.
3. Filter differential pressure transmitters.
4. Liquid flow control.
5. Liquid flow pressure indicator and transmitter.
6. Mass flow measurement and transmitter.

It states all tanks are at atmospheric pressure and pressure is not measured. Temperatures of liquids is ambient and is not measured. Flows to the tanks are not measured, specific gravity is not measured. Tank levels for normal switch-over to the standby tank and high level alarm are provided by a differential pressure transmitter located near the bottom of the tank. These

set points are program adjustable. High high level is detected by a fixed point ultrasonic probe located in elevation of 7' 9" above the tangent line for the ACS tank 102 4' 9" for ACS tank 101, 8' above the tangent on the 3 spent decontamination tanks and 18' 6" on the brine tank. They both have operational switch over to get to a standby tank and level detectors on these tanks. These set points are program adjustable, but cannot be changed by an operator.

#### 9.5 AGENT COLLECTION TANKS SYSTEM

This states that agent is drained from the munitions and pumped to either ACS tank 101 or ACS tank 102. In order to allow draining of agent to be initiated, an inlet valve to an agent tank must be opened and the tank cannot be at a high level. If these conditions do not exist, drainage is halted. When a tank has been selected to fill and the system is placed on automatic, the inlet valve is opened and the draining is permitted to proceed. When the tank is filled to a preset level, a high level alarm sounds in the control room to alert the operator. If the level in the tank continues to rise until a high high level is reached the control system automatically closes the inlet valve to the tank and stops draining operations.

The agent storage system seems to be secure and well protected. The "open vent" referred to is vented to a room under negative pressure whose air is constantly filtered. Concern is also expressed for the integrity of the tanks, mountings, piping,

valves, etc., in case of an earthquake. It would not be excessively expensive to design for earthquake protection.

#### RECOMMENDATION

The agent storage tanks, transfer lines, valves and all mountings be designed to resist any possible seismic load without rupturing or spilling. This slight added cost would eliminate an avoidable risk. They must be contained in a room designed to the Nuclear Regulatory Commission (NRC) seismic standards.

Volume II of the technical attachments, technical information supplement, covers pressure drop, efficiency calculations on the furnaces and pollution abatement system. It appears to be very well done with good engineering studies. They have chosen the best available technology in every case for their pollution abatement systems and no one should question their choice in applications of the materials and the equipment in the section.

In a report, "Chemical Agent and Munition Disposal--Summary of the U. S. Army's Experience" (2) the abstract states:

The report was prepared in support of the U. S. Army's Chemical Stockpile Disposal Program (CSDP) Programmatic Environmental Impact Statement, and discusses the Army's industrial scale chemical agent and munitions disposal experience. Since 1969, when the National Academy of Science recommended that ocean dumping be discontinued as a method of chemical agent and munition disposal, the Army has destroyed nearly 15 million pounds of chemical agents by either chemical neutralization or incineration. This experience has been incorporated into the design of the Johnston Atoll Chemical Agent Disposal System, which is being constructed on a small island in the Pacific Ocean, and the proposed CSDP disposal plants.

The disposal programs which are covered in the report include Project Eagle (disposed of mustard H/Hd and GB filled ton containers, bulk GB in underground storage tanks. M34 Cluster Bomb/M125 GB filled bomblet and the Honest John Warhead/M39 GB filled bomblet), and the Chemical Agent Identification Set disposal program, both of which were conducted at Rocky Mountain

Arsenal near Denver, Colorado. In addition, the report summarizes the results of tests conducted at the Chemical Agent Munitions Disposal System (CAMDS), which is the Army's pilot plant for testing and evaluating chemical agent and munition disposal equipment, process, and procedures. CAMDS is located at Tooele Army Depot, near Salt Lake City, Utah.

The report provides a concise description of the equipment, process (chemical neutralization or incineration), and procedures used, and environmental requirements, to include ambient air quality and emission standards, and analysis and disposal procedures of waste streams, for each program/project.

The report concludes that incineration field tests and trial burns indicate that the required Destruction Removal Efficiency (DRE exceeding 6 nines) can be met for all agents and the ash passed all toxicity tests.

9.6 Report on the Presentation by Mr. Brett McNight, Hazardous Waste Specialist, Oregon Department of Environmental Quality (DEQ) and Ms. Kathy Masschiano of EPA, Region X, August 5, 1987, at Hermiston City Hall, Hermiston, Oregon.

Covered the Hazardous Waste Permit Application Procedures for the onsite incinerator at Umatilla Army Depot.

- Army submitted Part B permit to DEQ
- DEQ issued Notice of Deficiency (NOD) after review
- Army submitted additional information to answer NOD's
- Army still has to submit site-specific information
- DEQ will review the completed permit application
- When DEQ feels they have an acceptable application, they will hold one or more public information meeting.
- Next they will hold a public hearing
- Then they will accept or reject the permit.

The trial burn procedure that must be followed is:

- Choose a Principal Organic Hazardous Compound (POHC)
- Choose a simulation compound similar to the POHC but more difficult to burn.
- Burn the simulation compound and determine the Destruction Removal Efficiency (DRE) (99.99% for all incinerators except the liquid incinerator, for which 99.9999% DRE will be required).
- Then burn the agent POHC for the final test.

Note: The Army must conduct a trial burn at Umatilla for each POHC. They cannot simply use the data from another, but similar facility, i.e., JACADS.

#### RECOMMENDATION

The Incineration (demil) Hazardous Waste Permit is thorough and should be approved by the Oregon Department of Environmental Quality.

#### 9.7 CHEMICAL STOCKPILE DISPOSAL SYSTEM AT UMATILLA, EMERGENCY RESPONSE.

Attachment G-2, Chemical Accident/Incident Control Plan and Oil Hazardous Substance Spill Contingency Plan.

This document is primarily procedural regarding on-depot accidents, if a chemical accident or incident occurs. It says what people will report to who and what action will be taken.

It primarily covers onsite situations and does not really take care of people off the post. It does point out that the hospital in Hermiston, the Good Shepherd Hospital, is the primary medical facility that would be used in case of a chemical accident/incident at the Umatilla Depot. But again these are only onsite people that this is concerned with. This document

does state that the decontamination teams would be put into affect should there be a chemical accident/incident. They are required to do certain things and maintain communication with a field controller. A logical extension of this would be to require similar equipment for personnel off the post, like the fire department, state police, etc., should they be required to take action due to an accident that allows the plume to escape from the depot area. The same equipment requirements would be reasonable for any civilian emergency response person on the team outside the depot. One item would be a 2-way portable radio with a designated frequency to the emergency command center. Another item is impermeable outfits, one for individual. Another item is a protective gas mask, M9 with hood, one per individual. Another item would be a kit, detection chemical agent. This would constitute the minimum package that should be in the trunk of each police car or sheriff car or fire department unit. These items are discussed further in the Army CSDP Emergency Response Concept Plan.

We must assume that even with the best management control, and equipment, release prevention cannot be 100% effective 100% of the time, so we need an emergency response plan. For such a plan to be effective the local government needs:

- Knowledge
- Understanding
- Resources
- People

-- Training

-- FUNDS

While the onsite monitoring and emergency response plan is very detailed and thorough (2), the off-post monitoring and emergency response is very weak.

Perimeter monitoring at the installation boundary may also be conducted at UMDA. The CSDP Monitoring Plan goes on to state (3).

"Agent monitoring off of the Government installation is called "off-post monitoring." This has not been accomplished for storage or demil in the past. Off-post monitoring could be a feature of future operations involving munition/agent transport through the public domain to regional or national sites. It is not recommended for storage and onsite disposal."

The concern of the citizens of the area is expressed in Chapters 17 and 18 of this report. Many of their comments are directed toward the need for a satisfactory emergency response plan as a need before project approval. Two letters, one from the Mayor of Hermiston and one from the Fire Chief are in Appendix.

#### RECOMMENDATION

The off-post emergency response program remains as a weak link in the system. It should be strengthened with equipment, training, supplies and money.

CHAPTER 10  
THE PHASED APPROACH

10.1 General

The Chemical Stockpile Disposal Program (CSDP) Supplement (1) outlines five program options for consideration. The intent of these options is to permit a phased CSDP that would allow future improvements based upon early program experience. Each of the options involves a time extension beyond the 1994 scheduled completion date. Completion dates would range from 1996 to 2008 depending upon the option selected. In addition, if operational experience called for significant revisions of the program, further delays might be needed.

The CSDP Supplement (1) provides an excellent description of the options to be considered along with the benefits and risks of each. In general, we support the phased approach. However, we do have some additional concerns and suggestions. Our observations lead us to believe that the CSDP is already facing tight time constraints. New information from the JACADS experience might impose additional demands upon time. Thus, it is realistic to assume that rescheduling to provide additional time might be needed. We recognize, of course, that delays themselves involve risks which must be evaluated.

There are a number of risks that can be expected to increase with time. That is, the stockpile can be expected to become more dangerous with time due to processes such as the following:

1. The rocket propellant destabilizes with time thus increasing the risk of autoignition (2).
2. Chemical agent leaks from warhead due to corrosion by the agent.
3. The strength of warhead decreases due to corrosion thus increasing handling risk.
4. Internal leakers created the potential of GB agent degradation products reacting with rocket components (bursters and fuse) to produce highly sensitive metal-organic compounds (2).
5. GB agent could migrate into the M417 fuze/cavity and interact with the spring metal causing the springs to loose elasticity. If the springs loose their elasticity, "the fuze could become armed through normal handling operations" (2).
6. With the decay of rocket propellant stabilizers, the M55 becomes more sensitive to accidental ignition from other causes such as brief fires (3) and kinetic energy dissipation to heat (see Section 12.4); this increases risks and handling problems which could result in further delays.

All of the above are time dependent processes. Thus, while the probability (per year) of an accident due to any of the above processes is now low, the probabilities can be expected to increase with time at a non linear (accelerating) rate. These processes could lead to catastrophic outcomes or added operational difficulties that could cause further delays which, in turn, would lead to further time dependent risks. One should also keep in mind that other munitions can be expected to have time dependent processes though we expect the M55 rocket to be the most sensitive.

Evidence provided to date is most encouraging. As an example, the destabilization of the rocket propellant appears to be a less serious risk than expected (2). Thus, the risk of time

delays may not be as great as previously thought. Nevertheless, we have the following concerns:

- \* The acceptable probability of autoignition of a rocket must be extremely low. A single rocket igniting within a single igloo could produce a catastrophic result. Thus, there is good reason to increase the sample size of propellant stability tests to better define the probability of auto-ignition. The current sample size and statistical analysis is not adequate.
- \* Certain probabilities (leaker, autoignition) are likely to be non-linear functions of time. If so, delays could produce far higher risks than the historical record would indicate; risks could rapidly increase with time.
- \* Some time dependent risks would result in operational delays thus compounding risks. As an example, larger numbers of leakers would make handling operations more difficult and, consequently, slow production and place greater demands upon time.

With the present knowledge base, we support Option 1 which would delay the completion date until 1996. This support, however, is conditional.

Any decision to delay must be accompanied by deliberate efforts to realize the benefits while assessing and mitigating the costs of delay. The costs of delays involve the increasing but unspecified probability of: (a) catastrophic explosions of large stocks of munitions due to the autoignition of propellants and other processes and (b) more dangerous and complex operations causing further delays due to degradation of the munitions. While we advocate careful planning, recognize that there can be legitimate causes for delays, and fully support delays that would enhance public safety, we stress that the risks of delays must be recognized. Thus, we conclude that:

Any delays that cannot be justified as a net benefit to public safety will place the public and the project at greater risks; such risks can be expected to accelerate with time.

The fact that sufficient data are not available to quantitatively define the probabilities of such risk must not be used as a reason for dismissing such risks (see Section 11.2)! In addition, while administrative reviews are essential, unwarranted delays must be considered as risks as real, though less dramatic, as earthquakes and plane crashes. Steady and thorough progress is called for.

#### 10.2 Realizing the Benefits of Delay

The primary benefit of any delay option is the knowledge gained from early (JACADS) experience and the use of such knowledge to improve later (CONUS) activities.

For new knowledge to develop effectively, there should be an ongoing community of professionals who are technically involved with all phases of the CSDP. The process of hiring outside consultants to perform a specialized study to meet a specific deadline is not, in itself, sufficient to this task.

One must sustain, over time, an interdisciplinary professional team whose primary task is to study the entire program and mitigate the problems. Such groups must do more than administer contracts. They must be deeply involved with the technical work throughout the entire project.

The mitigation team appears to fit these requirements. We were favorably impressed with their collective grasp of the entire program and its history. In contrast, we have found several specialized consultants to have a very narrow and short term focus. Over the life of this project, such consultants will no doubt be involved in different projects unrelated to CSDP. Indeed, some appear to jump from one task to another, rushing to complete the next report with little time for reflection or interaction with other study team members. The mitigation team stood out as a welcomed contrast to such behavior.

In our view, it is essential to maintain the continuity of a broad based professional mitigation team that has the authority, resources, and time to review all phases of the CSDP, reflect upon the lessons learned, consult with outside professionals, and establish a professional identity with the entire program. They should hold conferences and publish reports largely on the basis of their own findings rather than merely to meet administrative requirements. If this does not occur, then the benefits of any delay may not be realized and the additional time will be filled up with administrative busywork.

### 10.3 Sustaining an Outside Community

All professional groups, no matter how competent and dedicated, can become insulated within a program and the organizational complex that sustains it. Organizations (all of them) tend to insulate members from unfavorable information and the

consequences can be tragic (4). If this occurs over time, public trust can erode (5). We must emphasize that these are not esoteric concerns! History provides tragic lessons (the Shuttle explosion) of such behavior. We feel so strongly on these concerns that we will volunteer to present a workshop to the Army on this topic.

Professionals working on this program should be held professionally accountable to an outside peer community. Our reviews have provided some degree of outside accountability but there are some shortcomings which include the following:

- \* We outside reviewers (ourselves and other citizen teams) have not had to defend our own work to a broader community; therefore, it is too easy to take "cheap shots."
- \* Our review is a "one shot" affair. It's too easy for Army personnel to dismiss a criticism by saying, "Oh, that subject is covered in a report that will be out next month." While we commend the Army for taking the initiative to encourage our outside review, we believe that some long term improvements can be initiated.

#### RECOMMENDATION

Throughout the CSDP, a series of professional conferences be held; the first conference should be held before spring 1988.

Authors would present papers or technical presentations in a format similar to scientific and engineering conferences. The authors (presenters) would take professional responsibility for their own presentations; they would not be presented as the "policy" of any organization or group unless clearly stated. An Army disclaimer could be attached to each paper or presentation. Proceedings might be published. or a conference could be run

similar to the "Gordon Conferences." Presentations would not be limited to Army personnel. The authors of the "citizen reports" should also make presentations and be held professionally accountable to the same kind of questioning as Army personnel.

We suggest that the first conference be held within six months (before Spring 1988). This would enable the representatives of the citizen groups to present topics from each of their studies. Such topics could include:

- \* Time dependent risks such as autoignition of propellants and leakers.
- \* An assessment of the transport of munitions from Lexington and the risks involved.
- \* Is the accidental ignition of the M55 rocket incredible? What is the evidence?
- \* What types of organizational checks and balances are required for a program of this type? Are there historical lessons?

Such conferences would force Army personnel, including consultants, to periodically step outside of their administrative demands to address technical concerns in front of an independent and professionally qualified audience. It would also force critics to closely examine and defend themselves in front of this same audience.

At present, a broad based and independent professional community can be identified. Our own group has assembled a technical advisory committee with 6-8 active professional members. In addition, the group has four consultants. Other citizen groups have similar access to technical people. By drawing upon these resources, a technical conference could be

established. Funding for such a conference would be relatively small. A number of travel grants could be made available. In addition, letter proposals for grants of several thousand dollars each could be solicited to specific consultants for the study of particular topics and review of reports followed by a conference presentation.

We are concerned that without such activities, Army personnel will tend to withdraw into their own organizational system, consultants will tend to narrowly focus upon the immediate demands of their contract, and nobody will have time to reflect on the entire program. Under such conditions, the benefits that might be gained from a phased approach would not be fully realized.

#### 10.4 Technical Studies Required

If the JACADS experience suggests that program changes are called for, a key factor to be weighed in the decisions will be the risk of extended storage. While current information is encouraging (M55 propellant destabilization appears to be less than expected), we are concerned that the sample size is too small and the statistical analysis too limited. We recommend continued studies on M55 rocket propellant stability and leakers (external and internal).

In Section 12.8, we have recommended simulation studies to model the propellant destabilization process and other time dependent processes. Such simulation studies should be discussed

at the professional conferences previously described. These types of simulation studies have been done in many fields and thus a qualified peer community could be assembled.

To facilitate better information concerning the frequency of leakers as a function of time, we suggest that all data on leakers (and any other time dependent processes) be reported to a central data bank to facilitate statistical analysis. This is currently reported and compiled in the "Quarterly Leaker Report," which is classified, as it deals with the condition of the deterrent stockpile.

The statistical analysis applied to all storage risks needs to be improved and continually updated. Responsibility for this analysis should be clearly identified and sustained throughout the project. Finally, simulation studies should be conducted for time dependent risks such as autoignition of propellants and leakers (see Section 12.8). We suggest that appropriate staff be added to the mitigation team for such analysis.

#### RECOMMENDATION

We support Option 1 given in the CSDP report (1) which would extend the completion date to 1996, subject to the following recommendations:

1. Program decisions and operations should be assessed in terms of the delays that might be caused; the benefits of such delays should be weighed against the risks.
2. An interdisciplinary team responsible for broad based assessments and mitigation studies should be sustained throughout the entire project.
3. Periodic professional conferences should be held to sustain an independent forum where problems can be addressed,

assumptions examined, and data reviewed; the first such conference should be held by spring 1988.

4. Data should be collected to better assess time dependent risks such as the autoignition of the M55 rocket; computer simulation studies should also be conducted.

#### REFERENCES

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## CHAPTER 11

### INTERNAL RISKS AND OPERATIONAL REQUIREMENTS

#### 11.1 General

The identification of risks and mitigation efforts throughout the many documents that we have reviewed has been extensive. With respect to onsite storage and handling operations, however, we detect methods and assumptions that tend to direct inquiry primarily toward external hazards. Consequently, severe accidents that could result from internal hazards, such as operational disorders, may not have been as thoroughly examined.

#### 11.2 Risk and the Probability of Severe Accidents

Ideally, risk analysis seeks to: 1) identify possible accidents, 2) estimate the probabilities of these accidents, and 3) estimate some measure of relative severity. The product of probability and severity provides an indication of relative risk. Mitigation proposals can then be evaluated on the basis of risk reduction. We support this approach and commend the Army for its risk assessment and mitigation work. We believe, however, that the limitations of the risk assessment/mitigation approach must be recognized and addressed. Stated simply, the methods and assumptions can inappropriately shift attention away from certain classes of potential accidents.

Accident possibilities that result from rare combinations of events are extremely difficult to identify in advance. Such

"rare" combinations, however, can become realities during operational disruptions; the nuclear reactor explosion at Chernobyl provides a tragic example. Further, while any particular combination of events may be rare, there are many possible combinations and, thus, the risk of one of these occurring may not be incredible. Thus, there is a danger that risk assessment will direct attention toward accidents resulting from single dominant causes that are easily identified as possibilities. Accidents that result from combinations of events and operational disruptions tend to receive less attention, not because they are incredible (as a class), but rather because they are more difficult to identify as possibilities.

There is also a danger that attention is directed toward those possibilities for which probabilities can be estimated. Attention is directed toward external events (plane crashes, earthquakes, etc.) for which a historical record is available and from which probabilities can be estimated. Operational accidents, however, tend to be unique and one of a kind. Once they occur, organizational changes are made. However, if the likelihood of each contributing event can be quantified, the likelihood of the sequence of events can be calculated. Thus, a historical record from which probabilities can be estimated is typically lacking.

Further, an experimental and theoretical basis for estimating probabilities is often absent. Risk assessment tends to direct attention away from accident possibilities for which

adequate information to determine probabilities is absent. As an example, in Appendix A, of the most recent (August, 1987) "Risk Analysis of the Continued Storage of Chemical Munitions" (1), an accident sequence is described as follows:

"SL3 Spontaneous ignition of rocket during storage (not analyzed for lack of quantitative data)."

This accident sequence was not "considered for further analysis." The earlier draft contained the same rationale (2). We strongly disagree with this approach (see Sections 10.1 and 10.4), but it does illustrate the shortcomings of risk analysis that concern us. Classes of accidents that are "not analyzed for lack of quantitative data" tend to receive less attention than the dangers warrant.

The concerns of this section can be summarized as follows:

- A. Risk analysis tends to focus attention on accident possibilities that are initiated by single, dominant events.
- B. Risk analysis tends to focus upon those possibilities for which probabilities can be calculated.
- C. Accidents resulting from operational disruptions tend to be unique and involve combinations of internal events; possible accidents are more difficult to identify and sufficient data to determine probabilities is often lacking.
- D. Therefore, risk analysis has a tendency to direct attention toward accidents caused by single, external events in comparison with accidents caused by operational disruptions and combinations of events.

### 11.3 Severity of Serious Accidents

The severity of potential accidents has been estimated in terms of the maximum downwind distance of an agent plume that

could travel with lethal consequences (the "no deaths" distance). Other comparisons of severity employ some indicator of immediate accidental death or physical harm. We agree that such indicators can be used to provide relative comparisons of accident severity. However, there are secondary impacts not included in such indicators that should be addressed.

The most severe accidents identified in the risk analysis and mitigation study involve external hazards such as aircraft crashes, earthquakes, and meteorite strikes (reference 3, p. 3-6). We suggest, however, that internal accidents, such as those resulting from operational disorders or munition instabilities, would have secondary consequences that are not adequately addressed by indicators of immediate lethality or harm such as the "no deaths" distance.

Given the same (immediate) "no deaths" distance, an accident caused by internal hazards would likely have a far greater impact on the entire program than an accident caused by external hazards. As an example, a fire due to the autoignition of an M55 rocket would have far more significant impacts on the program than a similar fire due to a plane crash. Such internal hazards could have devastating effects on the entire program. Rather than resulting from a single external event (plane crash), internally caused accidents would indicate broad-based and ongoing deficiencies and risks within the entire program. Pressures to change, speed up, or even terminate operations would be significant. Such turmoil and change could well increase the

long term cumulative risks. By focusing on immediate deaths as a relative measure of severity, internal hazards are seen to be less severe than warranted.

The rationale of this section is summarized as follows:

- A. The relative severity of accidents is not adequately measured by indicators of immediate lethality or harm; secondary impacts must also be considered.
- B. Secondary effects include disruptions of program activities which could place the public at greater long term risk.
- C. Accidents resulting from internal events are more likely to have such secondary effects.
- D. Because immediate lethality has been employed as the indicator of relative severity, internally caused accidents may not have been given the attention they deserve.

#### 11.4 Our Concerns

Nearly all the accident scenarios involving serious off site effects have been assumed to be instituted by a single external event (plane crash, earthquake, etc.) that can be easily identified. This assumption has had a "ripple" effect in a number of studies. As an example, the emergency planning concept plan reflects this assumption. Our own study of historical accidents, however, reveals that accidents are typically the consequence of operational failures involving combinations of management failures, unusual operational demands, incomplete information, operator errors, and unforeseen combinations of events. Single external events are less often the dominant cause of serious accidents.

In another chapter of this report (see Sections 10.1 and

12.5), we reason that some of the most serious risks arise from internal events that become more probable (on a per year basis) with time. Such risks have been essentially excluded from the risks analyses for the reasons described above.

We are concerned that, with respect to storage, handling, and transportation operations (not plant operations), the risk assessment methodology may have led to a false presumption that essentially all accidents with the most serious consequences are initiated by single external events (plane crash, earthquake, etc.) that are easily identified and have little to do with operational disorders.

We have not found such a presumption with respect to the demil plant where process control is an essential component of design and permit applications. It is informative to compare planning for the demil plant with the handling transportation operations. Throughputs and stocks of munitions have been defined for operational stages of the plant, but we have been unable to find similar data for handling operations. The design of a control room for the plant has been an important component of plans. However, we have found very little concerning an operational control center that would meet the requirements of full scale handling operations. The difficulties imposed by plant shutdowns (planned and unplanned) have been examined. However, we have found little to describe how handling and transportation operations would be shut down during emergency alerts. Within the demil plant, the accidental ignition of the

rocket due to internal events is taken very seriously. Extensive testing of the shear machine to prevent such ignition has occurred and the shearing machine is isolated in an explosion-proof room to mitigate an ignition. In contrast, the handling-transportation portions of risk analysis contain very little on accidental rocket ignition, and the calculations are confused (see Chapter 12).

#### 11.5 Throughputs and Stocks

Our own estimates indicate that the stock of munitions at various stages of onsite handling and transportation operations could number in the hundreds at any given time. Maximum throughput and stocks will depend upon the package configuration (4), schedules, shutdown, and administrative restrictions. Operational disruptions (due to an emergency alert as an example) could find significant numbers of munitions in relatively exposed states. Moreover, given an emergency alert, it is not immediately obvious what the safest action would be at each operational stage. The numbers of leakers in these munitions would be relatively high (due to handling) and thus emergency handling operations might be further complicated.

In our view, one of the steps that needs to be taken is to clearly define the maximum throughputs and stocks of munitions, agents, explosives, and leakers that should be expected at all stages of the CSDP operations. That is, data for each site should be provided on:

- The maximum throughput rates of each class of (a) munition (number/hr), (b) chemical agent, (lbs./hr), (c) explosive-propellant (lbs/hr), at each stage of the process, beginning with the removal from the storage igloo to final destruction.
- The maximum stock (amounts) of each class of (a) munitions (numbers), (b) chemical agent (lbs), (c) explosive-propellant (lbs) at each stage in the demolition process, beginning with the handling operations inside the igloo, including amounts in various stages of transit, and ending with the final stage of the destruction process.
- The probable throughput rate and stock of leakers for each class of munition at each operational stage for each phase of the CSDP (estimates of the increase of leaker probability at each operational stage for each munition would required).

Such data should be based on conservative estimates for shutdowns due to weather, maintenance, and equipment failures. This data should be distributed to all working groups, in particular those dealing with risk analysis, mitigation, monitoring, and emergency response. Such basic data have not been included in any of the reports for onsite handling and transportation operations that we have reviewed. With such data, one can better appreciate how operational disruptions might cause significant and possibly dangerous "pile ups." As an example, the triggering of an emergency alert could be very disruptive to operations. The throughputs and stocks of munitions involved in such an operational disruption could be significant. The fact that a false alert could increase operational risks is not recognized (5). Such deficiencies can be traced back to the presumption that serious accidents are caused by external events (see Sections 11.2, 11.3, and 11.4).

A greater recognition of the throughputs and stocks of munitions involved in operations will, in our opinion, create a more realistic appreciation for the magnitude and complexity of handling and transportation operations and the risks of operational disruptions. We suspect that false alerts will be considered more risky and the importance of a single and effective operational command center would receive greater attention (see Section 11.6).

A suggested use of throughput and stock data is outlined as follows:

1. Develop in tabular and graphic form, data on the throughputs and stocks of munitions, agents, explosives, and leakers in all operational stages.
2. Identify plausible sets of operational disruptions including, but not limited to emergency actions, power outages, equipment failures, shutdowns, and communication breakdowns.
3. Using 1 and 2 (above), identify risky accumulations and distributions of munitions, agents, explosives, and leakers that could result from operational disruptions.
4. Mitigate risky disruptions by such actions as restraints (limits) on throughputs and stocks at different operational stages and management protocols for avoiding, recognizing, and dealing with operational disruptions.

One should note that the above steps do not require that all accident possibilities and probabilities be identified (see Section 11.2).

#### RECOMMENDATION

Data on throughputs and stocks of munitions, agents, explosives-propellants and leakers for all operational stages should be developed for each site and operational plans should be reviewed with the goal of handling of these during operational disruptions and avoiding dangerous "pile ups."

### 11.6 Preoperational Survey

The report, "Transportation of Chemical Agents and Munitions: A Concept Plan" (4), recommends that prior to the transportation operations, a preoperational survey will be conducted. We support this recommendation for all handling-transportation operations, particularly those of the onsite alternative. Such a survey would include the following:

"The preoperational survey will involve simulating operations beginning at the storage site where activities begin. Inert materials will be used to identify and eliminate potential safety problems and to ensure effective operation. The preoperational survey will be conducted by an independent team that will observe all aspects of the operations.

A detailed description of the preoperational survey is an important element of the safety management program." (page 5-2, ref. 4).

We recommend such a survey with independent review and a professional conference (see Section 10.3) to examine results.

This survey should be more than a check of the physical operations. A testing of command and control capabilities for all conditions, including emergencies, should be included. Survey facilities and equipment could also be used for training.

### RECOMMENDATION

Preoperational surveys involving simulated operations should be conducted for all operations including onsite storage, handling, and transportation.

### 11.7 Command and Control

The command and control requirement for onsite handling, transportation, and transfer to demil operations and the relationship of these operations to the demil command center have not

been adequately addressed, though such topics are mentioned in a number of documents (5, 6). We believe that the entire project should operate through a central command center where information concerning the real time status of all operations is monitored and command authority for safety resides.

There needs to be a single command center for dealing with events, incidents, and accidents. The organizational planning must be coordinated through this single center. It should be responsible for any notification of the public outside the facility.

In this regard, there is a need to clarify the following:

- \* the overall operational command structure and, in particular, all transfers of authority over munitions, emergency response authority, and safety.
- \* the relationship between the overall command center and the control center for the demil plant.
- \* the relationship of the overall command center to onsite operations not involving chemical agents.
- \* the authority over nonchemical munitions onsite.
- \* the control center requirements for onsite handling and transportation activities.
- \* the emergency shutdown requirements for onsite handling and transportation activities.

In brief, we recommend the following:

### RECOMMENDATION

1. A single document should be prepared describing the overall operational command and control requirements.
2. These requirements should be independently reviewed and tested through preoperational surveys (see Section 11.5) and drills.
3. Command and control proposals should be independently reviewed and updated in the earlier phases of the program.

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## CHAPTER 12

### ACCIDENTAL ROCKET IGNITION DUE TO MECHANICAL FORCES

#### 12.1 General

Throughout the early phase of our inquiry, it appeared to us that the accidental ignition of an M55 rocket due to force had essentially been considered as incredible. However, we could not find any analysis that attempted to prove such accidents as incredible. Nevertheless, within the risk analyses that we reviewed and throughout the technical presentations that we attended, accidental rocket ignition appeared to receive relatively minor attention and more than once we were led to believe that such accidents were incredible.

When we reviewed the worksheets and references, we did find evidence that rocket ignition had been included under the misleading term "burster detonation." In Section 2B, "Onsite Option", Section 10, "Onsite Transportation," Scenario VOXYZ004 (1), the term BE61(R) was named "Impact force sufficient to detonate burster." A probability of 0.002 was assigned and referenced. Upon reading this reference (2), we found that this probability was defined as "BE220 - Highway accident impact ignites the rocket motor." The probability estimate was determined from a drop test of 45 rockets in firing tubes in which 2 rockets ignited. This drop test had not been included within the data presented in any of the risk assessment reports or drafts that we had reviewed. In the November 1986 risk analysis (3),

this item (BE61) had been described as a rocket propellant ignition "which would eventually lead to burster detonation, due to dunnage fire or direct impingement." In the recent (July and August 1987) risk analyses, this same term is described as a "burster detonation" with no mention of rocket ignition (1, 4, 5).

In another worksheet, Appendix A-2 (6), three "frequencies of detonation" were determined for truck and train accidents. These calculations were based upon the detonation of the burster material and not the ignition of the rocket propellant.

Thus, when the terms "detonation" or "burster detonation" appeared within the risk analyses, it was not clear whether rocket ignition was implied or not. As an example, in "Onsite Transportation" (1), the same event number, BE61, is used in two scenarios (004 and 015) as a "force sufficient to detonate burster," but upon examining the cited references, one finds that the first probability is based upon rocket ignition, while the second probability is based upon burster detonation.

Further, information (data, assumptions, definitions, etc.) on rocket ignition due to accidental forces have not been compiled in any single reference that would facilitate our review. We had to pull together bits and pieces from many sources including worksheets and unpublished field notes (7). Despite these difficulties and with recognition that our review was necessarily limited, we now conclude that:

Rocket ignition due to accidental forces has not been

## 12.2 Mechanical Failures Defined in Risk Assessment

The risk assessment methodology classified mechanical failure into three categories:

Impact Failures: An object (munition) strikes a nonyielding object with a given velocity or equivalent drop height.

Crush Failures: Static forces completely independent of velocity.

Puncture Failures: The penetration (puncture) of an object (munition) by an unyielding slender object or probe.

In addition, the "spontaneous detonation" (not to be confused with "autoignition") of munitions due to "mechanical forces," "dynamic crush," or "undue mechanical force" is presented in Appendix A-2 (a worksheet) and appears in event BE53 (6) as a "crush force sufficient to detonate a burster." In these cases, a review of the calculation sheets shows that burster detonation is indeed the proper term (not rocket ignition). Based upon the information that we have reviewed, Table 12.1 provides a summary of the relationship of mechanical failures to rocket ignition and burster detonation that we found employed in the risk assessment.

We have not found any analysis that attempts to prove or demonstrate that "crush," "puncture," or "undue mechanical forces" could not cause a rocket ignition. Rather, it appears that such causes were simply not addressed, possibly due to a lack of data (see Section 12.9 for a discussion of the most risk analysis).

TABLE 12.1 - MECHANICAL AND THERMAL CAUSES OF  
IGNITION AND DETONATION INCLUDED  
IN RISK ASSESSMENT

|                             | Rocket<br>Ignition | Burster<br>Detonation |
|-----------------------------|--------------------|-----------------------|
| "Impact"                    | Yes (a)            | Yes (b)               |
| "Crush"                     | No                 | Yes (c)               |
| "Puncture"                  | No (d)             | No (d)                |
| "Undue Mechanical<br>Force" | No                 | Yes (c)               |
| External Fire               | Yes                | Yes                   |

- 
- (a) Event BE61(R) is mistakenly described in risk analysis as "burster detonation." Calculations showing that this is rocket ignition (2).
- (b) Based upon a 50% chance of burster detonation at 123 mph with a lognormal distribution of probability of detonation with velocity (6).
- (c) Same as "undue mechanical force."
- (d) Ignition of propellant in cartridge only is included.
- (e) Similar method to impact detonation except impact velocities (converted to kinetic energy) are converted to forces exerted over a distance (6).
- 

The broader coverage of burster detonation appears unjustified. All evidence that we have seen indicates that rocket ignition is more likely to occur from a wider range of causes than burster detonation. As an example, essentially all rounds of 30 caliber ball ammunition fired into rocket motors caused ignition, while none caused a detonation when fired into the rocket burster. Such results suggest that a "puncture" ignition of a rocket motor deserves consideration (see Section 12.6).

The broader coverage of burster detonation leads to some inconsistencies in the risk assessment. Given an onsite truck accident, the risk analysis report states that the probability of rocket ignition (mistakenly called "burster detonation") is much higher than the probability of burster detonation (we agree). Given an offsite train accident, however, the risk analysis states that the probability of rocket ignition is reduced to zero, while the probability of burster detonation increases by two orders of magnitude (compare scenario VOXYZ015 "Onsite Transportation" with scenario RWXYZ015 in "Offsite Transportation Rail"; ref. 1 and 8). This implies that an accidental rocket ignition is more sensitive to a truck accident than a train accident while the reverse is true for a burster detonation.

Such differences are a consequence of the classification approach summarized in Table 12.1. Because truck accidents involve impacts (as defined in the risk assessment) and train accidents do not, rocket ignitions are limited to truck accidents. Because train accidents include "undue mechanical forces," the probability of burster detonations remains (and actually increases). However, because rocket ignition is not included under the "crush," "puncture," and "undue mechanical force" categories (which all apply to train accidents), the probability of rocket ignition given a train accident disappears. In brief,

The mechanical failure classification system as employed in the risk assessment allows rocket ignition to disappear as a possible outcome of train accidents.

### 12.3 The Evidence

The data on accidental ignition (5, 9, 10) of the M55 rocket included in the most recent risk analysis (5, 9, 10) and the earlier "Munition Failure Thresholds" (11), includes only two pallet drops; one accidental drop and one test drop (See Table 5-3, ref. 11). No agent leaked, no rockets ignited, and no bursters detonated. The earlier (1986) risk analyses relied on this same limited amount of data (3). This is not an adequate basis for the very limited consideration given to accidental rocket ignition within the risk assessment.

We have examined some additional data that might pertain to accidental ignition. Such data include the following:

- \* Forty-five rockets in fiberglass shipping containers were individually drop tested from 40 feet onto a concrete pad. Of 13 dropped nose down, 2 ignited. One of the rockets that ignited fell from only 32 feet due to a rigging slippage. None of the other rockets dropped nose up, horizontal, 45 degrees nose up, or 45 degrees nose down ignited. Three warheads leaked. No burster detonated (7).
- \* Essentially all rounds of 30 caliber ball ammunition fired into the rocket (with steel casing) resulted in rocket ignition. No bursters were detonated (12).
- \* Testing on the rocket shearing machine did result in some rocket ignitions. The rocket shearing machine is enclosed in an explosion proof room and now has cooling sprays to prevent such ignition (13, 14, 15, 16).

Such information, while limited, does not support the notion that an accidental ignition due to some form of mechanical force is incredible.

We are concerned that the data related to the accidental ignition of rockets have not been assembled for examination. The

drop tests of individual rockets cited above which produced two ignitions were not written up in a report and few people were even aware of these results. The primary reference is a copy of the field notes (7).

The accidental rupture of the warhead has been a major concern in this study and we agree that it should be. However, of the rockets dropped (2 pallets of 15 rockets each and 45 individual rockets in shipping tubes), 3 had agent leakage and 2 had rocket ignition. These are sparse data indeed, but, they do not provide any justification for the relative neglect of rocket ignition in the risk analyses in relation to ruptures and leaks in the warhead.

We are not saying that accidental ignition is likely. However, when we consider the many other accidental events that were considered credible and the sparse data upon which their probabilities were (necessarily) based, we find no justification for excluding several types of accidental rocket ignition as credible events.

#### 12.4 Kinetic Ignition

The development of accident scenarios would be aided if conceptual models were developed that described the plausible physical mechanisms through which accidental ignition might occur. Such descriptive models should provide a simple but basic description of the physics involved. These physical descriptions could then form a bridge between a) those with expertise in

munitions, propellants, and explosives, and b) those familiar with the operational requirements of the CSDP.

Earlier in this chapter (Section 12.2), we reasoned that the accidental force classification as employed in the risk assessment was misleading. In this section, we will outline a portion of an alternative approach that is based more on physical principles.

For the purpose of this discussion, we will define "kinetic-ignition" as follows:

Kinetic-Ignition: the transfer of kinetic energy to heat within a portion of the propellant, ignitor, or material in contact with the propellant or ignitor so as to produce a local temperature rise sufficient to initiate ignition.

There are, of course, other plausible mechanisms that could lead to rocket ignition (electrical, shock, etc.)

Though limited, the evidence indicates that ignition could involve the dissipation of kinetic energy to heat within the penetrated steel casing of the rocket motor or objects penetrating the steel casing. As an example, when eight rounds of 30 caliber ball ammunition were fired at rocket motors with steel casings, all rockets ignited. However, when eight rounds were fired at the propellant alone, only one ignition occurred (12).

The risk analysis, including the most recent (August 1987) drafts fail to describe the steel rocket casing. The recent draft simply states: "The rocket casing is made of aluminum." This is wrong. Because the authors had given relatively little attention to the rocket motor, they either failed to realize that

the casing is steel or believed that this fact is unimportant. The reason why the steel casing (0.1 inch thick) is important is that any puncture, crimping, shearing, or tearing of this casing would involve a significant dissipation of energy (because the casing is strong). Because steel has a relatively low heat capacity, such energy dissipation might result in momentary temperature rise sufficient to initiate ignition. Such ignition did, in fact, occur in the shear machine before an adequate heat removal spray was included. A test report on the shear machine (16) concludes, "Cooling spray on the blade during shear operations is vital."

A plausible mechanism for ignition would thus involve the following:

Plausible Mechanism for Kinetic-Ignition: Kinetic energy is rapidly dissipated to heat with a small enough region of the steel rocket casing or objects penetrating the casing to produce a momentary and local temperature rise sufficient to initiate ignition.

Kinetic impact ignition requires: a) sufficient kinetic energy dissipation during b) a short period of time over c) a small region of the rocket casing or penetrating object. Other internal components of the rocket such as the internal spring and igniter might be similarly involved.

The kinetic energy involved in various plausible accidents can be calculated (see Table 12.2). Calculations demonstrate that kinetic energy transfers to heat at such levels will not produce a temperature increase sufficient to initiate ignition unless some of the energy dissipation is concentrated in a small

TABLE 12.2 - EXAMPLES OF KINETIC ENERGY DISSIPATION

| Event                                                                          | Energy Dissipated |
|--------------------------------------------------------------------------------|-------------------|
| Rocket (67 lbs)<br>Falling 40 ft                                               | 2700              |
| Forklift (6000 lbs)<br>Velocity 5ft/sec                                        | 2300              |
| Puncture of rocket<br>Casing (0.1 inch thick)<br>by 1 inch diameter<br>missile | 550 (a)           |

(a) based on a modification of the "general puncture equation" (19) or "general equation for missile penetration" (20). Check calculations because we did not have the primary reference.

region of the steel casing or penetrating object. Moreover, heat transfer will reduce temperature peaks with time, thus the speed of impact has some influence. Calculations indicate that an energy dissipation at 1 ft-lb within one square centimeter of steel casing (0.1 inch thick) would result in a temperature rise of approximately 6 degrees C (we realize that these are "mixed" units; we have selected units that correspond to those most commonly used by the Army). Thus, if only a fraction of the kinetic energy shown in Table 12.2 was rapidly dissipated to heat in a small portion of the casing, a significant momentary temperature rise would be theoretically possible.

Several mechanisms through which kinetic energy might be rapidly transferred through the casing as heat within a relatively small portion of material (including the casing) in contact with the propellant (or ignitor) are listed below. (Examples of actual rocket ignitions are given).

High velocity puncture - 30 caliber ball ammunition fired at rocket engines produced ignition in essentially all cases (12).

Low velocity shear, tear, or puncture - This is less likely than a high-velocity puncture (above), however, two rocket ignitions did occur in the testing of the rocket shear machine. Other ignitions occurred in the shear pilot testing. Those who design and operate the shear machine believe that low velocity shear ignition is a credible risk (13, 14).

Abrasion or friction - Ignitions have occurred in rocket sawing operations (13). A frictional spark may have ignited the igniter in the 2 drop test ignitions (see below).

Crimping, buckling, or pinching - In a test involving the nose down drop of thirteen individual rockets within their fiberglass containers, two rockets ignited on impact (7). Though there is no evidence on the mechanism of ignition, the crimping or buckling of the rocket casing might provide a plausible explanation. (We recognize that this is speculative.) A pinching of the rocket ignitor might also have initiated ignition.

While limited, the evidence briefly cited above does indicate plausible causes of kinetic-ignition.

#### 12.5 Credible Accidental Ignition

Any ignition (Kinetic or other) of an M55 rocket could be a very serious accident. Ignited rockets break loose from their pallets and firing tubes (12). In a confined area with other rockets (igloo or transportation containers) there is a reasonably high probability that the ignition of a single rocket would lead to the ignition of other rockets and the detonation of bursters. Major fires or explosions could occur. Such events could have severe consequences.

Our concerns for the accidental ignition of the M55 rocket are summarized below:

1. We have found no adequate justification for treating the accidental impact-ignition of the M55 as an incredible event in any accidents involving the rapid dissipation of kinetic energy.
2. Available evidence, while sparse and often circumstantial, does indicate that kinetic ignition is credible under a wide range of circumstances.
3. The consequences of an accidental ignition of an M55 rocket could be severe.
4. There are some measures to mitigate accidental kinetic-ignition that are not expensive and would not create program delays or disruptions. (We will describe these in later sections of our report.)

We have described a plausible mechanism for kinetic-ignition. The following recommendation, however, is not based upon the validity of this particular mechanism. It is the Army's responsibility to develop plausible mechanisms to explain its own experiences which have included kinetic-ignitions of rockets.

Given the four observations listed above, we find ourselves in sympathy with the recent (1987) statement by the Transportation Panel:

"If the rockets must be shipped in their existing configuration, the precise packaging system requirements should be determined only after a comprehensive test program has been carried out to resolve the impact threshold and sympathetic detonation questions." (ref. 17, page C-5)

We do not, however, advocate a delay in the CDSP to carry out a comprehensive test program. Instead, we recommend the following:

#### RECOMMENDATION

The kinetic-ignition of the M55 rocket should be considered as a credible accident and mitigation steps should be taken.

This recommendation is consistent with the approach already taken in the Mitigation Draft report (see ref. 18, Chapter 5.4, page 5-13). An accident not considered credible in the risk analysis was, nevertheless, considered and mitigation recommended.

We suspect that there is more information available on kinetic-ignition than we have been able to uncover and there is certainly more than that included in the risk analyses. We recommend that an effort be made to draw together and review this information in a single document. A workshop on this topic should also be held drawing upon appropriate internal and external expertise and data from similar rocket tests and accidents. Such activities, however, should not be considered as a substitute for the above recommendation.

#### RECOMMENDATION

All information relevant to the possible kinetic-ignition of the M55 rocket (including data on similar rockets) should be assembled and reviewed in a single document; plausible mechanisms for accidental ignition should be developed.

#### 12.6 A Suggestion for Estimating Accidental Puncture Ignition Probabilities

In this section, we suggest a practical way in which accidental rocket ignition might be incorporated into the existing risk analysis with a minimum of time and effort. That is, we suggest a method by which the existing probability estimates might be utilized to obtain probability estimates for accidental rocket ignition.

Within the existing risks analysis, the highest probabilities of munition failures fall under the category of "puncture." We propose a method for estimating the conditional probability of rocket ignition given a rocket puncture (one might need to adjust rocket warhead puncture probabilities to rocket casing probabilities). By multiplying this conditional probability by the probability of a puncture failure, one can estimate the probability of an accidental puncture ignition.

The proposed method is based upon conservation of energy; the kinetic energy required to puncture a munition is dissipated as heat and this heat causes a temperature rise in the casing and penetrating object. A conditional probability estimate (ignition given puncture) is obtained as follows:

1. For a range of missile (puncturing object) diameters, compute the kinetic energy lost given a puncture of the steel rocket casing (0.1 inch thick). The equation used to calculate the penetration velocity can be modified for this purpose (see Appendix C, "Structural Calculations for Risk Analysis," pages C-93 or C112, ref. 19).
2. Convert the kinetic energy lost (1 above) into an equivalent heat gain for each missile diameter.
3. For each missile diameter, estimate the heat gain in the steel casing by dividing the equivalent heat gain (2 above) by two (assume that half of the energy goes to the missile and half to the casing)
4. For each missile diameter, calculate the temperature rise in the steel casing for the corresponding heat gain (3 above) assuming an even heat distribution over the impact area of the puncturing missile ( $\pi D^2/4$ ) or an estimate of the puncture hole area. We realize that heat will be distributed over a broader area, however, heat will not be evenly distributed. Estimating the temperature over the missile area is a conservative compromise. The heat capacity of steel is required for this calculation.

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DRAFT PROGRAMMATIC (U) UNATILLA COUNTY SOIL AND WATER  
CONSERVATION DISTRICT PENDLETON

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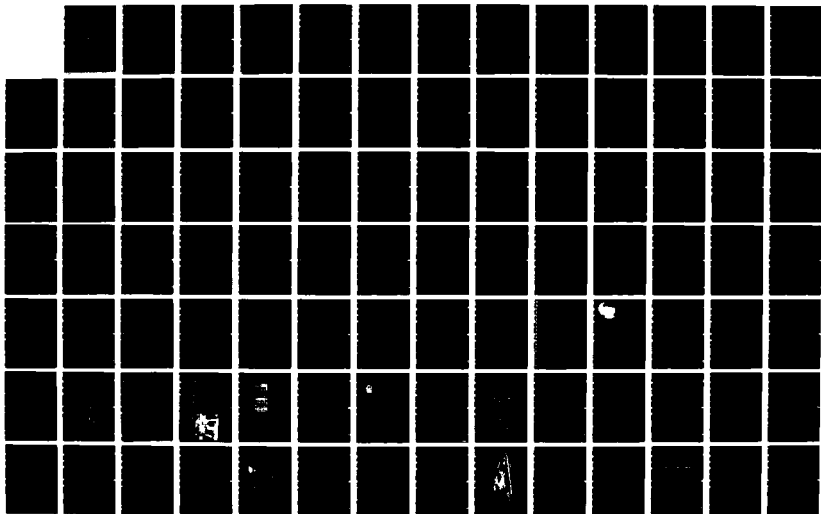
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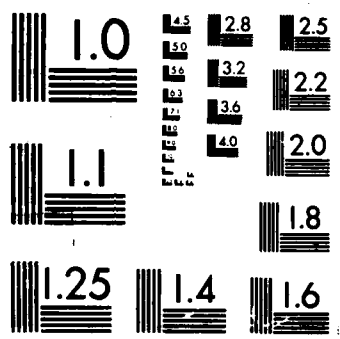
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5. For each missile diameter, add the temperature gain (4 above) to the ambient temperature (20°C) to obtain a puncture temperature.
6. For each missile diameter, compare the puncture temperature (5 above) to the ignition temperature for the propellant.
7. If the puncture temperature is above the ignition temperature (6 above), assign a probability of one (1.0) for ignition given puncture; if the puncture temperature, is below the ignition temperature, assign a probability of zero (0) for ignition given puncture. Do this for each missile diameter. This crude method will suffice unless puncture temperatures are close to ignition temperatures.
8. For each range of missile diameters, multiply the conditional ignition probability (7 above) for the midpoint of that range by the fraction of punctures assumed (in your risk analysis) to be caused by that missile diameter's range. (These fractions should add up to unity).
9. Sum up these products (8 above). This sum is an estimate of the probability of ignition given puncture. If all punctures result in temperature above ignition, the conditional probability is one.
10. Apply this method for all classes of puncture accidents.

The major uncertainties of this method involve the assumed heat distribution of the dissipated kinetic energy and the assumed ignition temperature appropriate for these conditions. The method could also be employed to bursters, however, we believe that the probabilities would be lower because the effective ignition temperatures for bursters (which are designed to detonate by shock) under these conditions are likely to be higher than for propellants (which are designed to be initiated by heat, to ignite). In addition, the casings of bursters are not as thick and thus the kinetic energy dissipated through

puncture is less.

Some concern might be expressed that the above method does not consider the velocity of the penetrating object. This is not the case. The method determines the probability of ignition given puncture of the steel rocket casing. The energy for a missile or object required to puncture the casing is a function of the missile (stub, probe) velocity relative to the steel casing. An object with a low velocity will not penetrate the casing and thus the conditional probability described above does not apply. An object of the same mass at a higher velocity however, might penetrate the casing and thus the conditional probability would apply. Thus, the conditional probability applies only to the higher velocity (relative to the casing) objects of a given mass class (those with sufficient kinetic energy to cause puncture).

The velocity of the puncture could influence the heat distribution. If heat dissipation occurred very rapidly (due to a high velocity puncture), the peak temperatures would be higher than if the puncture resulted from a more massive and slower penetrating object. This effect of puncture velocity is not included in the above method. The method could be modified by assuming that the area of heat dissipation (step 4) was inversely related to the puncture velocity. Thus, a higher velocity puncture would dissipate heat over a smaller area thus producing a higher peak temperature. This peak temperature, however, would rapidly decrease and thus its relative influence on ignition

might be less than crude calculations indicate.

We do know that high velocity puncture (30 caliber ball ammunition) does produce ignition essentially every time. The method above should lead to a conditional probability of one for such a puncture. We have found no data that would allow the above method to be modified to include a functional relationship between puncture velocity and the effective distribution of heat. In the absence of such data, we believe that the conservative assumptions included in the above method are justified. We do not believe that the risk of puncture ignition should be ignored for puncturing objects with velocities substantially less than 30-caliber ball ammunition (see Section 12.9).

The method outlined above may underestimate the probability of accidental rocket ignition for rockets inside containers. If in an accident, rockets break loose from their wooden pallets, they may experience significant forces that could cause ignition even if the container is not punctured (bending, buckling, crimping, etc.). Additional forces would be encountered during the "clean up" operations after an accident. Finally, particularly in a train accident, "dynamic crush forces" might be encountered that could result in a kinetic-ignition (see Section 12.4). We must point out that the calculation of "spontaneous" detonation that did address "dynamic crush forces" were based upon burster detonation and not rocket ignition. A review of the references demonstrates that rocket ignition is included in item number BE61(R).

In the following section, we will address inconsistencies in the computational methods employed for "dynamic crush forces."

#### 12.7 Inconsistencies: Truck and Rail Transportation

In developing methods to estimate accident probabilities given limited data, two general guidelines should be followed:

1. Tend toward conservative assumptions, and
2. Maintain consistency in assumptions and methods among different classes of accidents.

The second guideline, consistency, is particularly important when alternatives are to be compared on the basis of risk. If conservative assumptions are made for one alternative and not another, comparisons of relative risks are misleading.

We have reviewed the risk analysis to see if significant inconsistencies can be found that might lead to misleading comparisons. We believe that there is an inconsistency between onsite truck transportation and offsite rail transportation that would tend to minimize (in a relative sense) the risks of rail transportation.

In brief, with respect to "burster detonation," steps were taken to convert "impact" into the "dynamic crush forces" or "undue mechanical forces" involved in a rail accident. These same types of conversion steps were not done for rocket ignition. Thus, because in a rail accident munitions in vaults "experience no impact," rocket ignition plays no role in rail accidents. This inconsistency leads to relatively lower risks for rail

transportation (see Section 12.2). To illustrate this inconsistency, we have drawn together in Table 12.3 the conditional probabilities from the risk analyses.

Given a truck accident, the ratio (I/D) of rocket ignition probability to burster ignition probability is estimated as follows (from data in Table 12.3):

$$I/D = BE61(R)/BE61 = 0.002/9 \times 10^{-8} = 2.2 \times 10^4$$

Available data does indicate that, given an impact or puncture by 30-caliber ball ammunition, rocket ignition is much more likely than burster detonation. However, because the data are very limited and no burster detonations occurred, one cannot say that the I/D estimated above is reasonable; it could be off by an order of magnitude or more and still be consistent with the available data. Nevertheless, the value of I/D given above is consistent with the risk analysis calculations and is not inconsistent with the available data.

For a train accident, the burster "impact" method that led to BE61 was transformed to yield "dynamic crush forces" and the result was  $BE53 = 1 \times 10^{-5}$ . This same transformation was not done with BE61(R). It is this inconsistency that concerns us.

If we assume that I/D is approximately the same for truck accidents and rail accidents, one can obtain a rough estimate of what a "dynamic crush force" for rocket ignition might be. That is, BE53(R), "dynamic crush force" sufficient to ignite rocket in vault, would be (refer to Table 12.3):

TABLE 12.3 - CONDITIONAL PROBABILITIES FOR ROCKET  
IGNITION AND BURSTER DETONATION FOR  
TRUCK AND TRAIN ACCIDENTS

---

Truck Accident

| Event No | Name                                                            | Probability            | Scenario                                                                                 |
|----------|-----------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------|
| BE61(R)  | Impact force<br>sufficient to<br>ignite rocket (a)              | 0.002                  | VOXYZ004<br>(onsite and<br>collocation<br>options, see<br>ref. 1 and 4;<br>also ref. 21) |
| BE61     | Undue mechanical<br>force sufficient<br>to detonate burster (b) | $9 \times 10^{-8}$ (d) | VOXYZ015<br>(onsite and<br>collocation<br>options, see<br>ref. 1 and 4)                  |

---

Train Accident

|      |                                                               |                    |                      |
|------|---------------------------------------------------------------|--------------------|----------------------|
| BE53 | Crush force sufficient<br>to detonate burster<br>in vault (c) | $1 \times 10^{-5}$ | RWXYZ015<br>(ref. 8) |
|------|---------------------------------------------------------------|--------------------|----------------------|

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- (a) Mistakenly defined as "burster detonation" in draft risk assessment (July 1987): primary reference (2) makes clear that this term applies to rocket ignition.
- (b) In a calculation sheet (6), this term is calculated as an impact accident with frequencies of detonation computed for velocity ranges.
- (c) In a calculation sheet (6), impact velocities are converted to dynamic crush forces by equating kinetic energy of impact to this force times a detonation distance of three inches; a "mass" (weight is the proper term) of 1500 lbs was assumed when deriving the kinetic energy. This term was defined as the "frequency of spontaneous detonation given a train accident producing undue mechanical forces."
- (d) In the August 1987 draft risk assessment this probability is given as  $4.7 \times 10^{-10}$ , we do not have the worksheets on the calculation of this number. We are concerned however that burster detonation and rocket ignition data may have been mixed together.

$$\begin{aligned}
 \text{BE53(R)} &= \text{BE53 [I/D]} \\
 &= [1 \times 10^{-5}] [2.2 \times 10^4] \\
 &= 0.22
 \end{aligned}$$

This is an exceptionally high number (also see Section 12.7). This is, of course, a conditional probability. Thus, the probability of an accidental rocket ignition is still very low because the probability of a train accident is low. However, given a train accident (an unlikely event), this calculation indicates that the probability of an accidental rocket ignition is high. While we certainly do not defend this particular number, these simple calculations point to the significance of the inconsistency.

If rocket ignition had been computationally treated in a manner consistent with what had been done for burster detonation, rocket ignition would have become the dominant accident scenario for rail transportation. Because rocket ignition was not treated in a computationally consistent manner, rocket ignition accidents play essentially no part in rail transportation.

We recognize that in the final analyses, there will probably be different structural characteristics of the rail and truck transport packages, as well as different accidents to which each transportation mode is subjected. All such factors need to be considered for the best predicted risk analysis.

While we are not putting forth or defending any particular numbers, we are forced to conclude that:

Inconsistencies within the risk analysis lead to the relative underestimation of rail accident risks in comparison to truck transportation risks with respect to accidental rocket ignition.

With this conclusion in mind, we recommend the following:

#### RECOMMENDATION

The influence of "dynamic crush forces" and "undue mechanical forces" on the risk of rocket ignition should be reviewed and made to be more consistent with the handling of burster detonation in rail accident.

While seeking to promote consistency, (guideline 1, above), conservative assumptions are still called for (guideline 2, above).

#### 12.8 The Use of Conditional Probabilities Developed on a Per Munition Basis

Because units are often missing from probability summaries and descriptions, it is often difficult to check the method employed when probabilities are combined. We have reviewed the work described in the calculation sheets where available; these have been most helpful. The latest (August 1987) draft risk analyses have done a better job of specifying the units, however some confusion still remains. Because some final results are classified, we have been unable to review calculations. Thus, some questions remain.

We are concerned how the overall probabilities of truck accidents are computed. In the earlier (July 1987) draft risk

analysis, the following description was given:

The number of munitions truckloads is computed from the classified stockpile values divided by the number of munitions per truck load from Table 10-2. The accident frequency is determined by first multiplying the values in Tables 10-5 by the number of truckloads. This product is multiplied either by the number of onsite truck miles or by the number of onsite "truck exposure years" (Section 10.3, ref. 1).

In the more recent (August 1987) risk analysis, this same description was given (it does appear that tables were numbered incorrectly, page 8-29, ref. 5).

From our review of the original references and calculation sheets, it appears that some conditional probabilities were determined on a per munition basis. Such probabilities include BE61(R) and BE61 given in scenario VOXYZ004 (1, 4).

We believe that the accident of significance to be concerned about is the ignition of one or more rockets, or the detonation of one or more bursters, within a container. In particular, a single rocket ignition inside of a container would have a very high probability of igniting other rockets in the containers (see Section 12.7). If the probability of such an accident is to be estimated, it appears that the probabilities obtained by the method described above should be multiplied by the number of munitions per truck. It may take only one munition ignition or detonation to result in serious consequences. It appears to us that the risk analysis method cited above underestimates the risks involved because it does not multiply the conditional probabilities obtained by the number of munitions on the truck. A similar and greater underestimation may occur in the calculated

conditional probabilities of serious accident given a train accident. The numbers of munitions would not, of course, change the probabilities of truck or train accidents. However, the conditional probabilities (ignitions or detonations given an accident) would be a function of the numbers of munitions involved in an accident.

Because we do not have the actual calculations to review, we are not able to check out our concerns. We believe that these concerns should be checked out and either: (a) the conditional probabilities should be revised upward to account for the numbers of munitions per accident vehicle or, if this has already been accommodated in the calculations, (b) the description of the method given in the risk analysis should explain how conditional probabilities based on a per munition basis are employed to obtain probabilities on a accident per mile, per event, or per project basis.

#### RECOMMENDATION

The use of conditional probabilities (frequencies) developed on a per munition basis to determine accident probabilities should be examined and explained.

#### 12.9 Packing for Transportation

At the time of our review, the design of the transport container was in the concept phase. We believe the credibility of an accidental impact ignition of the M55 rocket within a container should have a significant influence on the design of the container.

Within any transport container, rockets are held in place by wooden pallets. Regardless of the strength of the containers, in an accident, rockets could break loose within the container and crash into each other and the inside of the containers. The forces involved in such a crash are not limited to "impact" as defined in the risk analysis (see Section 12.2). A single rocket ignition inside of an insulated container would likely ignite other rockets and bursters. Tests that we have reviewed on the sympathetic ignition of rockets due to a single rocket ignition do not apply to a closed container. Such test were conducted with single pallets in the open; ignited rockets either were propelled from the pallet (12) or were vented to prevent this. A closed environment containing other pallets of rockets is an entirely different condition, particularly when the container is small, insulated, and tightly constructed. It is highly unlikely that any container would be able to contain the consequences of a single internal ignition that can be expected to cause other ignitions and detonations. The container might be just strong enough to contain forces and temperatures until they reached extremely high levels. At high temperatures, rocket propellants might explode! Given a single rocket ignition, the container could become a virtual bomb. We conclude that:

The accidental ignition of a single rocket within a transport container should be treated as a serious credible accident with extremely serious consequences.

Given such a conclusion, the internal dunnage of the

container, which reduces the probability of kinetic ignition, becomes an extremely important component of the container design and testing program. We are in agreement with the transportation panel which recommended the following:

"If the rockets must be shipped in their existing configuration, the precise packaging system requirement should be determined only after a comprehensive test program has been carried out to resolve the impact threshold and sympathetic detonation questions. These tests should be designed to yield such information as the type of cushioning needed to ensure nonignition, and dunnage concepts to eliminate sympathetic ignition if a single rocket ignited (page C-5, ref. 17).

At the time of the "packaging" review (June 1987), an inflatable dunnage was proposed. No check had been planned at that time to assure inflation of this dunnage. Such concepts need to be considered.

#### RECOMMENDATION

The design and testing of the internal dunnage of the transport containers should be considered with greater emphasis given to the ignition of the rockets within the container as a result of an accident and the "clean up" operations after an accident.

We did convey this recommendation to the "packaging team" during our June meeting. We were favorably impressed with those who made the packaging presentation and we have every reason to believe that steps consistent with our recommendation are being pursued.

The mitigation report is consistent with our own conclusion given above. The mitigation report points out, as we have, that an impact ignition in a rail accident (called "detonation," but the discussion does refer to rockets) was not considered credible

in the risk analysis but this accident was nevertheless considered in the mitigation report because, "if it did occur, it would have serious consequences." We agree! Further, we have reasoned that the probability of such an accident (rocket ignition) could be much greater than determined in the risk analysis (see Section 12.6).

The mitigation report explores the possibility of employing a "vapor-tight explosion-containment vessel." We support such studies. We are skeptical, however, that a practical explosion-containment vessel could be developed to contain the effects of a rocket ignition.

The consequences of rocket ignition within a container meeting the package system performance specification (22) should be examined. The consequences could be severe and, under conditions of internal ignition, might actually be magnified by an insulated container that was able to contain the forces until they were able to reach high levels. Would such an explosion create "undue mechanical forces" within adjacent containers? Would the "clean up" operations after such an explosion be extremely dangerous due to adjacent damage (electrical shunts disconnected from rockets in adjacent containers) resulting from such an explosion? Such questions need to be asked.

#### RECOMMENDATION

The accidental rocket ignition within a transport container should be considered as a credible accident with extremely serious consequences; the extent of such consequences should be examined and mitigation steps taken.

If the consequences of a container explosion are found to be severe, controlled venting of the container under conditions of high internal temperature and pressure should be considered. The choice between a catastrophic explosion and a less catastrophic venting (if possible) might favor venting in extreme circumstances. As a "side note" of interest, controlled venting of containments during extreme nuclear power accidents are being considered for boiling water plants. A recent New York Times article (23) stated:

"Among engineers at the Nuclear Regulatory Commission and elsewhere there is a growing belief that in some accidents, the choice would be between a catastrophic release of nearly all the radiation in a plant when a containment bursts from too much pressure, or a 'less catastrophic' release through controlled venting."

This reasoning is not unlike our own given above.

If rocket ignition within a container is found to be a serious and credible accident and an offsite disposal alternative is selected, it might be wise to consider onsite disposal only for those munitions that pose a serious risk of accidental ignition or detonation during transportation.

One possible mitigation step would be to fill in the voids of a loaded transport container with water (or an appropriate solution). Because water conducts heat well and has a high heat capacity, it could serve to reduce the peak temperatures involved in any accidental dissipation of kinetic energy (recall the spray on the shear machine). Such an action might cause more problems than it's worth (we are skeptical), however, it might be worth considering if an offsite alternative is selected.

## 12.10 Degradation of Propellant Stabilizers

In previous chapters (see Sections 10.4 and 11.2), we have reasoned that the autoignition of the rocket propellant must be taken seriously. While the probability of autoignition per year is unspecified, we do know that this probability can be expected to increase with time. The consequences of autoignition would be severe (see Section 11.3).

In the future, the program may be faced with decisions involving project delays (see Section 10.1). Analyses must now be done so that the risks of such delays can be better assessed. We have recommended continued sampling of the munitions (see Section 10.4). In addition, we also recommend computer simulation studies.

The uncertainty analysis (ref. 10, Section 2.6) of the risk analysis for continued storage provides a useful and concise description of simulation techniques. These techniques should be applied to the degradation of propellant stabilizer and the risk of autoignition. In brief, such a simulation study should involve:

1. The development of a model(s) of the chemical processes involved and their dependency upon environmental conditions such as temperature (ref. 24) provides a simplified description of such a model).
2. Selecting "pseudo-random" sample values for process coefficients and environmental variables from corresponding distributions developed from data (where available) and professional judgement employing conservative assumptions.
3. Combining 1 and 2 (above) in a series of simulation runs of sufficient size, develop pseudo-randomly generated values of output functions.

4. Conduct a series of simulation runs to identify worst case plausible conditions with respect to stabilizer degradation and autoignition including temporal and spatial variations, wall effects, and pockets within the propellant.

Such a simulation study, along with continuing chemical analysis of propellants including aging (elevated temperature) studies, could help to accomplish the following:

- (a) provide improved estimates of the risks of autoignition as a function of time,
- (b) through sensitivity analysis, provide guidance to laboratory studies and sampling so as to improve the model and gain better information on those parameters most relevant to (a) above,
- (c) identify indicators of relative risks of autoignition that would help to identify potentially dangerous lots and evaluate unexpected changes, and
- (d) help to interpret and guide sampling results and the statistical analysis of such results.

These suggestions are summarized in the following recommendation.

#### RECOMMENDATION

Computer simulation studies should be conducted to examine propellant destabilization and the risks of autoignition as a function of time.

#### 12.11 The August 1987 Draft Risk Analysis

We did not receive the August 1987 draft risk analysis in time to include it in our review. In fact, the majority of the material written in this chapter was completed before we received the August 1987 draft. Moreover, we did not have the most recent worksheets and therefore it was difficult to check assumptions. We did conduct a brief review of the August draft. The risk

analyses are impressive. With respect to accidental ignition of the rocket, however, we found very little that would cause us to change the material presented in this chapter.

While some changes in methods and numbers have occurred (and thus are different from those cited in this chapter), these changes appear to have little or no influence on the conclusions and recommendation of this chapter. In our view, rocket ignition is not adequately addressed.

The following statement appears several times in the risk analysis.

"Puncture-induced rocket propellant ignition has not been included because there is no evidence that a probe exists or could occur at the velocities necessary to cause puncture-induced propellant ignition. A 30-caliber bullet traveling about 1500 mph is required." (5, 9)

We strongly disagree with the reasoning and implications of this statement! We agree that a 30 caliber bullet travels at about 1500 mph. We agree that a 30 caliber bullet will cause a rocket ignition (if fired through the steel casing) at a frequency close to 100%. But, to conclude that a "a 30-caliber bullet traveling about 1500 mph is required" (emphasis added) is totally unjustified! Granted, there is essentially no data on lower velocity punctures (with the exception of the evidence from the shear machine ignitions). But, it makes no sense to conclude that a 30-caliber bullet at about 1500 mph is required because these are all the data available. It is absurd to then justify not including puncture-induced rocket propellant ignition because there is no evidence of probes that could occur at such

velocities. Clearly this reasoning must be rejected as a justification for not including an entire class of potentially serious accidents.

We stand by the method for puncture-induced rocket ignition outlined in Section 12.6 of this chapter. We recognize and expect that some modifications of this method might be needed once it is applied with real numbers and checked against the limited data available. However, we believe that our method points toward a far more reasonable line of reasoning than the statement cited above that appears many times in the August 1987 risk analysis.

#### 12.12 Mitigation

We were very favorably impressed with the mitigation efforts (18). We support the existing plans for continuing these efforts. We have found that the mitigation team has independently raised concerns similar to our own and taken steps to mitigate the risks and consequences. With respect to the concerns of this chapter, a few comments are made in support of mitigation proposals.

A kinetic-ignition of the rocket (see Section 12.4) through puncture, abrasion, or crimping of the steel casing by a forklift tine cannot be ruled out, though it is a highly unlikely event. Limiting the speed of the forklift and increasing the area of the tine with blunt hard rubber tips (page 5-11, ref. 18) would help to reduce the risk of such an accident in addition to those

accidents identified in the risk analysis. We also support removing the propellant from the 4.2 inch motor shells and 105 mm cartridges prior to transportation, particularly if an offsite alternative is selected. The development of improved fire fighting equipment also appears reasonable.

Finally, we wish to again support the continuation of such mitigation efforts throughout the duration of the entire project (see Section 10.2).

#### 12.13 Frequency of Detonation Calculations

While this chapter has been concerned with rocket ignition, some comments are offered on the burster detonation calculations done in Appendix A2, 5/15/87 and 5/26/87, "Compute Frequency of 'Spontaneous' Detonation for Truck Accident" (6).

The method assumes a lognormal distribution of detonation probability with velocity. The conditional probability (frequency) for detonation is then calculated for different impact velocities. These conditional detonation frequencies are then multiplied by the relative frequency of different velocity ranges and an administrative frequency giving a weighted frequency for each velocity range. These weighted frequencies were then added over all velocity ranges to produce a total "frequency of detonation given an accident producing impact." Based upon our review of the calculations, we have two concerns that could both lead to underestimations of this conditional frequency (probability).

1. The "unweighted detonation frequencies" used for each velocity range were determined from the bottom (lowest value) of the velocity range rather than the midpoint of the velocity range. Because such frequencies increase with velocity, this approach tends to underestimate the weighted frequency for each velocity range. This, in turn, results in an underestimation of the total frequency for all velocity ranges.
2. The method used to determine the effect of administrative controls leads to nearly a thousand fold decrease in frequency of detonation given an accident producing impact in the first calculation that included velocity ranges up to 60-70 mph. A further reduction occurs when maximum velocity ranges are reduced to a 20-30 mph. Such administrative reductions do not include those that would reduce the probability of an accident occurring. Thus, the total reduction of the accident probability due to administrative controls could be even higher. We support administrative controls and agree that they serve to reduce probabilities of accidents, however, when taken altogether, the influence of administrative controls may have been overestimated.

In the calculations dated 5/15/87 (6), the "frequency of spontaneous detonation given a train accident producing undue mechanical forces" is determined by a similar approach except that velocity ranges are replaced by "dynamic crush" ranges (lbs). The bottom of the dynamic force range is employed rather than the midpoint. In this case, however, the influence of this method is not as great as with the velocity ranges discussed above. No administrative reductions were employed.

The calculations employed in the more recent (August 1987) risk analysis should be checked to see if similar underestimates occur.

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## CHAPTER 13

### ATMOSPHERIC EMISSIONS FROM DEMILITARIZATION

Permitted atmospheric emissions from a hazardous waste incinerator are set by the U.S. Environmental Protection Agency. Only three emission standards are covered:

- Principle Organic Hazardous Compounds (POHCs) 99.99%  
Destruction Removal Efficiency (DRE)
- Particulate Emission Standard 180mg/dscm
- HCl Removal Efficiency 99%

The demil facility should have no trouble meeting these federal standards with the proposed incinerators and pollution abatement systems (1). Other emission standards can be invoked by state and local governments.

One serious shortcoming of the documents examined concerns the emission of oxides of nitrogen (NOx) from the facility. In the original DPEIS, NOx was not even listed as an emission. In the permit application to Oregon Department of Environmental Quality (1), an analysis is made of the amount of NOx emitted from the facility. In a recent letter from J. A. Scott, Project Director for Ralph M. Parsons Company to the U.S. Army Engineering Division, Huntsville (2), the "Products of complete incineration of 'HD' (Predicted) are listed as 'CO<sub>2</sub>, H<sub>2</sub>O, SO<sub>2</sub>, HCl, N<sub>2</sub>.'" Note that NOx has again been eliminated from the list.

Of greater concern, however, are the calculations involving NOx which appear in the permit application (1). The following

information is extracted from Tables F-2-8 and F-2-9 of the permit application:

| Pollutant Emitted                     | Particulate | SO   | NOx  | CO   | NMHC |
|---------------------------------------|-------------|------|------|------|------|
| Table F-2-8, LB/HR<br>Facility Total  | 16.5        | 11.5 | 85.8 | 6.6  | 0.23 |
| Table F-2-9, TON/YR<br>Facility Total | 39.7        | 27.8 | 51.1 | 14.9 | 0.48 |
| Ratio TON/YR:LB/HR                    | 2.40        | 2.42 | 0.59 | 2.25 | 2.08 |

It is difficult to see why the ratio for NOx is so out of line with the other pollutant emissions. If this is roughly analyzed, another way, using the permit application data, the following data can be developed:

| NOx Emission From | LB/HR | Use Factor | HR/Year | LB/YR   |
|-------------------|-------|------------|---------|---------|
| Process Steam     | 5.3   | 0.50       | 8,760   | 23,214  |
| Building Heat     | 2.7   | 0.38       | 8,760   | 7,884   |
| LIC               | 11.8  | 0.80       | 6,000   | 56,640  |
| MPF               | 4.6   | 0.80       | 6,000   | 22,080  |
| DFS               | 61.2  | 0.80       | 6,000   | 293,760 |
| DUN               | 0.2   | 0.80       | 6,000   | 460     |
| Total             | 85.8  |            |         | 404,538 |

404,538 pounds per year is 202 tons per year which again does not compare with the 51.1 tons per year previously stated. It is interesting to note that  $202 - 85.5 =$  a ratio of 2.35, which compares favorably with the other pollutant ton/yr - lb/hr ratios. It should be noted that the NOx annual emission rates,

calculated by the Army, include the contribution that the different munitions type make.

A further check could be made if the quantity of natural gas used were known, but this is listed as "Confidential" in the permit application. This exercise leads to questioning the statement made on page C-1-1 of the application (1) which states:

"Because emissions from the proposed source for all pollutants, including NOx, are estimated well below the 250-ton-per-year level (Section F-2) and the facility is located within a region which beyond 50 kilometers, is designated attainment for all pollutants (Section G-2), the proposed facility is exempt from new source review requirements."

This entire discussion is probably academic anyway because the proposed incinerator is located so far from a non-attainment area that no difference will be noted if the NOx emissions were 85 tons per year, 202 tons per year, or 249 tons per year. All would be legal emissions with no serious consequences.

#### RECOMMENDATION

The projected atmospheric emissions are attainable and are not hazardous to human health. The permit should be approved.

#### REFERENCES

1. Application for Air Contaminant Discharge Permit for the Department of the Army, Umatilla Depot Activity, Chemical Stockpile Disposal System, Submitted to Oregon Department of Environmental Quality, Air Pollution Control Division, March 1987.
2. Scott, J. A., Project Director, The Ralph M. Parsons Company Letter to U.S. Army Engineer Division, Huntsville, File No. 3.2.1, Task D-4-40, PC-1005, August 10, 1987.

## CHAPTER 14

### AIR AND WATER QUALITY CONSIDERATIONS

#### 14.1 Air Emissions - Disposal Facility

Sources of atmospheric emissions from the disposal facility include those from the process steam boiler, building heat boiler, liquid incinerator, metal parts furnace, deactivation furnace, dunnage incinerator, ventilation system, and brine evaporator (1,2). Of these, the latter six potentially contain chemical agents and will be addressed here. Each of the first three combustion emission sources is equipped with a pollution control system consisting of an afterburner, quench tower, venturi scrubber, packed bed scrubber, and demister. For the dunnage incinerator, a baghouse filter is employed instead of the venturi scrubber, etc., prior to discharge to the atmosphere. The two furnaces and the liquid incinerator share a common exhaust stack. The ventilation system exhaust is treated with a filter train for particulates removal and adsorption of organic compounds. The brine evaporator system has no emission control equipment since the feed brines are monitored for chemical agent and treated by addition of an appropriate decontaminant if agent is detected.

Under normal operations, the predicted atmospheric emissions of agents from disposal facility sources are well within air quality standards (1-hr emission limits) for the State of Oregon (2). Air quality modeling analysis was reported for chemical

agent dispersion using EPA recommended procedures and models. Maximum predicted downwind concentrations were compared with permissible exposure limits as established by the U. S. Surgeon General. For all three agents (GB, VX, and mustard), predicted concentrations were greater than a factor of 100 less than the permissible limits (2). Based on the above cited information, it is apparent that under normal operating conditions, no significant impact is anticipated from the disposal facility.

Abnormal operations, or conditions resulting from malfunction of incinerators, furnaces, or pollution abatement equipment, were addressed in the DPEIS (1) or Air Permit Application (2). Apparently it is assumed that the level of redundancy and containment in the disposal facility, in combination with the monitoring system, including automatic shutoffs are sufficient to preclude accidental atmospheric releases.

A system of monitoring that includes automatic control and shut-down capabilities is a primary means proposed for prevention of accidental releases of chemical agents. There are four types of agent monitors employed that have varying sensitivities, response times, and purposes. Monitors are located in a monitoring house on the exhaust stack from the furnaces and incinerators. Automatic cut-off of feed systems is caused upon detection of chemical agents in the stack. The two monitor types used for automatic control have response times of about 10 to 15 minutes. Thus, excessive concentrations of chemical agents could be released for at least this period of time prior to initiation of

feed cut-off. Additional time may lapse if a level of redundancy is built in such that confirming evidence is required before shut-off is initiated. Depending on the inventory of chemical agent in the incinerator, fugitive agent release may further continue for an unspecified period of time. Because of this possible lag, the Army is relying primarily on furnace process controls to provide a means of detecting upsets, correcting them, if possible, and shutting off furnace systems if this correction is unsuccessful.

Another condition that warrants consideration is that of false alarms. If the monitoring system is overly sensitive or responds to interferences or non-target chemical species, frequent unnecessary shut-downs may occur. This could engender a complacent atmosphere among operators and lead to illicit disconnections of monitors.

For the reasons stated above, atmospheric releases of chemical agents and their incomplete combustion products should be calculated for proposed malfunctions and worst case accident scenarios. These releases should be compared to appropriate regulatory criteria. Furthermore, because any worst case releases appear to have the potential for causing downwind hazard, then an accidental release dispersion model such as the D2PC computer program (discussed in greater detail in Section 14.2) needs to be available onsite for dispersion plume calculations. The source term subroutines of the program must be appropriate for the types of releases expected for the proposed

accident scenarios, such as so-called "puff" releases (short duration, large magnitude) and perhaps time-varying releases.

#### RECOMMENDATION

Accidental release scenarios should be developed that include malfunctions of the incinerators or air pollution abatement systems. Quantities of chemical agents released should be estimated for worst-case conditions.

#### RECOMMENDATION

An appropriate atmospheric dispersion model needs to be on-line to calculate chemical agent plumes in the event of accidental releases from the demilitarization facility.

### 14.2 Accidental Releases - Air

#### 14.2.1 D2PC GAUSSIAN DISPERSION MODEL

The D2PC computer model was developed by the Army for use in predicting the hazards of accidental releases of chemical agents to the atmosphere. Its most recent form is described in the document Personal Computer Program for Chemical Hazard Prediction (D2PC) (3). The model is based on the standard Gaussian dispersion technique to calculate downwind concentrations of contaminants released to the atmosphere. The program has been adapted to handle the release of the chemical agents in the Army's chemical weapons disposal program. This includes subroutines to predict the magnitude of the source term, or quantity of agent released under various accident scenarios from the different chemical weapons in the Army's inventory. Specific data inputs

required to run the model include the type of agent released, quantity of agent released, mode of agent release, and meteorological conditions. The program appears to provide reasonable predictions of downwind concentrations for most atmospheric conditions and release scenarios. It is the program presently being used at the eight continental U. S. chemical weapons storage locations for emergency response predictions of downwind hazard distances for any accidental releases that may occur during storage and handling activities.

The DPEIS (1) uses the D2PC model to predict the maximum downwind distance (ground level) at which lethal effects are predicted, that is, the no-deaths distance, for various accident scenarios. Accidents are divided into severity categories according to predictions of no-deaths distances of 0.5, 1.0, 2.5, 10.0, 20.0, 35.0, and 50.0 km downwind. Populations at risk (PAR) can also be predicted for these accident severity categories by the estimated land area encompassed by the dispersion plume of the agent. For the Umatilla Depot, Table 2.5.5 of the DPEIS uses a maximum accident scenario (release parameters not specified) to predict a PAR of 24,190 at a downwind distance of 20 km resulting in an estimated maximum fatalities of 412. Meteorological conditions used were those considered as "conservative most likely". Because the specific parameters of the release and the meteorological condition parameters were not provided, it is difficult to evaluate the calculations in Table 2.5.5 and to place them in a spectrum of possible accident

scenarios and conditions. However, these calculations certainly provide an indication that severe consequences could result from major accidental atmospheric releases of agent at UMDA during chemical demilitarization activities.

A major concern arises in use of the D2PC model for conditions that may be outside the intended limits of the Gaussian dispersion technique. These conditions could include extremely large releases of agent resulting in far downwind dispersion of the agent, extremely stable meteorological conditions with low wind velocities, situations in which meteorological conditions change at some time after a release, and other combinations of conditions. Specific limitations of the model are not listed in the DPEIS and so it is not possible for the reader to ascertain the validity of D2PC calculations under extreme conditions. However, implicit limitations were recognized as stated in the following quote on p.4-5:

The no-effects distances for large releases cannot be calculated accurately by the D2PC code, since the basic Gaussian assumptions become invalid over the long travel times and large distances involved. To solve the problem, a technique (see Appendix K) to estimate the downwind extent of small concentrations of agent was developed. The approach is used to estimate the potential downwind distance affected by small concentrations of agent and represents a simple screening technique for predicting the extent of impacts from a release.

A review of Appendix K of the DPEIS reveals that the technique developed for the conditions stated above is a "box model" approach. The D2PC code is used in combination with a downwind moving volume (or box) that is assumed to "disperse"

in a fixed arc of 30° with a fixed height of 750 m.

The supporting information provided in Appendix K for the development of the "modified box model approach" is very limited. There is apparently no precedent for the manner in which the box model approach is adapted for this or even similar applications. The technique developed is certainly not site specific since the mixing height and dispersion factors are taken to be constant and not to vary with meteorological and geographical conditions. No evidence is provided to judge whether the parameters assumed represent conservative or "worst-case" conditions. As presented in the DPEIS, the use of the box model modification to the D2PC model cannot be considered completely valid for prediction of agent dispersion and downwind hazard distances even though the EPA has reviewed their application and found them "acceptable." Army personnel are well aware of the limitations of the D2PC model and are presently developing alternative or improved versions of the model (James Walters, personnel communication).

Output from D2PC model computer runs is presently based on calculation of the no-deaths distance although a "no-effects" dosage has been identified and can be used in the D2PC code. There are also sub-lethal effects of the chemical agents that are of concern to the general public and for which notice must be given. Sub-lethal effects concentrations could include those at which the most sensitive individuals in the population first experience physiological effects, those at which the general

population experiences similar effects, those at which chronic impacts may be evident, those at which other effects are noticeable such as impacts on agricultural crops, and those at which other terrestrial biota are impacted.

The following recommendations are made with regard to accidental release dispersion models:

#### RECOMMENDATION

Fundamental assumptions of all atmospheric dispersion models should be clearly specified, such as the dispersion technique, computational algorithm (numerical vs. explicit solution), and fixed parameter values with rationale for value selections.

#### RECOMMENDATION

For any model atmospheric dispersion employed, specific conditions for which the model calculations are considered valid as well as limiting conditions of the model should be clearly listed.

#### RECOMMENDATION

If a unique modeling technique is developed for agent dispersion calculations for the chemical weapons disposal program, the predicted concentrations and plume profiles should be validated by making comparative runs with at least two generally accepted air dispersion modeling programs (e.g., EPA ISC and similar models). In addition, tracer studies should be performed to validate the model using site-specific data and real-time meteorological information.

#### RECOMMENDATION

The dispersion model used for accidental atmospheric releases of chemical agents should be tested under simulated emergency conditions. The model input data requirements and computational algorithm must be kept simple enough such that output is generated within time limits imposed by emergency response protocols.

#### RECOMMENDATION

Dispersion model calculations (program output) should be based on criteria other than (or in addition to) lethality to humans. Distances at which sublethal effects concentrations are realized should be predicted and used as a basis for varying levels of emergency response.

#### RECOMMENDATION

A full-time atmospheric scientist should be employed onsite. This employee is responsible for analyzing real-time meteorological data and assuring proper application of the computer model used to estimate agent release from an incident/accident.

#### 14.2.2 EMERGENCY RESPONSE

Prediction of downwind hazard from accidental release of agents to the atmosphere is one of the first activities in emergency response. Results of model predictions are the primary information used in deciding what level of emergency response is required both on and off base. It is thus of critical importance that emergency response procedures are well coordinated to ensure rapid and accurate transfer of information to the location and persons responsible for running the computers that generate model output. Information may initially come from operators who directly observe accidents that cause releases, or from automatic monitoring equipment. Thus, the roles of monitoring instruments, as well as those of operating personnel, must be considered in development of accurate information on accidental releases (source term data). Several documents were reviewed that addressed different aspects of emergency response as related to air dispersion modeling. These documents included: DPEIS (1),

CSDP Monitoring Concept Study (4), Emergency Response Concept Plan (5), Accidental Releases with Off-Site Consequences (6), and Mitigation of Public Safety Risks (7).

Methods of characterizing a release must be clearly specified. The classification scheme reported in reference (5) has most of the attributes necessary to accomplish this characterization. A few important points were either omitted or not well developed. First, the procedure for characterization must include determination of what specific individuals are responsible for accident assessment. In an emergency situation, it should be known for various accident types which individual will be determining source information for input to the dispersion model. Secondly, lines of communication must be clearly specified. This should include not only the mode of communication but to what office or individual the information is to be transmitted. For operators, or those individuals determined to be responsible for reporting accidental release information, a standard format should be developed. The format should include all pertinent information related to the accidental release needed as input for the dispersion model and thus must include quantitative estimates of the source term.

The role of monitoring in emergency response is addressed in references (4), (5), and (6). It is difficult to determine unambiguously from these documents at what level of the emergency response process that monitoring information is used and this needs to be clearly specified. The following quotation is from

reference (6), sec. 6.1.3:

In those cases where the release is not observed (i.e., during storage), the storage area high-level monitors will identify the concentration and dose (i.e., time-weighted concentration) read at the receptor site. That information will be used directly to determine the downwind hazard distance and direction using real time meteorological information from the meteorological monitoring tower and using the D2PC dispersion code (see Sect 6.1.4). Moreover, the dosage reading will be used with the real time meteorological information and the D2PC dispersion code to estimate the total source size of the release (i.e., the total quantity of agent "spilled" on the floor of an igloo or other storage area), assuming both the nearest and farthest possible source of the release (i.e., which part of the storage area is involved in the release). By using this dosage estimating procedure, it will be possible to set lower and upper bounds of the total source size very quickly (<2 minutes) from the original receptor reading; ....

It is unclear how monitoring data, either historical and/or actual concentration information, can be used to "directly determine downwind hazard distance" without first determining the magnitude of the source term and the mode of agent release. Furthermore, the use of monitoring data and the D2PC model "to estimate the total source size of the release" (i.e., by back calculation) is fraught with potential errors.

Other factors in use of monitoring information for emergency response and dispersion modeling need consideration. False alarms could trigger a series of responses that themselves lead to accidents. Procedures need to be developed for determining and handling false alarm situations that minimize risks yet recognize that an emergency situation may exist. A minimum level of redundancy in monitoring needs to be employed such that the output from more than one monitor is used in determining agent

releases. Information on the reliability and accuracy of monitors and the probability of false alarms should be used to help determine the need for confirming data before an emergency response is initiated.

The following recommendations are made with regard to emergency response and dispersion modeling:

#### RECOMMENDATION

Individuals or job positions with specific responsibility for reporting emergency response information need to be identified. The lines of communication and direct receptor of the information needs to be clearly specified. The information required to characterize the release and quantify the source term for modeling predictions should have priority. A standard format should be developed for reporting accidental release information.

#### RECOMMENDATION

The revised D2PC model should be run for a spectrum of possible accidental releases of agent, including worse cases. These results can be used as default predictions of downwind hazard for emergency response purposes in cases where source term information is ambiguous, where injury to personnel has occurred precluding rapid characterization of source term information, or when inadequate time is available to make model runs on the computer.

#### RECOMMENDATION

The role of monitoring information in emergency response and dispersion modeling needs to be clearly identified.

### 14.3 Potential Groundwater Impacts

Under normal operating conditions, there is no planned discharge of liquid streams from the on-site chemical weapons disposal process (1). Brine solutions from air pollution scrubbers and decontamination solutions are either evaporated to

dryness or neutralized if they contain chemical agents. Dried brine salts and other solids residuals are specified to be completely decontaminated before ultimate disposal. Thus, assuming that liquid storage tanks and processing equipment are designed with adequate capacities, no discharges of liquids should normally occur to either surface or to ground waters.

Existing ground water resources in the Umatilla Army Depot vicinity are used extensively for irrigation and for water supply. Three of four of the cities within 10 km of the Depot use wells for their municipal water supplies. The unconfined upper alluvial aquifer is recharged from surface runoff and from infiltration. Confined aquifers are found in fractured zones in the basalt at lower soil depths. Recharge of these aquifers is from the overlying alluvial aquifer. Soils are predominantly sandy and thus infiltration rates are rapid. It is readily apparent that chemical agent spills to the ground have the potential of causing groundwater contamination and are thus of major concern.

Stored at Umatilla Army Depot are ton containers of the chemical agent VX and bulk containers of agents GB and VX. Leaks from these containers during storage, spills during transport and transfer operations, and other possible accidents are means by which the ground and eventually groundwater could become contaminated with significant quantity of chemical agent. Explosive release of agents in M55 rockets or other munitions could also lead to contamination of large amounts of agent over a wide area

including the ground. There thus appear to be several plausible accident scenarios by which groundwater contamination could occur.

In the event that a spill occurs on the ground, containment and decontamination procedures need to be established for emergency response. These have not been significantly addressed in the DPEIS or emergency response (5) documents, although such contingency plans are included in the RCRA Permit Application. Chemical reactions and biological degradation processes may aid in mitigation of chemical agents in soils and groundwaters. However, these reactions are highly dependent on environmental conditions including solution phase pH value, temperature, and composition. Certain products of these chemical degradation reactions are also toxic and may be persistent, resisting further degradation. There is insufficient information presented in the documents reviewed (references 1-7) to make a reasonable prediction of the fate and persistence of chemical agents in soils and groundwater.

#### RECOMMENDATION

Accident scenarios including worst cases should be developed for chemical agent spills to the unprotected ground. Estimates of the quantity of agent spilled and land area covered should be made.

#### RECOMMENDATION

Emergency response protocols should be developed for chemical agent spills that include containment and decontamination procedures.

#### RECOMMENDATION

Similar to the approach for surface water spills, a groundwater spill dispersion model should be developed and run for a spectrum of accident scenarios including worst cases. Site-specific conditions should be used for parameter values.

#### RECOMMENDATION

Groundwater monitoring of chemical agents and their principal degradation products at appropriately located wells should be conducted on a periodic basis to assure that undetected contamination has not occurred.

#### 14.4 Surface Water Contamination

Under normal operating conditions, no discharge of liquid streams occurs at any point in the proposed chemical weapons disposal process. There are no surface waters of any type on the Umatilla Army Depot. Runoff from precipitation events occurs by infiltration into the sandy soil rather than on the surface. The closest surface water is an irrigation canal near the northern boundary of the Depot. It is thus highly improbable that direct surface water contamination could occur from accidental spills of chemical agents. The only accident scenarios in which surface water contamination could occur are atmospheric releases with resultant agent deposition and possibly large explosive releases causing direct contamination.

The DPEIS (1) addresses surface water contamination in much greater depth than that for groundwater. The aquatic spill dispersion model that was developed for calculation of chemical agent concentration plumes is a rather simple, one-dimensional model that includes the processes of advection, longitudinal

dispersion, hydrolysis, and volatilization. It is adequate for rough estimates of agent concentration profiles downstream as a function of time. In the DPEIS, calculations performed for a "generic river" show that a significant agent spill could cause hazard downstream for tens or even hundreds of kilometers. Thus, although the probability of a significant spill of agent into surface waters at Umatilla Army Depot is very small, the impact could be great.

#### RECOMMENDATION

Accident scenarios including worst cases should be developed for contamination of surface waters in the Umatilla Army Depot vicinity. Estimates should be made of the quantity of agent and mode of contamination (atmospheric deposition or direct spill).

#### RECOMMENDATION

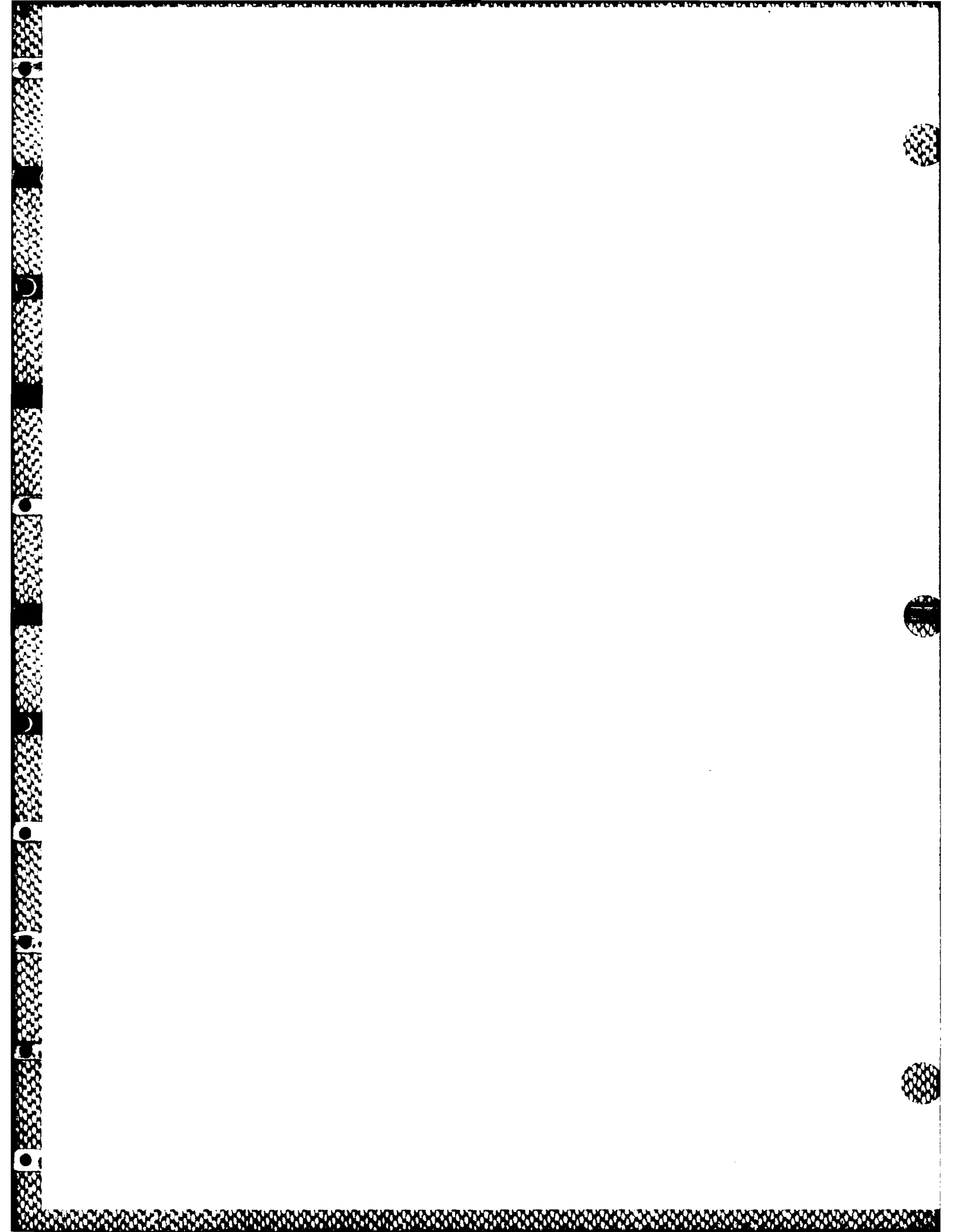
Emergency response procedures should be developed for surface water contamination scenarios.

#### RECOMMENDATION

The aquatic spill model should be run for plausible accident scenarios for affected nearby surface waters using site-specific, worst-case conditions.

## REFERENCES

1. Program Manager for Chemical Demilitarization, Chemical Stockpile Disposal Program Draft Programmatic Environmental Impact Statement (DPEIS), Aberdeen Proving Ground, Md., July 1, 1986.
2. UMDA Air Application, Revision No. 1, submitted to Department of Environmental Quality, State of Oregon, Jan. 30, 1987.
3. Whitacre, C.G., et al, Personal Computer Program for Chemical Hazard Prediction (D2PC), U.S. Army Armament Munitions Chemical Command, Aberdeen Proving Ground, Md., Jan 1987.
4. Kuryk, B.A., et al., Chemical Stockpile Disposal Program Monitoring Concept Study, Office of the Program Executive Officer - Program Manager for Chemical Demilitarization, Aberdeen Proving Ground, Md., July 24, 1987.
5. Jacobs, Schneider, Emergency Response Concept Plan for the Chemical Stockpile Disposal Program, Contract No. DACA87-86-D-0085, Delivery Order 0007, undated.
6. "6. Accidental Releases with Off-Site Consequences," no authorship, date, or other documentation provided. (Superseded by Reference 4.)
7. Program Executive Officer-Program Manager for Chemical Demilitarization, et al., Mitigation of the Public Safety Risks of the Chemical Stockpile Disposal Progra, Draft Report, July 1987.



## CHAPTER 15

### RECOMMENDATIONS FOR AUGMENTING THE HEALTH IMPACT ASPECTS OF THE DRAFT EIS FOR DISPOSAL OF CHEMICAL WARFARE AGENTS

This section of the report responds to the draft EIS as it discusses potential exposure of humans and other species to either primary agents, or products of their combustion or degradation. Because the final EIS is still in development, it is not possible to predict how the whole spectrum of biological impacts will be treated in that version of the document. From information about ongoing work, however, it appears that the final document will be much more informative than the present draft.

1. It appears to us that the review of toxicologic literature has been reasonably complete. We are of the opinion that considerably more effort must be directed to interpretation of the literature in the process of completing the analysis of toxicologic risk. Items discussed below will expand on this concern. We assume that coverage of the military research on the agents themselves is complete, because we have little access to that body of literature.
2. It would be highly desirable to be able to instantaneously detect hazardous emissions from any point in the handling and destruction processes, especially the stack. However, a

real time direct monitoring system does not seem feasible, and perimeter monitoring devices may not be practical for other than historical performance data. Alternatively, the capacity of the various "compartments" in the handling and destruction programs should be defined. That information determines the upper limit of the amount that can be released from any single or combined compartment.

It is possible that by the time installations in CONUS are operational, the physical and engineering monitoring of the system would be so well documented that such data could serve as a surrogate for quick response emission data. Particularly, the temperatures in various parts of the installation, coupled with throughput information should give usable information about the character of the stack output. Even if not precise, an indication of a lapse in the process could be used to indicate a maximum possible excursion.

Stack emission estimates and limits for unintended losses prior to combustion provide a basis for upper limit exposure estimates at any point away from the source in the event of an incident, if dispersal models and data are in place. When combined with data on dose-response, discussed below, it seems likely that estimates of the full spectrum of expected biological response at any point could be obtained almost immediately.

3. To develop such an estimate of risk, all of the known non-

lethal effects and dose response information of the agents or their products should be considered. This is perhaps our most important recommendation in the realm of health hazard assessment. The earliest and most sensitive responses are far more important than lethality, which the EIS seems to imply is the end point of primary concern. If the potentially affected population is defined only according to the number and distribution of fatal exposures, the public will be given an incorrect sense of the nature of the chemicals and the process of risk evaluation. The fact that these chemicals are intended to kill people has no more meaning in the context of risk analysis than the fact that gasoline is intended to power engines, unless a catastrophic event causes release of vast quantities, with exposures resembling those of military use.

In the case of the organophosphates, there is a very clear symptom pattern associated with acetylcholinesterase inhibition that allows for immediate clinical diagnosis if exposure is known to have occurred, as well as characteristic but much slower clinical chemistry diagnostic information. There is a considerable body of dose response information from animal studies of OP military agents and insecticides that can be the basis of relative potency information. Accidental or experimental human exposures to insecticides as well as some experimental human exposure to the military agents have been reported. The two groups of

data should allow prediction of dose rates of the agents that can be expected to cause early effects.

The models for upper limit distribution patterns discussed earlier are the basis for upper limit exposure and dose estimates, and when linked to the dose response models just mentioned, expected toxic impact predictions can be generated almost immediately. The necessity for such predictive capability for warning and response is obvious.

4. Assuming that incineration is the selected option for destruction, there should be a discussion of the toxicological character of the combustion products. For both classes of agents, it is highly likely that even with inefficient combustion, the agents will lose their original toxic character. The products that have been identified during both complete and partial combustion are relatively simple, common compounds for the most part. Many, if not most, have a reasonably complete toxicological dossier already, which should make this discussion straightforward.
5. There is public concern about irreversible impacts such as reproductive and genetic injury, and cancer. It is evident to a toxicologist that the probability of such outcomes is remote, again assuming that truly catastrophic releases do not occur. Even then genetic injury and cancer risk should be minimal, and reproductive toxicity would most likely be a

function of major insult to the mother. Nonetheless, the EIS should include a comprehensible discussion of the concept of risk and probability and the potential for such effects because of the prevalent perception that these very common afflictions are easily induced by chemical exposure of any kind.

6. Because UAD is in the heart of a strong agricultural area, the EIS should include a discussion of various possible impacts on agriculture. An assessment of acute direct effects on livestock is easily factored from the same data used in developing a human impact assessment. Along with that evaluation should be estimates of animal exposure through ingestion of residues on forage and an assessment of losses of production. It is doubtful that exposure of animals would lead to secondary human exposure, but the potential for secondary human exposure through consumption of crops should be discussed. Obviously, persistence estimates are necessary, including the possibility of harvesting and storing forage that might have been contaminated.
7. Whether or not the EIS itself requires it, the entire spectrum of short term and long term effects of the chemicals in the stockpile should be described in as simple a fashion as is possible, for the residents of the area. The information is in the EIS but difficult for most citizens to

use. It is not enough for only emergency responders to understand the nature of the agents. As it stands, the chemicals have acquired a legendary character; the people of the community must understand that even though they are very potent substances, they are not magical, and that their effects can be described.

For example, the residents of the area around UAD are very familiar with the OP insecticides, and with an explanation of the difference in potency they will be in a position for a full explanation of the nature of the military chemicals. In fact, the general experience of the people in this areas will equip them for ready assimilation of this kind of information. They should also be provided with an explanation of the environmental behavior of the chemicals to show the interested members of the community the limits for distribution of the amounts of material that might be released.

8. Also, though again probably not a required part of the EIS, a thorough emergency training and response plan ought to be incorporated at some point. It is our understanding that such plans are under consideration, but their status is not known to us as yet.
9. As we read the EIS draft, it seems to be written with reasonable clarity, although in some cases a considerable

technical expertise seems assumed. The point in mentioning this is that various such documents have been challenged in court as not being readable by the general public. It seems advisable to have a reading expert examine the document.

In the same context, the glossary, adds more unfamiliar terms than it defines.

#### RECOMMENDATION

The maximum amount of material that can be in any "compartment" of the handling and demil process should be determined. This information provides a basis for an immediate worst case estimate of the concentration of material at any point away from the source, according to the dispersal model employed.

#### RECOMMENDATION

The dose-response relationship for the earliest and most sensitive responses to all agents should be determined. When incorporated with the dispersal/concentration model the product is an immediate estimate of the location of the expected most sensitive response.

#### RECOMMENDATION

The toxicologic character and expected impact of combustion products should be discussed.

#### RECOMMENDATION

The expected impact of the program on agriculture in the surrounding community should be discussed.

## CHAPTER 16

### OTHER CONCLUSIONS AND RECOMMENDATIONS

In their intensive examination of reference material, discussions with Army personnel, and visits to Army Depots, the study team has formed some opinions which should be expressed as conclusions, with recommendations for action. These are general recommendations to make the project safer or more creditable.

#### 16.1 Discussion of Option I

Much research remains to be done on incineration of highly toxic materials. The Army has an excellent facility for such research at Tooele Army Depot. The CAMDS is essentially an incineration system 1/3 the size of the JACADS and proposed CONUS facilities. Research can be conducted on material handling systems, corrosion resistant materials, monitoring and control systems, and pollutant abatement systems. Corrosion, for example, covers a spectrum from that occurring in low temperature portions of the system where the temperature may approach the dew point of the acid gases, to the other extreme, in the combustion chamber, where the temperature may exceed 2500F and high temperature corrosion occurs. In a research facility different materials can be tried and accurate measurement made of corrosion rates as a function of the other process variables.

After the various systems have been investigated in a research facility, they can be put into a production facility

such as JACADS. The full-size facility can be extensively monitored to determine if the same situations exist that were noted in the research facility. If the JACADS incinerators check out as being okay, then the technology can be replicated at the eight other CONUS facilities. If a problem develops at either CAMDS at Tooele, or JACADS, the other CONUS incinerators can be put on a holding cycle until it is solved (1).

#### RECOMMENDATION

The plan referred to as Option I, the phased approach, is recommended. Tooele continues with the research program, JACADS proceeds with the operational demilitarization, and the CONUS facilities follow on a schedule about three years behind JACADS. If a failure occurs at JACADS, the CONUS facilities are put on hold until the problem is solved.

#### 16.2 SARA Title III

On October 17, 1986, Congress enacted Title III, the Emergency Planning and Community Right-to-Know Act of 1986 as part of the Superfund Amendments and Reauthorization Act (SARA). For the first time, this act brought Federal facilities under the EPA Superfund program. The applicable requirements of this act may be found in the Appendix. The State of Oregon was more than a year ahead of the U. S. Congress when they passed a bill in 1985 establishing the Interagency Hazard Communications Council (IHCC) for the state. Details of the way the IHCC has been used to comply with SARA Title III in Oregon are as follows:

## THE OREGON STATE PROGRAM

### Emergency Planning

Governor Goldschmidt has designated the Interagency Hazard Communications Council (IHCC) to be the state emergency response commission. The IHCC was originally formed by the 1985 Legislature to oversee the activities of several state agency programs involved in hazardous materials. It is composed of 15 state agency heads and 4 members of the public at large, including industry and local government. The Department of Environmental Quality has been designated as the lead state agency for emergency planning activities, and the State Fire Marshal's office has been designated as the lead agency for community right-to-know activities. Currently, various alternative approaches to establishing local planning districts are being considered. The options range from having one planning district represent the entire state to one planning district for each local community. It appears that the most feasible approach is to have the districts established on a regional, geographic basis with perhaps 9 to 12 local districts. State agency representatives will be conducting informational meetings with each county in the latter part of April and early May and will solicit input from interested parties on the question of local planning district boundaries. (NOTE: The State of Oregon has selected the option where one planning district represents the entire state.)

### Community Right to Know

The State Fire Marshal's office pursuant to ORS 453.307 to 453.372, passed by the 1985 Legislature, is in the process of completing the first phase of a hazardous substance survey similar to that mandated by Title III. The state community right-to-know program is actually more comprehensive than the federal program because it includes a larger number of employers. The major differences in the two programs are the reporting forms and notification requirements. The state will seek to modify its program to have it meet the intent of Title III reporting requirements. State agency representatives will also be discussing the state and federal community right-to-know programs during the county meetings.

### Planning Schedule

- (1) April, 1987 - Governor designates the Interagency Hazard Communication Council as the State Emergency Response Commission.

- (2) Late April to early May, 1986 - Informational meetings will be held in each of the counties to solicit input on local planning district boundaries and local planning committee membership.
- (3) Late May to early June - Meetings will be held around the state to solicit final input on planning district boundaries.
- (4) July 17, 1987 - Local planning district boundaries are designated by the IHCC.
- (5) August 17, 1987 - Local Planning committee members are appointed by the IHCC.
- (6) September, 1987 - The first meetings of the local planning committees are scheduled to begin.

#### Information

For further information contact either:

Bruce Sutherland  
Department of Environmental Quality  
811 S.W. Sixth  
Portland, OR 97204  
229-6047 or toll-free at 1-800-452-4011

or

Mitch Wang  
State Fire Marshal  
3000 N. E. Market St. Suite 534  
Salem, OR 97301  
378-2885

The Oregon Department of Environmental Quality has two Emergency Response Plans that apply to the Umatilla Depot. These are designated as ANNEX O, Umatilla Chemical Emergency Response Plan (2) and ANNEX M, Oregon Emergency Operations Plan (3).

Since the Umatilla Demilitarization facility will be processing and handling hazardous material and hazardous waste, they must comply with the Oregon State Plan to meet the

requirements of SARA Title III. Cooperation between the Army and the Oregon State Fire Marshal will assure that the maximum protection of citizens will be attained at the Umatilla facility.

#### RECOMMENDATION

The State of Oregon has an approved plan which the EPA has accepted for complying with SARA Title III. This plan deserves acceptance and support by the Army.

#### 16.3 Proposed Airspace Restriction

The operation of aircraft over the present storage igloos at the Umatilla Depot constitutes a hazard that could be avoided by putting an airspace restriction in place. The two specific aircraft operation, currently occurring, are overflights of agricultural aircraft (usually at low level) and overflights of Navy combat aircraft using the Boardman bombing range. Airspace restrictions currently exist to prevent unauthorized aircraft from entering the area over the Boardman bombing range. These restrictions contain altitude limitations and are not therefore continuous from the surface to high flight levels (4). There have been unconfirmed reports of "dog fights" between ag planes and Navy aircraft over the Umatilla Depot property. Aircraft crashes into the igloos, storage buildings, or the demilitarization facility are an avoidable risk.

#### RECOMMENDATION

A total airspace restriction needs to be implemented over the chemical weapons storage and demil areas, plus three miles on all sides. This should be done immediately to eliminate an avoidable risk.

#### 16.4 Proposed Newsletter

During the period the study team was working on this contract, several rumors, false reports and misstatement of fact were encountered. Although we tried to verify all information, we had difficulty in this area of communication. We also felt the lack of an information source where all pertinent information was summarized and up to date. We suggest that the Army start immediate publication of a newsletter, with input from military, contractors, and others interested in this project. A suggested title for this publication, "PASSING GAS."

#### RECOMMENDATION

The Army should institute a monthly report (newsletter) to all concerned persons (not classified) reporting on successes, events, incidents, and accidents. This would stop the circulation of rumors and false information.

#### REFERENCES

1. "Chemical Stockpile Disposal Plan Supplement," U. S. Army Program Manager for Chemical Munitions, Aberdeen Proving Ground, MD, March 1987.
2. ANNEX M, Oregon State Emergency Operations Plan, Umatilla Chemical Emergency Response Plan (UCERP), Oregon State Department of Environmental Quality, Portland, Oregon, 1986.
3. Oregon Emergency Operations Plan - ANNEX O, Oil and Hazardous Materials Emergency Response Plan, Oregon State Department of Environmental Quality, Portland, Oregon, January, 1987.
4. Special Use Airspace on Seattle Sectional Chart, Number R-5701, R5704, R5706, National Oceanic and Atmospheric Administration, Rockville, MD.

## CHAPTER 17

### REPORT

#### TECHNICAL ADVISORY COMMITTEE

##### Introduction

The following pages summarize points to be considered by the Army when they draft a site specific Environmental Impact Statement (EIS) for the Chemical Stockpile Disposal Program as applicable to the Umatilla Army Depot Activity. This is in no way a totally comprehensive guide, many points were brought up in the committees' meetings, and the consultants have their concerns also. Therefore, the minutes of the committees' meetings, and the consultants' reports should also be studied.

Points to be considered:

1. Emergency Response Plan Test

What will be done in the case of an accidental release of chemical agent, particularly during transport operations, was a mainstay of committee discussions. This was due to this being a worst case scenario and input from the consultants indicating that they thought that the transportation and handling procedures needed more study. Since the Umatilla Chemical Emergency Response Plan (UCERP) is already in existence it should be reviewed by all concerned agencies and modified if necessary to encompass the disposal alternative selected in the site specific EIS. Then a test of the UCERP should be run and appropriate modifications then made, with retesting until all the concerned agencies feel that it is a workable plan, not just paper plan.

2. Incineration Effects

A. Local Air Quality (i.e., Human Health Effects)

The information relayed to the committee through the consultants is that many tests of the incineration equipment have been run using ethylene glycol to simulate the chemical agents(s). Actual combustion products should be determined by testing (such tests, using GB and VX are underway at Tooele Army Depot according to the consultants). Then the impact on local air quality can be predicted if accurate site specific meteorological data is used.

B. Impact on the Columbia River

This was touched upon in the Draft Programmatic Environmental Impact Statement, but needs to be considered in detail when the actual combustion products are known.

C. Agricultural Crops, Lands, and Livestock

Again, when the actual combustion products are known, the effects on the surrounding agricultural community can be predicted.

3. Site Considerations

A. Soil Stability

A standard engineering consideration that will pose no problem if adequate preparation is done. The main

reason it is mentioned here is because the proposed site will require cut and fill work.

B. Containment/Drainage of Potential Spills

The potential incinerator site will be located where runoff liquids, greater than predicted for the facility design, will run to the Columbia River if they are of too great a volume to percolate into the soil. If they do percolate, the groundwater also goes to the Columbia River.

C. Natural Disaster, Earthquake, Flood, Range Fire, etc.

The effects to the proposed incineration site of a natural disaster should also be address. The effects of a natural disaster can be overcome by design or relocation of the facility.

D. Building Orientation

A minor consideration, that has probably already been thought of, is to orient the buildings so that and releases of a gaseous nature are blown back into the buildings by the prevailing winds.

4. Real Time Weather Modeling

The present system which uses weather data from the Pendleton Airport and assumes constant wind velocities is not adequate for any of the proposed disposal alternatives that involve movement and handling of the weapons or containers. Effort should be expended to study the meteorological conditions at the Umatilla Depot Activity for at least a year to give a valid source of weather patterns to use. The equipment and system used to ascertain this weather base should either be kept in place or re-installed if the incineration option is used.

5. Base Line Conditions

A system for data collection and interpretation should be installed to determine the current levels of chemicals present in the area already. Since some of the agricultural chemicals used in the vicinity are related and trigger the currently installed sensors this data base will be needed to prevent false alarms and to show that the Army is not making things worse.

6. Status of the Confederated Tribes of the Umatilla

An official determination of whether or not the Confederated Tribes of the Umatilla are an "Affected Party" should be made. If it is determined that the Tribes are affected, they should be brought in to the proceedings as soon as possible to prevent delays at some time in the future. This question should be addressed as there are potential effects to the Columbia River and their downwind location. It has been determined that they are an "Affected Party" in the case of a nuclear waste repository at Hanford, Washington, which is farther away than the Umatilla Army Depot Activity.

7. Time Delay Until Johnston Island has been Fully Evaluated

The consultants have reported that consideration has been given to a proposal to ask Congress for a time extension. This time would enable a full-scale operation to be conducted at Johnston Island to see if any modifications would have to be made to the system. This would be an excellent idea because:

- a. The incinerator system can be debugged if necessary, allowing any required modifications to be installed before start-up of the other incinerators.
- b. This would provide more time to obtain and interpret the meteorological and chemical presence data bases mentioned above.
- c. The time frame being considered is not sufficient to cause concerns due to deterioration of the munitions.

Summary

The alternative of disposal by incineration appears to be the optimum choice for the stockpile portion at the Umatilla Depot Activity, but in any case, a more site specific study is needed and a time extension to acquire valid data is strongly recommended.

## CHAPTER 18

### CITIZENS ADVISORY COMMITTEE CONCERNS

The Army shall provide appropriate public safety officers adequately maintained protective clothing and gas masks and train those officers in the equipment's use. These public safety officers shall be required to carry this equipment at all times.

All unclassified data generated by this program shall be directly available to the public upon request.

The Army shall provide training, supplies and equipment to local area health care facilities.

The EIS shall address contamination of the biosphere within each accident scenario zone. The biospheric persistence shall also be addressed.

Personnel employed at U.S. Army UDA prior to the start-up of this project, displaced upon project completion, shall be provided job retraining.

If any spills, leakage, explosions or contamination of the biosphere occurs, the cleanup shall be handled as State and Federal law dictates.

Off-site transport has not been adequately addressed in the EIS. In addressing off-site transportation, the philosophy that the constitutional common defense risk should be shared as equitably as possible should be a factor in determining the alternative chosen: The more who share in the common defense (that is the disposal of these weapons), the more equitable that alternative is.

The final Draft Programmatic EIS shall address waste quantities and transport.

All reasonable alternatives, as required by NEPA, should be considered, including chemical detoxification.

The methodology and rationale for determining acceptable acute and chronic dosages of GB, VX, and HD is referenced in the DPEIS, but should be explicated in the FPEIS.

Any risk assessment shall include the public's perception of that risk.

All the specifics of monitoring the facilities shall be well developed and explained in the EIS. Additionally, it would be desirable to have the QA/QC plan included in the document.

The legal parameters of the DOA's ability to fund reasonable emergency planning needs of each site shall be addressed in the EIS.

The EIS shall detail a program of decommissioning/dismantling of the facility and how the site will be returned to its pre-construction baseline condition.

Site-specific social economic impacts (that is who wins and who loses), resulting from the alternatives, shall be developed in the EIS.

Since there are large unknowns in the Army's proposals, worst cast scenarios, not significant agent release or maximum creditable events, should be used in the Risk Assessment.

Biospheric monitoring should be entirely independent of the production-maintenance operative (that is the fox shouldn't be guarding the chicken coop).

In order to insure the safety of citizens living within five (5) miles of the proposed facility, the Army shall provide:

1. Sirens to be heard within a five-mile radius.
2. An automatic phone system to contact all residents in this five mile radius.
3. Two-way radios to residents living within five miles of the depot as a backup system of communication for those away from their homes (i.e., farmers working in the fields).
4. Patrols to go to each house within the described safety area not responding to the phone calls.
5. In case of emergency, determine and catalogue all disabled or incapacitated residents within the described area. These residents shall be contacted by patrol and provided transportation out of the area.

For the next twenty (20) miles, the following safety procedures might be followed:

1. Install an additional phone system.
2. Train patrols of emergency personnel equipped with loudspeakers to patrol the streets.

Beyond a twenty-five (25) mile radius from the depot, procedures would be only as deemed necessary.

Time constraints relative to this project should be abolished. The emphasis should be on completing this project safely and properly. It should not be rushed to meet deadlines.

Proposed Disposal:

The disposal shall be onsite. Not items for disposal shall be moved onto this site from another storage area. No item onsite shall be removed from this site for disposal at another site.

Monitoring of Disposal Process:

Monitoring should be part of the permit process of DEQ. Also, the Department of Health should be involved in some way.

Stay within the guidelines of any and all permits issued by county, state, and federal agencies for the health and welfare of the citizens during the construction, operation, and dismantling of the incinerator.

The Army shall assume any and all liability for damages to civilians and/or their property occurring outside the military facility due to this project.

All emergency personnel located within the boundaries of the Depot shall have available to them for their use, all necessary equipment to handle any and all emergencies which arise as a result of this project. This equipment shall be kept current with technical advances. There shall be increased medical training for on-base personnel to meet Oregon State Certifications. The onsite emergency facilities shall also meet Oregon State Certification standards.

Address the problem of communication, in case of an emergency, with non-English speaking citizens, who may be within the area of danger.

The Army shall meet with, and come to an agreement in writing, with all affected counties, cities, private groups, emergency groups, health care facilities, police departments, civil defense groups, schools, etc., which states all procedures needed, assigns specific responsibilities, and develops a chain of command to be in place in the event of an accident. The Army shall develop and follow a timetable for the accomplishment of these objectives. The Army shall provide all needed apparatus and/or supplies needed to implement the aforementioned agreement.

The Army shall have in place, prior to project start-up, an economic recovery fund with appropriate legal mechanism in place. This fund shall be reserved for payment of claims against this fund.

A P P E N D I X

|                                                                                                                     |      |
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| Letter, Mayor of Boardman to Lt. Col. J. C. Pate                                                                    | A-1  |
| Letter, Mayor of Hermiston to Vernon N. Houk, M. D.                                                                 | A-2  |
| Letter, Hermiston Fire Chief to Hermiston City Manager                                                              | A-4  |
| Newspaper Articles Concerning Project                                                                               | A-6  |
| Briefing Outline and Viewgraphs for Army presentation,<br>September 1, 1987                                         | A-13 |
| Information Sheet, Emergency Planning and Community<br>Right-to-know, Oregon Department of Environmental<br>Quality | A-57 |



*City of Boardman*

TOWN SQUARE

PO BOX 228

BOARDMAN, OREGON 97818

TELEPHONE (503) 481-9252

April 28, 1986

Jerry C. Pate  
Lieutenant Colonel, U. S. Army  
Commanding Officer  
Umatilla Army Depot  
Hermiston, Oregon 97838-9544

Dear Lt. Colonel Pate:

The City of Boardman was unable to attend the public meeting last Friday and therefore would like to add our comments at this time.

We are strongly supportive of the "destroy on-site" concept as we feel the security, safety and economic benefit far outweigh any advantage there may be in regional or national disposal.

It makes sense not to have to transport these munitions and subject them to loading and unloading a minimum of two times, constant security pressure and therefore massive manpower requirements, and the potential of breakage due to movement, accident, sabotage or acts of God. This area has lived with these munitions for years and supported the Umatilla Army Depot vigorously and would not like to see the control and handling passed elsewhere.

Please convey our sentiments to those in charge of this project, and be sure to let us know what additional assistance we may give.

Sincerely,

Gale Grill  
Mayor

  
L. D. Dalrymple  
City Manager

A-1

city  
of  
**hermiston**

180 N.E. 2ND STREET / HERMISTON, OREGON / 97838

April 7, 1987

Vernon N. Houk, M.D., Assistant Surgeon General  
Director, Center for Environmental Health  
Centers for Disease Control  
1600 Clifton Road, N.E.  
Atlanta, GA 30333

Dear Dr. Houk:

The national program to eliminate existing chemical weapons has an overriding interest to all Oregonians. This correspondence is designed to register our community position and solicit at the national level a response to our local concerns on this issue.

The City of Hermiston has been closely affiliated with the Umatilla Army Depot from inception. We have worked closely with civilian and military personnel at the depot to assure the safety of current depositories and to work together toward our national goal of destruction of the weaponry currently in storage.

During my recent testimony at the Center for Disease Control in Atlanta, Georgia, I had the opportunity to support our community position of destroying the stockpiles at the Umatilla Depot site. We have reviewed the environmental assessment prepared for the Umatilla Depot site, and we concur with the conclusions indicating the potential for serious incident is minimized by on-site destruction. I will not reiterate all of the findings of the existing studies, suffice it to say Hermiston, as the community which has the largest potential for impact, strongly supports the destruction of materials on site.

We are concerned about our ability to adequately respond to a major incident on the depot. I have had our city manager, fire chief and chief of police review our capability to respond. Our community has continuously viewed the depot as a major regional asset, and we support the proposed destruction program; however, we cannot fiscally respond to the emergency service needs in our community should an incident occur.

Our financial needs are for adequate training for existing personnel and the provision of capital resources to meet the demands on our residents. Our training requests include classroom and situational training for primary response personnel and the medical community as well as the continuation of the excellent public education program offered to date by the Department of Defense. Specific joint training exercises and simulations involving potentially affected individuals are considered a local necessity.

The cost of this type of training is somewhat difficult to assess. We perceive the need to conduct a series of drills of sufficient intensity to involve all personnel. This would necessitate our public safety employees, hospital employees and similar individuals to be required to participate at overtime compensation rates.

Vernon H. Houk, M.D.

April 7, 1987

Page 2

Should our requirements evolve to including evacuation drills, additional potential costs loom as a spectre.

In association with these critical training needs, we face the acquisition of equipment necessary to respond. Our equipment needs are more fully described in the enclosed copy of correspondence from Fire Chief John Shull. To summarize for purposes of this correspondence, our capital facilities needs are:

|                                                             |               |
|-------------------------------------------------------------|---------------|
| 1. Adequate Breathing Apparatus                             | \$ 23,500     |
| 2. Aid Response Vehicle                                     | 50,000        |
| 3. Modernization of Emergency Communi-<br>cations Equipment | <u>50,000</u> |
| Total                                                       | \$123,500     |

In each case, our requests for consideration are not based on something "desirable" or on something which is a community need for some other purpose. We currently have facilities adequate to meet the emergency situations normally faced by our personnel; however, the items listed are considered critical to ability to react on the level necessary to assure community safety should a major incident occur.

It is our sincere hope that the planned on-site destruction of chemical stockpiles will proceed. During the fiscal analysis of proceeding, the critical elements of adequate community response readiness must be considered as an integral cost of the project.

We are providing copies of this correspondence to our Congressional delegation as requested during our recent meeting. We trust this will be sufficient to explain the positions of our community. Should any additional information be necessary, please advise.

Respectfully,

*William E. Neuffer*  
William E. Neuffer  
Mayor

WEN/pat

Enclosure

cc: Senator Mark O. Hatfield  
Senator Bob Packwood  
Representative Les AuCoin  
Representative Bob Smith  
Representative Ron Wyden  
Representative Peter DeFazio  
Representative Denny Smith

A-3

city  
of  
hermiston

295 EAST MAIN STREET / HERMISTON, OREGON / 97838

March 31, 1987

TO: Bill Peterson, City Manager

FROM: John Shull, Fire Chief

SUBJECT: Umatilla Army Depot - Chemical Weapons

Per your request for information regarding the fire departments preparedness in the event that the Umatilla Army Depot is allowed to proceed with destroying their chemical weapons on site; the following deficiencies should be corrected:

Self contained breathing apparatus would likely become a necessary item. While we do have air pac's in place, we would not have the quantity to fully supply two engine company's, of four men each. Also, the present hi-pressure air compressor would be insufficient to supply air volume that would be needed. I would recommend that a minimum of four additional air pac's be acquired, including two spare air cylinders for each pac, and replace the aging air compressor with a new hi-pressure unit and Cascade System.

|                                           |            |              |
|-------------------------------------------|------------|--------------|
| 1. Air Pac @ \$1,095. ea. x 4             | = \$4,380. |              |
| 2. Spare Air Cylinder @ \$290. ea. x 8    | = 2,320.   |              |
| 3. Hi-pressure Air Compressor @ \$12,000. | = 12,000.  | Approx.Total |
| 4. Cascade System (5 cylinders)           | = 1,500.   | \$23,500.00  |
| 5. Cylinder Fill Station @ \$1,200.       | = 1,200.   |              |
| 6. Air Purification System @ \$2,000.     | = 2,000.   |              |

The next item to be considered is the AID RESPONSE vehicle replacement. The present vehicle is a department built vehicle on a 1966 surplus van. Since this unit carries our various rescue-aid-traffic control-air supply and other appliances, it is an important vehicle and must be reliable. This unit would have to be replaced with a larger, heavy duty unit, that can operate in an off-road mode (4 x 4) consistent with our area terrain. The approximate cost of this type vehicle would be \$45,000 to \$50,000.

Lastly, the Communication capabilities of the Safety Services (police & fire) are, and would be, inadequate when taken in the context of the responding to a Depot emergency, where medical emergencies may exist and evacuation is a possibility.

While our dispatch center has been recently modernized, our field units (mobiles and hand-held) are mostly outdated or obsolete and include the Base Stations for both police and fire departments. Our mobile units and hand-held units need to be tone controlled and field programable to be able to coordinate voice communications with the various agencies that would become involved in a major incident. ie: Sheriffs Department, Oregon State Police, local Police and Fire, Umatilla Depot activity, and the various State level agencies.

The police department has seven mobile units and seven hand-held units that would fall under this request. The fire department has fifteen mobiles and thirteen hand-held radios. (Eight of these units are adequate.) The police need to replace and update all their present units to allow reliable inter-agency communication, with the units programable, tone controlled, with priority, scan and channel isolation capability. The fire department needs the same type of units. Both Base Stations need to be multi-channel, providing at least two frequencies each. The police department may require an additional Base to handle another dual frequency if and when the Hermiston Safety Center becomes the dispatch center for the whole of West End Umatilla County, including the City and Fire District in the City of Umatilla.

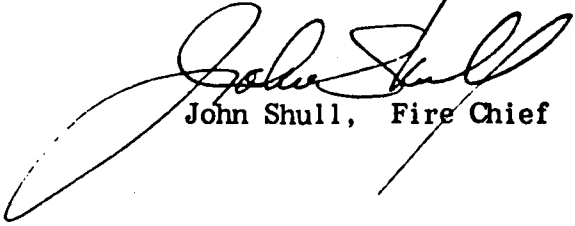
The cost of these changes will run in the area of about \$50,000.

Hand-held radios @ \$900. ea. (9)

Mobile radios @ \$850. ea. (11)

Base radio @ \$4,000. + accessories and installation (3)

HERMISTON FIRE DEPARTMENT



John Shull, Fire Chief

JS:bd

# Volunteers needed for two committees to study Army depot incineration plan

HERMISTON — The county Soil and Water Conservation District is looking for volunteers to serve on two committees for its review of the Army's weapons incineration plan. Residents throughout the region are encouraged to submit a brief letter of interest to Umatilla County Soil and Water Conservation District, 1229 S.E. Third, Pendleton, OR 97801.

Two local committees will be formed, one technical and one citizen, said Cliff Bracher, a soil

conservation district board member from Hermiston.

The committees will oversee the work of a team of scientists the district hired to look for errors or omissions in the Army's draft plan to incinerate chemical weapons at Umatilla Army Depot. The \$99,257 study is funded by the Army.

The technical committee probably will include people from regional colleges and the nuclear reservation at Hanford, but anyone with a background

in science is welcome to volunteer.

Under federal law, the Army must destroy its stockpile of chemical weapons at Hermiston and seven other depots in the United States by 1994.

## Area

East Oregonian, Friday, April 17, 1987 Page 3A

# Soil and water group named to study Army plan

By W.H. Phinney  
of the East Oregonian

**PENDLETON** — The Umatilla County Soil and Water Conservation District has been named the "agency of review" for the U.S. Army's proposal to incinerate nerve gas at Umatilla Army Depot.

The district still has to come to terms on a contract, said Cliff Bracher of Pendleton, district vice-chairman

assigned as director in charge of the special project. The Army has budgeted about \$100,000 for the review and a similar project in Kentucky had a \$97,000 price tag.

The Department of the Army asked for an unbiased local group to do a review of the proposal, and the soil and water district was one of three applicants. The others were from Hermis-

ton and La Grande.

"This is right up our alley," said Bracher. "It deals with the impact of the particular products on soil, water, and air, so we should be the likely local agency to do such a study."

District officials will meet next week with Dr. Frank Dost of the Oregon State University Extension Service ag/chemistry department. Facts and

figures need to be collected, Bracher said, so SWCD can compile a scope of its expected work by the end of April. By the first of May, he said, details of the contract should be known.

Dan Swearingen of Pendleton has been hired by SWCD to do preliminary ground work with OSU Extension Service, which will provide much of the technical work as a sub-contractor to the district.

Bracher said the district must present a rough draft of anticipated issues by June 30 with the final draft due Sept. 30 for the Army's Environmental Impact Statement. The EIS will be forwarded to Congress to facilitate funding for the study project.

The Army is expected to begin incineration of the old nerve gas by 1994, Bracher said.

# Specialists hired to study nerve gas plan

By Steve Meyers  
of the East Oregonian

**HERMISTON** — The county Soil and Water Conservation District has started a \$99,257 study of nerve weapons by hiring a team of scientists and making plans to form two local advisory groups.

Earlier this month, the Army chose the soil conservation district to do an independent study of its plan to incinerate nerve gas weapons at Umatilla Army Depot near Hermiston.

Similar studies are planned for communities near depots in Kentucky, Maryland, Indiana and Arkansas.

Meeting Tuesday in Hermiston with the soil conservation board were Richard Boubel and Frank Dost.

Boubel, the project leader, is a professor emeritus of mechanical engineering at Oregon State University. He taught at the university from 1954-1986 and has a doctorate in environmental engineering. His specialties include air pollution

control and the reduction and management of hazardous waste.

Dost, a doctor of veterinary medicine, is a professor of agriculture chemistry at Oregon State and an Extension Service specialist in toxicology.

The other team members — David Bella, Peter Nelson and Jim Witt — are scientists with ties to Oregon State or the Extension Service.

The Extension Service is providing the labor of some members, and other team members are working at "substantially reduced" consulting fees because of the public nature of the study, said Dost.

In the study, Boubel and his team plan to look for errors and omissions in the Army's draft Environmental Impact Statement, and look at such factors as whether the Army will use the latest technology to minimize risk.

To meet its deadline to begin destroying weapons by the 1990s, the Army wants from the independent groups a draft re-

port June 30 and a final report Sept. 30.

But Boubel said Tuesday it's unrealistic to meet those deadlines, and they'll ask the Army for more time. But, "We don't want to drag it out," he added. "The Army wants an answer."

For its part, the soil conservation board will oversee the study and form two local advisory committees — one technical and one citizen. Dost and Boubel said community comments are "critical" to their work.

Dan Swearingen of Pendleton will be local coordinator of the project.

Under federal law, the Army must destroy its stockpile of chemical weapons by 1994, although that deadline may be extended.

At Hermiston, the proposal favored by the Army and most community residents is to build an on-site incinerator.

The incinerator would employ 270 people for 2½ years, with construction and operating costs estimated at \$220 million.



East Oregonian/Steve Meyers

Frank Dost, left, and Richard Boubel are two members of the team from Oregon State University which will be helping the Umatilla County Soil and Water Conservation District study the Army's plan for incinerating nerve gas weapons at the Umatilla Army Depot.

## Depot review group will meet tonight

HERMISTON — The citizen committee reviewing the Army's study of nerve gas incineration at Umatilla Army Depot will meet here tonight to discuss emergency planning.

The public is encouraged to participate in the meeting, which lasts from 7:30 p.m. to 9 p.m. at Hermiston City Hall.

Guest speakers include Den-

nis Olson, county planning director; Roy Baker, administrator of Good Shepherd Community Hospital; Bill Peterson, Hermiston city manager; and Stafford Hansell, retired farmer and former state legislator.

The Umatilla County Soil and Water Conservation District is reviewing the Army's weapons destruction plan for errors and omissions. The \$38,257 study is to be finished by fall.

East Oregonian - July 9, 1987

## **Committees meeting**

**HERMISTON —** Committees reviewing the Army's study of nerve gas incineration will meet at Hermiston City Hall on Thursday.

The citizen committee will meet from 3:30-5:30 p.m. and the technical committee from 7-9 p.m.

Both meetings are open to the public.

The Umatilla County Soil and Water Conservation District is reviewing the Army's weapons destruction plan for the Umatilla Army Depot for errors and omissions.

East Oregonian - July 21, 1987

## Commentary

# Public invited to nerve gas hearings

By Dwight Wolfe

Sometime within the next five years, the U.S. Army will begin destroying the nerve gas that is stored at the Umatilla Army Depot. Will it be transported to one central location in the United States, two regional locations, or will



Dwight Wolfe

it be an on-site incineration at each facility?

This is one of many questions that need to be answered before the disposal can take place. Should you, as a citizen, be concerned? I hope so. Let me explain this in further detail.

The U.S. Department of Defense is required by Public Law 99-145 to destroy the stockpile of lethal chemical agents and munitions stored at eight U.S. Army installations in the United

States and at Johnston Island in the Pacific.

The Army developed a plan for destruction of the chemical munition stockpile. This plan is set forth in the Army Chemical Stockpile Disposal Concept Plan submitted to Congress in March 1986 and supplemented in March 1987. Three alternatives are described:

1. Move the stockpile to a national destruction center.
2. Move the stockpile to two regional destruction centers.
3. Destroy the agents and munitions at their current storage installations.

These three disposal alternatives were also described in an environmental impact statement published by the Army in July 1986. Following the release of that statement, the Army asked citizens groups at each of the eight locations to study their environmental impact statements under contractual agreement. The Umatilla County Soil and Water Conservation District obtained that contract for the Umatilla Army Depot.

The Soil and Water Conservation District is made up of elected representatives from each major area of Umatilla County. They serve as an advisory committee concerned with all natural resources in the county.

The District hired five scientific consultants to study the Army's impact statement. They will make recommendations about deficient areas of the statement after studying those areas. These five scientists include one mechanical engineer, two civil engineers from Oregon State University, and two extension toxicologists from OSU.

Where do you, a citizen, fit in with all of this? Part of our contract with the Army was that we would form two citizens advisory groups. One is composed

of lay citizens, including groups interested in the safety of the disposal process. The other is a technical group, evaluating the findings of the consultants from a non-specific, general scientific position and conveying that information to the community.

Through these two groups, you the citizen have an opportunity to voice your questions and concerns about the destruction of the nerve gas.

Meetings are being held once a month with our consultants in the Hermiston City Council Chamber. This month's meeting will be this Thursday, July 23, from 3:30 to 5:30 p.m. for the citizens group and 7 to 9 p.m. for the technical group. Members of the public will be welcome at either session Thursday.

If an incinerator were built at the Umatilla Army Depot for destruction of the nerve gas here, 200 to 250 workers would be required to build it, and a similar number to operate it — a sizable impact on the Hermiston area.

Nerve gas is being destroyed on Johnston Island, in the Pacific, and a small-scale incinerator is under construction at Toelle, Utah. So the technology wouldn't be brand new if an incinerator were built at the Umatilla Army Depot.

I encourage you to attend these meetings. The Army wants to know how the citizens feel about destroying the nerve gas. But don't delay! This study is to be completed by Sept. 30. Hope to see you there.

*Dwight Wolfe, who farms southwest of Pendleton, is chairman of the Umatilla County Soil and Water Conservation District's evaluation of the Umatilla Army Depot incinerator proposal.*

## Open forum

clears the air of any pollution as well.

Incinerators should be built at the site of nerve gas storage. Some are now to be built, or improved, as such places as Alabama, Arkansas, Johnson Island (under construction), Kentucky, Oregon, and Utah.

Transporting the munitions increases the hazard and creates additional expense. The agencies involved require approval from other involved agencies. The list reads like a menu of alphabet soup, i.e. — EPA, DOT, FEMA, DOD, DA, DOE, federal, state, county and local. Transportation of chemical munitions must be accompanied by a large number of security measures for escorting and safeguarding the items, as well as, notification of all concerned. Not only does the act of handling and transporting increase the likelihood of a possible accident and the release of the agents, but the non-military controlled property would be vulnerable to accident or detonation.

I write not only as a concerned citizen but also as the project officer of the first shipment of nerve gas to, at that time, the Umatilla Army Depot. Members of the first toxic crew still living in this area can testify concerning the success of receiving and storing the material. No incidents or accidents were experienced. It was an excellent operation for the first ever of its kind.

The present status of the incineration program is being debated at Senate and House committee meetings. Please write to Sen. Hatfield, Sen. Packwood, Rep. Bob Smith and other members of Congress and express your opinions concerning the problem of getting rid of the 1961 stockpile. Twenty-six years is a considerable time to store, handle and transport agents.

DON HANSEN  
575 West Highland  
Hermiston

**BRIEFING FOR U.S. ARMY  
ON U.S. ARMY CONTRACT DAAA15-87-Q-0086**

**EVALUATION OF THE DRAFT PROGRAMATIC  
ENVIRONMENTAL IMPACT STATEMENT FOR THE  
DESTRUCTION OF CHEMICAL MUNITIONS  
STORED AT THE UMATILLA ARMY DEPOT AND  
OTHER ARMY FACILITIES**

**CONTRACTOR  
UMATILLA COUNTY SOIL AND WATER  
CONSERVATION DISTRICT**

**SEPTEMBER 1, 1987,  
UMATILLA ARMY DEPOT, OREGON**

**Destroy nerve gas on site**

The disposal of the nerve gas stored at the Umatilla Army Depot is receiving consideration by Congress, the press, the public and by the world's worriers.

A 1994 deadline for destruction of the nation's stockpile of aging and deadly chemical weapons still exists, but the manner of destruction has not been decided nor funded to date.

The safest way to destroy the stockpile is one of the less publicized and still undecided issues. Incineration appears to be the safest way to totally destroy the gas, the containers, and the dunnage. This method

## UMATILLA ARMY DEPOT DRAFT REPORT AND BRIEFING OUTLINE

- I. Identify Study Objectives/Areas of Concern
  - A. Critique of DPEIS.
  - B. Develop positive information for FPEIS.
  - C. Get input for UMDA site specific EIS.
  - D. Perform independent studies as necessary.
  - E. Review current studies conducted by the Army and its contractors.
  - F. Attend review meetings scheduled by the Army.
  - G. Organize Citizens Advisory Committee and Technical Advisory Committee.
  - H. Prepare Draft Report, Army Briefing, and Final Report.

## II. Scope of Efforts in these Study Areas

- A. Critique of DPEIS - about 15% of total effort.
- B. Obtaining site specific information (meteorological information, emergency response capabilities, state and local permits, contacts with ;UMDA) - about 15% of total effort.
- C. Independent studies - about 20% of total effort.
- D. Review Army studies - about 25% of total effort.
- E. Attend Army review meetings - about 10% of total effort.
- F. Final reports and briefing - about 15% of total effort.

### III. Approach and Methodology Utilized

- A. DPEIS evaluated and assigned to consultants according to their interests.
- B. Consultants reviewed Army and contractor documents in their area of interest.
- C. Consultants attended Army meetings in their area of interest.
- D. Consultants performed independent studies of literature, public agencies, other consultants, technical organizations, etc.
  - 1. Oregon DEQ (various offices).
  - 2. Oregon State Fire Marshall
  - 3. CH2M-Hill (various offices).
  - 4. U. S. EPA (various offices and Region X).
  - 5. ORNL.
  - 6. OSD Environmental Policy/Environmental Engineering.
  - 7. CDC.
- E. Critical examination of the engineering of the process.
  - 1. Materials handling.
  - 2. Combustion systems.
  - 3. Emission control.
  - 4. Emission monitoring.
  - 5. Plume modelling.
  - 6. Ultimate waste disposal.
- F. Critical examination of the organization of the operations and the control of such operations.
  - 1. Communications.
  - 2. Responsibility.
  - 3. Actions.

G. Assessment of the proposed exposure and risk estimates.

1. Dispersion models.
2. Risk analysis.
3. Emergency response.

IV. Extent of Community Involvement

- A. Citizens Advisory Committee.
- B. Technical Advisory Committee.
- C. Radio, Television, Newspaper coverage.
- D. Contact with U. S. Congressmen.
- E. Contact with local elected officials.
- F. Contact with police and fire departments, and paramedics.

V. Findings, Observations, and Concerns

- A. The public is concerned about their health and welfare.
- B. Many citizen concerns have been lessened through the public information portions of this project.
- C. There is strong support from the majority of the citizens for this project - the Army has good credibility in the area around the Umatilla Depot.
- D. The citizens feel the need for emergency programs, operation plans, right-to-know, training, supplies, etc.
- E. The citizens want continuing, assured financing for all phases of the emergency response program.
- F. More on this subject will be presented by the Citizens and Technical Advisory Committees.
- G. The Army was very cooperative in getting material to the study team. This material was of varying degrees of usefulness. Some material was actual final reports while other material was draft copies from some unknown report. This later material was impossible to catalog because of the lack of titles, authors, dates, references, etc.
- H. Some of the information supplied by the Army was extremely thorough and useful. An example of such information is the material on Mitigation. The study team feels that this ongoing study was excellently covered.

## VI. Rationale/Presentation of Conclusions and Recommendations

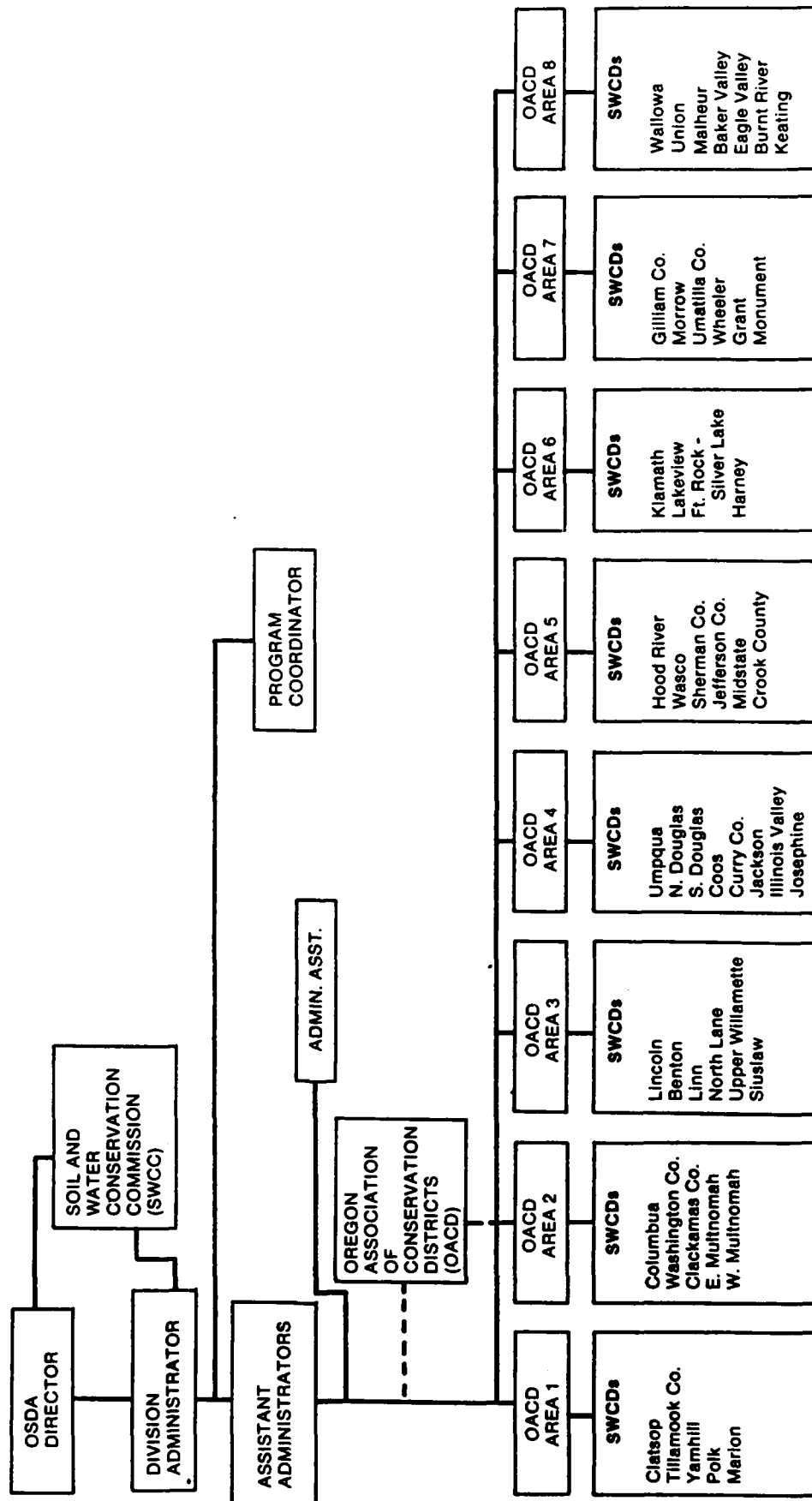
- A. The preferred alternative is onsite incineration.
- B. The incineration (demil) permit is thorough and should be approved. The projected atmospheric emissions are attainable and not hazardous to human health.
- C. The off-post emergency response, and onsite handling operations programs remain weak.
- D. The Army should institute a monthly report (newsletter) to all concerned persons (not classified) reporting on successes, events, incidents and accidents. This would stop the circulation of rumors and false information.
- E. There needs to be developed a more thorough description of the proposed training evaluation. Will certification be required for some, or all, positions? What is proposed for simulated emergency situations?
- F. A total airspace restriction needs to be implemented over chemical weapons storage and demil area plus three miles on all sides. This should be done immediately to eliminate an avoidable risk.
- G. The agent storage tanks, transfer lines, and valves should be designed to resist any possible seismic load without rupturing or spilling. This slight added cost would eliminate another avoidable risk.
- H. The State of Oregon has an approved plan which the EPA has accepted for complying with SARA Title III. This plan deserves acceptance and support by the Army.
- I. The chemical munitions handling operations, prior to entering the demil facility, are not as thoroughly developed as they should be. Since the rockets are considered as hazardous waste by the State of Oregon, the proposed handling of the rockets throughout the entire process should be detailed in the Part B Permit application.
- J. A task force group (outside consultants and Army) should meet every six months to discuss the progress, and problems of the Chemical Stockpile Disposal Program.
- K. There needs to be developed, and made available to those concerned (consultants, emergency response teams, etc.), accurate data on stocks and throughput for all handling and transportation steps.

- L. There needs to be a single command coy for dealing with events, incidents, and accidents. The organizational planning must all be coordinated through this single center. It alone should be responsible for any notification of the public, outside the facility.
- M. The plan referred to as Option I, the phased approach, is recommended. Tooele continues with the research program, JACADS proceeds with the operational demilitarization, and the CONUS facilities follow on a schedule about three years behind JACADS. If a failure occurs at JACADS, the CONUS facilities are put on hold until the problem is solved.
- N. There needs to be additional studies to investigate the accidental ignition of the rockets.
- O. The risk analysis study must recognize that internal events can cause serious accidents just as well as external events.
- P. A full time atmospheric scientist should be employed on the day shift. This employee would be responsible for analyzing real time meteorological data and assuring proper application of the computer model used to estimate agent release from an incident/accident.
- Q. The D2PC dispersion model, in its present form, is inadequate for predicting far downwind, worst case agent concentrations due to accidental releases. A revised model or new model when developed, needs to be subjected to rigorous technical review before being considered adequate.
- R. The quantities of material accidentally released from malfunctions of the incinerators or air pollution abatement systems need to be considered. This information is necessary for input to the D2PC model.
- S. The site specific study for UMDA needs to consider emergency response to accidental spills and mitigation for both ground water and surface runoff situations. Ground water monitoring should also be considered.
- T. The revised D2PC model for plume behavior needs to be thoroughly evaluated for a spectrum of possible accidental releases of agent, including worst cases.
- U. All known toxicological impacts of the various agents or combustion products should be considered in developing a risk analysis. The earliest and most sensitive responses are most important.
- V. The toxicological impacts on the agriculture of the

area should be considered along with the human health effects.

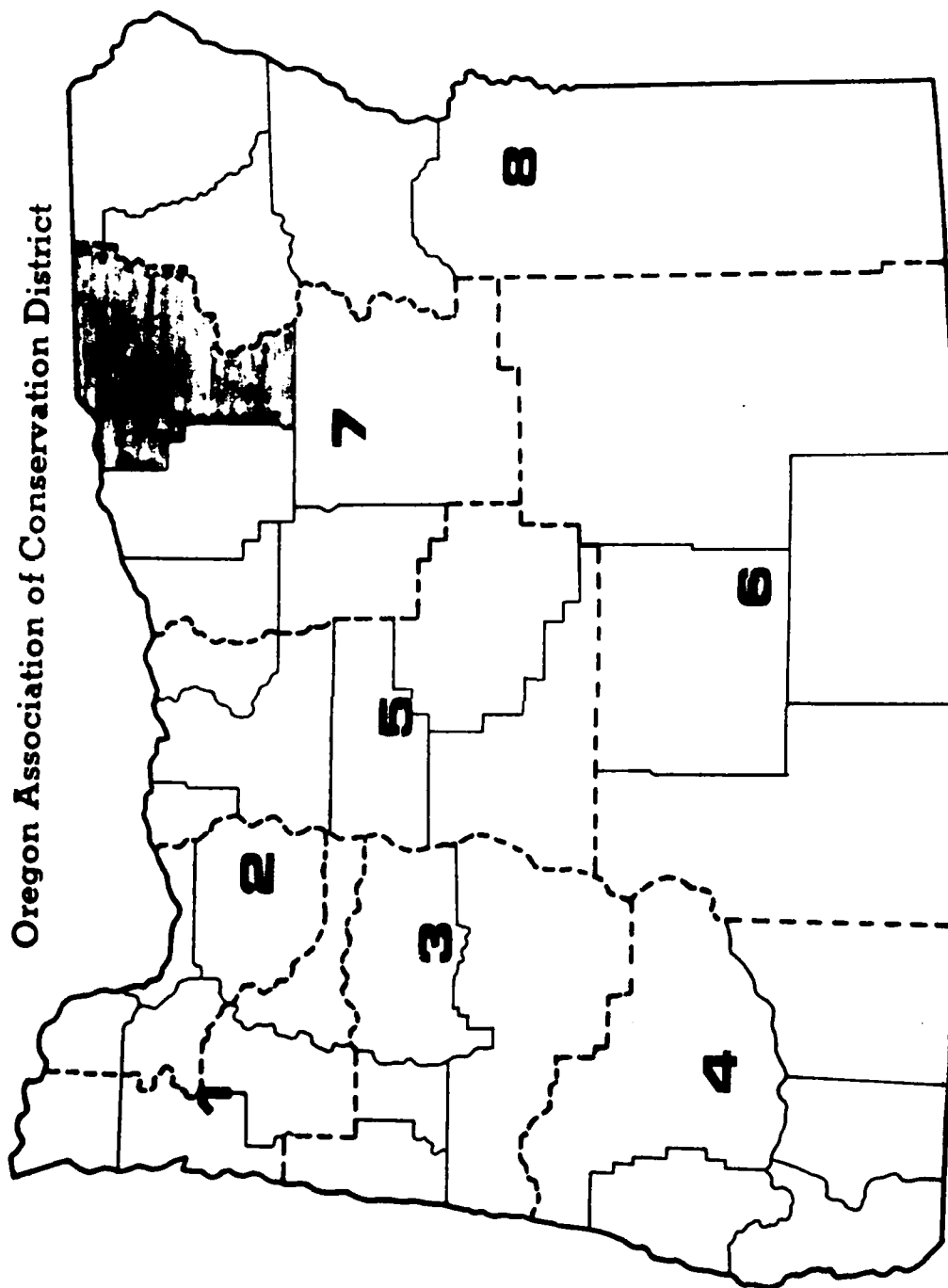
- W. The FPEIS should include a simple discussion of the irreversible effects such as reproductive and genetic injury, and cancer, and a discussion of the nature of biological risk.

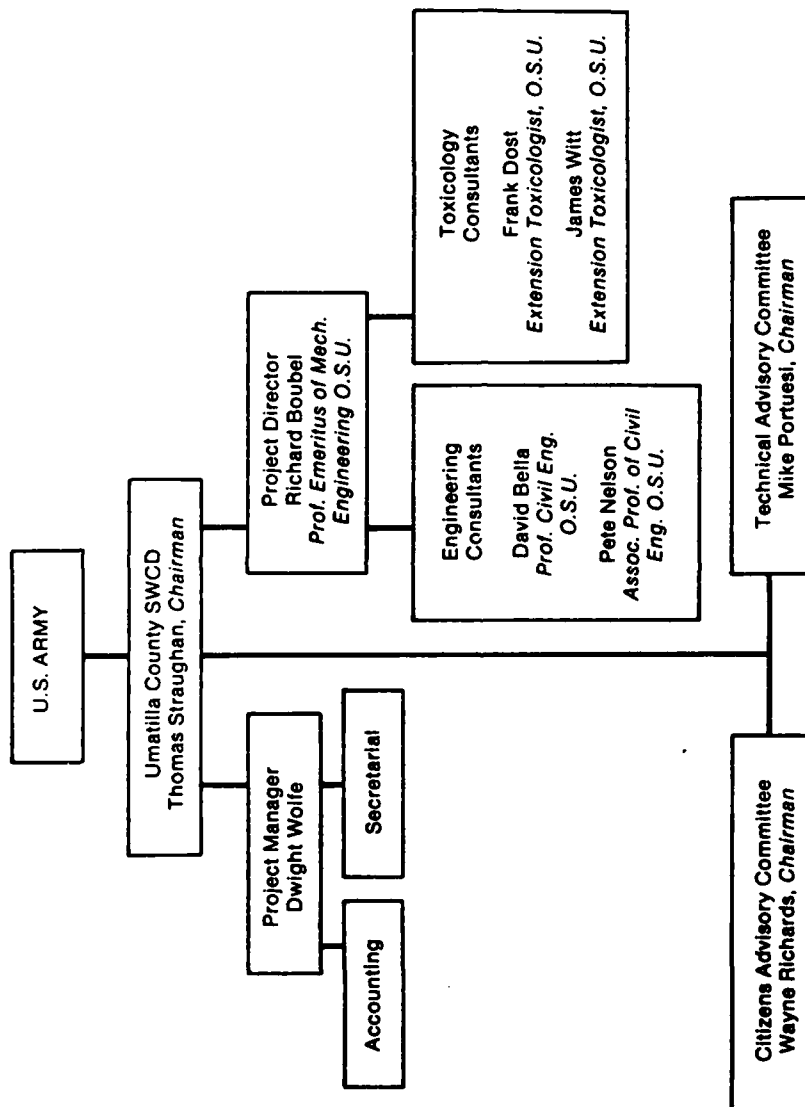
# STATE DEPARTMENT OF AGRICULTURE SOIL AND WATER CONSERVATION DIVISION ORGANIZATIONAL STRUCTURE



\*SWCD: Soil and Water Conservation District

Oregon Association of Conservation District



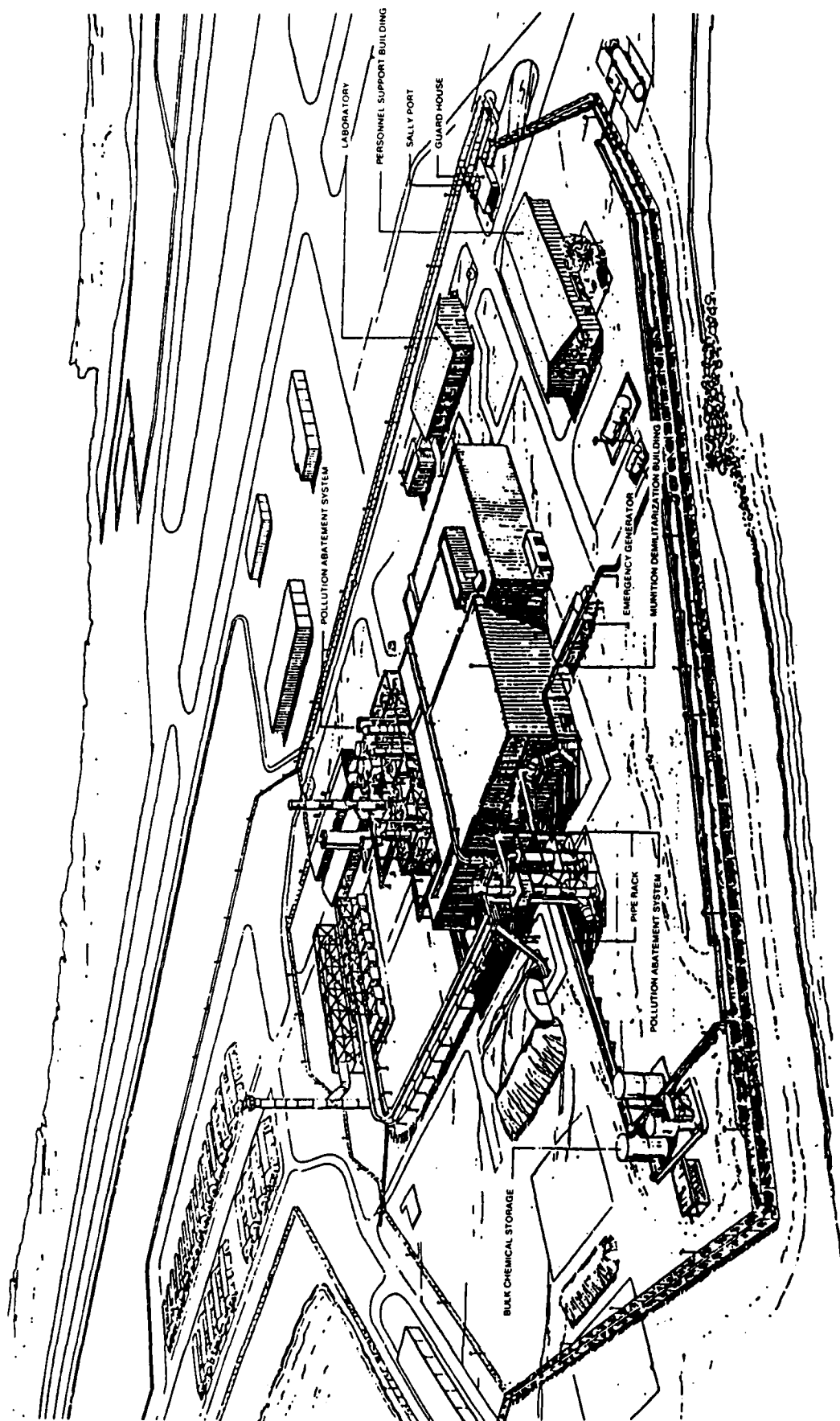


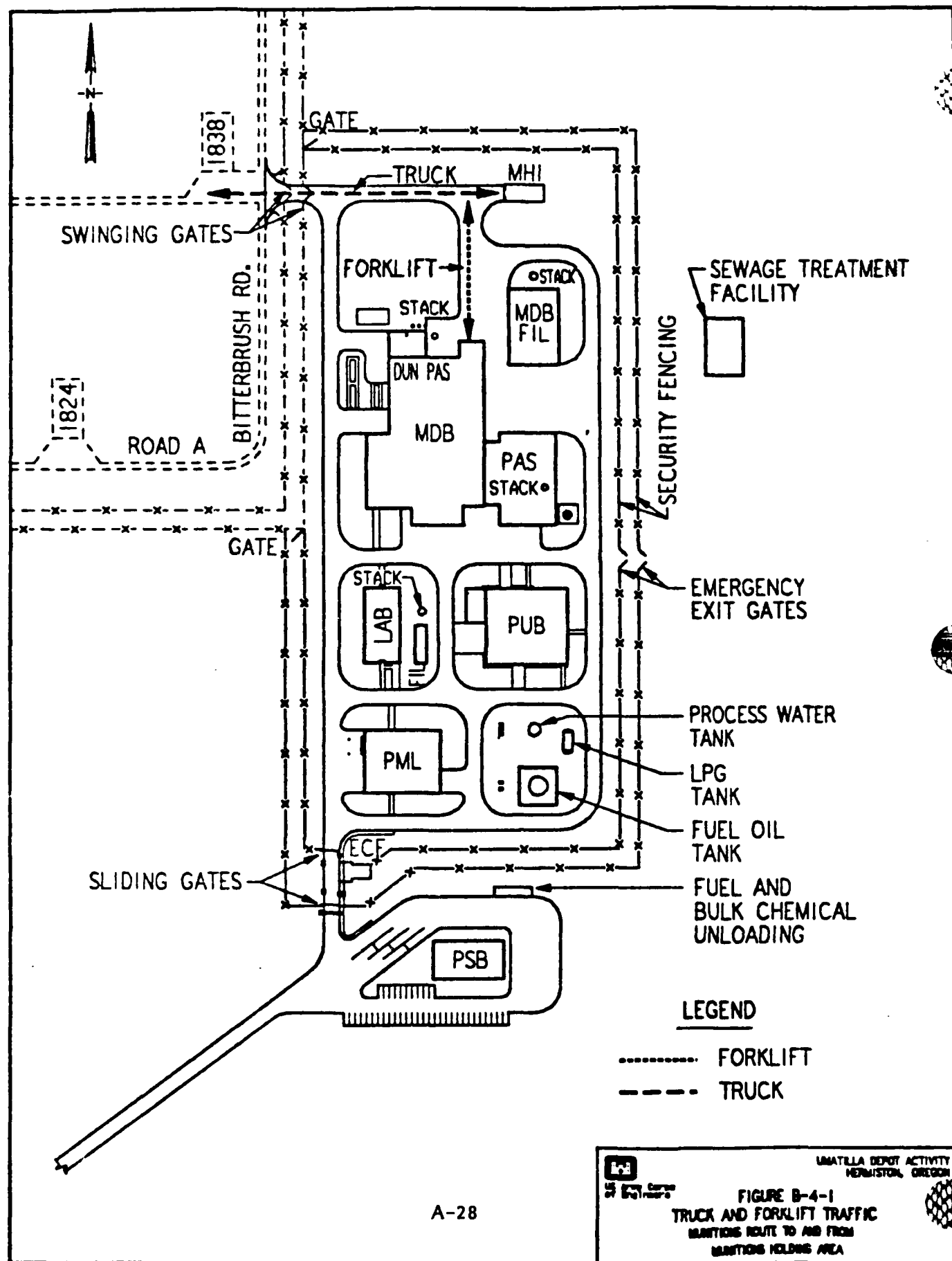
## **BASIC GUIDELINES FOR OUR STUDY GROUP**

- The material we are to dispose of was created for a single purpose, **TO KILL HUMAN BEINGS**. Some techniques and systems that are acceptable for disposal of less toxic, but still "hazardous", waste or material would be completely unacceptable for this project.
- We cannot consider terms such as: "estimates of lethality", "no death distances less than 20 km", or "1% lethality levels". If a single death occurs outside the boundary of any of the 8 continental United States facilities, and that death is related to any release from one of those facilities, **THE ENTIRE CHEMICAL STOCKPILE DISPOSAL PLAN WILL COME TO A GRINDING HALT**. The effect of the media would be so powerful that even a release that "nearly" resulted in a death would probably stop the project. Remember, nobody died as a result of the Three Mile Island accident.

## **SIMPLIFYING ASSUMPTIONS USED FOR THIS STUDY**

- Only on site incineration of the chemical munitions is practical.
  - ☐ This eliminates study and analysis of the other "alternatives".
  - ☐ This complies with local and national politicians' desires.
  - ☐ This permits use of proven technology which is also the most cost effective technology.
- A stepwise process should be followed.
  - ☐ Continued research and development at Tooele Army Depot.
  - ☐ Construction and operation of the full scale facility at Johnston Atoll should proceed in a timely manner.
  - ☐ Facilities within the continental United States should be designed, constructed, tested, and operated using the information developed at Johnston Atoll. If any problems develop at Johnston Atoll, the continental United States facilities should be put on hold until the problems are successfully solved.





A-28

## **RELEVANT EXPERIENCE FACTORS**

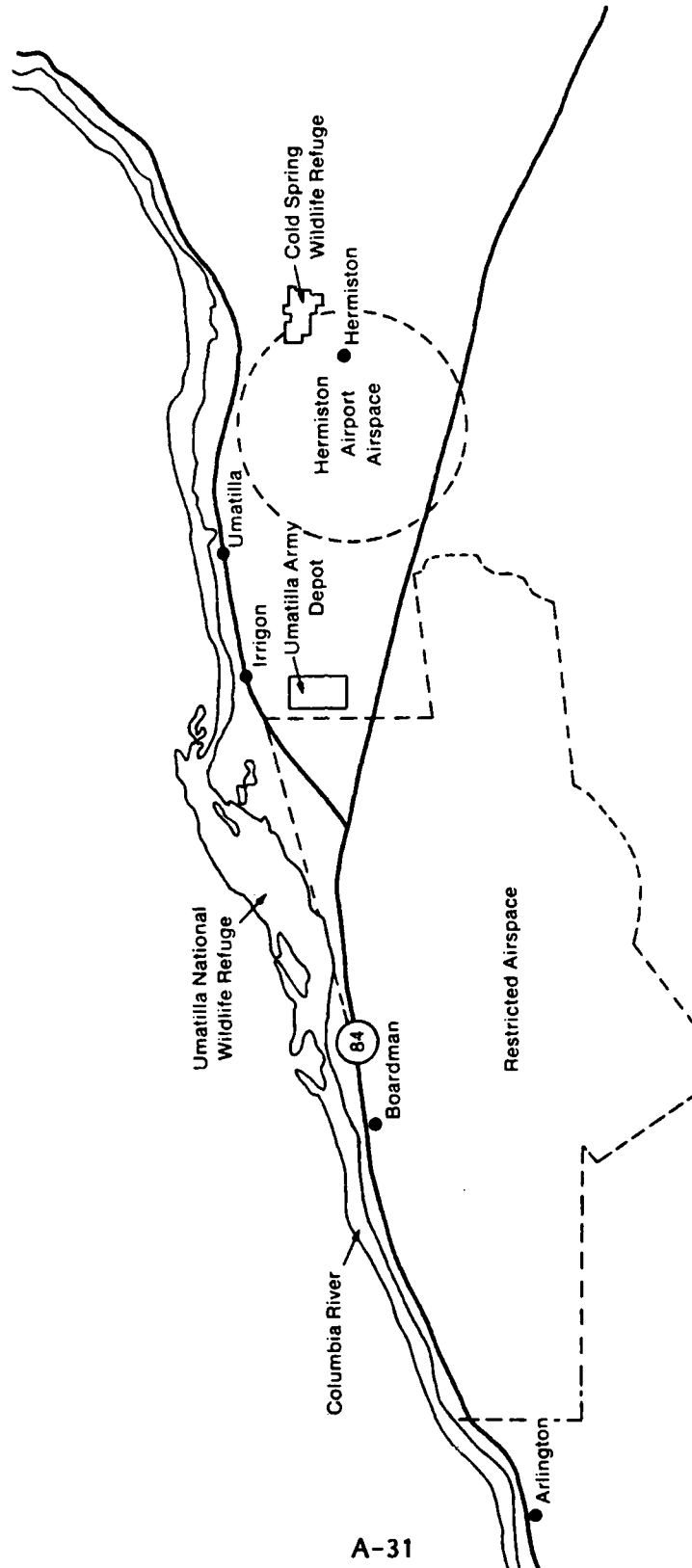
- The U.S. Army, and its contractors, have excellent experience, credibility, and safety records concerning all aspects of Chemical Munitions.
- CH2M-Hill prepared the Part B application for the Hazardous Waste Incinerator Permit. They also prepared the required air and water permits. CH2M-Hill has a vast amount of experience along with an excellent reputation.
- The Oregon Department of Environmental Quality is serving as the lead agency for review of these permits. The experience and credibility of the DEQ assures that the interests and health of the citizens of Oregon will be protected.
- Region X of the U.S. Environmental Protection Agency is cooperating with the Oregon DEQ in all phases of this project.

# **EPA Incinerator Standards**

**Principle Organic Hazardous Compounds (POHCs)  
99.99% Destruction Removal Efficiency**

**Particulate Emission Standard 180 mg/dscm**

**HCL Removal Efficiency 99%**



### **SARA TITLE III**

#### **The Emergency Planning and Community Right-To-Know Act of 1986**

- By April 17, 1987, the governor must appoint a State Emergency Response Commission (SERC)
- By July 17, 1987, the SERC is required to designate local emergency planning districts within the state and appoint members.
- By May 17, 1987, local industries which use chemicals in excess of quantities established by EPA must report their existence to SERC.
- By September 17, 1987, local industries must provide the name of their emergency coordinator to the local emergency planning district.
- By October 1988, local emergency planning committees are required to develop emergency response plans which are reviewed annually. They must provide the public with the chemical usage information received.
- Once developed, local plans must be submitted to the SERC.

AD-A193 353

CHEMICAL STOCKPILE DISPOSAL PROGRAM EVALUATION OF THE  
DRAFT PROGRAMMATIC (U) UMATILLA COUNTY SOIL AND WATER  
CONSERVATION DISTRICT PENDLETON

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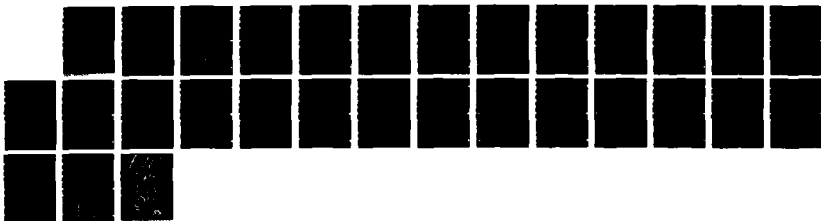
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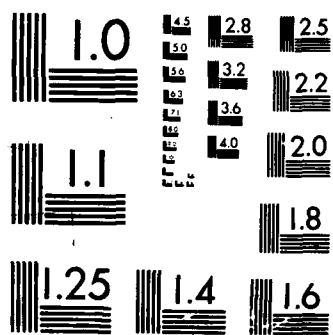
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## ROCKET IGNITIONS

- Drop Tests
- 30-Caliber Bullet
- Shear Machine

**EXTERNAL      INTERNAL  
EVENTS      EVENTS**

|   |   |
|---|---|
| + | + |
| + |   |

**DEMIL PLANT**

**HANDLING**  
Storage  
Transportation

# ACCIDENTS ASSUMED

|          | ROCKET<br>IGNITION | BURSTER<br>DETONATION |
|----------|--------------------|-----------------------|
| IMPACT   | yes                | yes                   |
| CRUSH    | no                 | no                    |
| PUNCTURE | no                 | no                    |
| FORCES   | no                 | yes                   |

**We disagree with the following:**

"Puncture-induced rocket propellant ignition has not been included because there is no evidence that a probe exists or could occur at the velocities necessary to cause puncture-induced propellant ignition. A 30-caliber bullet traveling about 1500 mph is required."

August 1987 Risk Analysis

**Plausible Mechanism for Kinetic-Ignition:** Kinetic energy is rapidly dissipated to heat with a small enough region of the steel rocket casing or objects penetrating the casing to produce a momentary and local temperature rise sufficient to initiate ignition.

## **TECHNICAL REVIEWS OF POSSIBLE ACCIDENTS**

- Fuse Malfunction
- Burster Detonation
- Rocket Ignition

The mechanical failure classification system employed in the risk assessment allows rocket ignition to disappear as a possible outcome of train accidents.

### **RECOMMENDATION**

The kinetic-ignition of the M55 rocket should be considered as a credible accident and mitigation steps should be taken.

Rocket ignition due to accidental forces has not been adequately covered in the risk assessment.

## **COMMAND AND CONTROL**

- A single document should be prepared describing the overall operational command and control requirements.
- These requirements should be independently reviewed and tested through preoperational surveys and drills.
- Command and control proposals should be independently reviewed and updated in the earlier phases of the program.

### **NEED FOR PROFESSIONAL CONFERENCES**

- The outside reviewers (ourselves and other citizen teams) have not had to defend our own work to a broader professional community; it is too easy to take "cheap shots".
- Our review is a "one shot" affair. It's too easy for Army personnel to dismiss a criticism by saying, "Oh, that subject is covered in a report that will be out next month".

- **THROUGHPUTS AND STOCKS**
- **COMMAND AND CONTROL**
- **TECHNICAL**

### **THROUGHPUTS AND STOCKS**

Data on throughputs and stocks of munitions, agents, explosives-propellents and leakers for all operational stages should be developed for each site and operational plans should be reviewed with the goal of handling of these during operational disruptions and avoiding dangerous "pile ups".

THE CAPACITY OF THE VARIOUS "COMPARTMENTS"  
WILL DETERMINE THE UPPER LIMIT OF THE AMOUNT  
AND CONCENTRATION OF AGENT THAT CAN BE LOST.

A MODEL BASED ON OPERATING TEMPERATURE AND  
OTHER REAL TIME PHYSICAL MEASUREMENTS IN THE  
DESTRUCTION SYSTEM COULD DESCRIBE THE  
CHARACTER OF THE OUTPUT AT ANY GIVEN TIME.

WITH AN APPROPRIATE DISPERSAL MODEL THE  
MAXIMUM AMOUNT OF MATERIAL THAT CAN BE  
AT ANY POINT OUTSIDE THE FACILITY, AND ITS  
CONCENTRATION, CAN BE ESTIMATED AT ANY TIME  
WITHOUT REAL-TIME CHEMICAL MEASUREMENTS.

EVERY AGENT IN THE STOCKPILE HAS A VARIETY OF NON-LETHAL EFFECTS, ALL OF WHICH SHOULD BE CONSIDERED IN ANALYZING RISK. THE EARLIEST OBSERVABLE RESPONSE IS PARTICULARLY IMPORTANT.

THE EIS SEEMS TO IMPLY THAT THE PRIMARY END POINT IN THE ANALYSIS IS DEATH, WHICH WILL GIVE THE PUBLIC AN INCORRECT SENSE OF BOTH THE NATURE OF THE CHEMICALS AND THE PROCESS OF HAZARD EVALUATION.

FOR ALL OF THE EFFECTS OF EACH CHEMICAL  
THERE IS A DOSE-RESPONSE RELATIONSHIP.

COMPARISON OF DOSE-RESPONSE INFORMATION  
FROM ANIMAL STUDIES OF ORGANOPHOSPHATE  
MILITARY AGENTS AND INSECTICIDES SHOULD  
PROVIDE DATA ON RELATIVE POTENCIES. THE  
LIMITED DATA ON HUMAN EXPOSURE TO BOTH  
GROUPS, AND RELATIVE POTENCY DATA SHOULD  
ALLOW PREDICTION OF DOSE RATES THAT CAN  
BE EXPECTED TO CAUSE SPECIFIC SYMPTOMS.

MAXIMUM RELEASE DATA, METEOROLOGICAL DATA  
AND DOSE/CONCENTRATION-RESPONSE DATA CAN  
BE BROUGHT TOGETHER. EITHER AT TIME OF  
INCIDENT OR AS A PREDICTIVE EXERCISE, THE  
APPROPRIATE MODELS CAN THEN ESTIMATE THE  
DISTRIBUTION OF THE EARLIEST AND MOST  
SENSITIVE RESPONSES IN A POPULATION.

THE TOXICOLOGICAL CHARACTER OF THE COMBUSTION PRODUCTS SHOULD BE DISCUSSED. EVEN WITH INEFFICIENT COMBUSTION, THE AGENTS SHOULD LOSE THEIR ORIGINAL TOXIC CHARACTER. MOST OF THE COMBUSTION PRODUCTS THAT HAVE BEEN IDENTIFIED ARE RELATIVELY SIMPLE COMMON COMPOUNDS FOR WHICH SUBSTANTIAL INFORMATION IS AVAILABLE.

THE EIS SHOULD INCLUDE A DISCUSSION OF  
POSSIBLE IMPACTS ON AGRICULTURE AND THE  
PROBABILITY OF OCCURRENCE. ACUTE DIRECT  
EFFECTS ON LIVESTOCK, ESTIMATES OF ANIMAL  
EXPOSURE THROUGH INGESTION OF RESIDUES ON  
FRESH AND STORED FORAGE, AN ASSESSMENT OF  
LOSSES OF PRODUCTION, AND HUMAN EXPOSURE  
THROUGH CROP CONSUMPTION SHOULD BE DISCUSSED.

THERE IS GENERAL PUBLIC CONCERN ABOUT  
REPRODUCTIVE AND GENETIC INJURY, AND  
CANCER; THE PERCEPTION IS THAT THESE  
AFFLICTIONS ARE EASILY INDUCED BY  
CHEMICAL EXPOSURES OF ANY KIND. EVEN  
THOUGH THE RISKS OF SUCH EVENTS ARE  
EXCEEDINGLY LOW, THE EIS SHOULD INCLUDE  
A DISCUSSION OF RISK ASSESSMENT THAT IS  
READILY COMPREHENSIBLE TO THE PUBLIC.

THE EIS DRAFT SEEMS TO BE WRITTEN WITH  
REASONABLE CLARITY, ALTHOUGH IN SOME  
AREAS A TECHNICAL EXPERTISE SEEMS TO  
BE ASSUMED. SUCH DOCUMENTS HAVE BEEN  
SUCCESSFULLY CHALLENGED IN COURT AS NOT  
BEING READABLE BY THE GENERAL PUBLIC. A  
READING EXPERT SHOULD EXAMINE THE DOCUMENT.

THE GLOSSARY MAY ADD MORE UNFAMILIAR  
TERMS THAN IT DEFINES.

# ACCIDENTAL RELEASES - AIR

## Comments

### 1. D2PC Gaussian Dispersion Model

Critical consideration: limits of model

- need to be clearly specified

Calculates no—deaths distance

- should consider other non—lethal criteria

Sample calculations — WC and ML cases

- source term not specified

- accuracy of calculations?

Box model modifications

- Unclear where applied (cases, conditions?)

- Undocumented

- Parameter selection questionable

- Use not justifiable

Characterization of release

- methods of quantifying source term unclear

- should develop max. release scenarios for accidents  
use these as first run "WC"

- back calculation of source term using D2PC:  
too many error sources, not acceptable

- need a standard format for reporting

## Comments, cont'd

### 2. Emergency response (ER)

#### Monitoring

- relationship of monitoring (alarms) to ER actions unclear
  - primary or secondary information?
  - data provided (conc. or threshold?)
  - how used to quantify source term?
  - errors in measurements?
- How are false alarms determined? handled?
- What is level of redundancy in system?

#### Organizational

- clear lines of authority and responsibility not specified
- listed controlling authorities are:
  - government contracting officer, central command and control officer,
  - operations center, emergency op. center

#### Accident assessment

- classification scheme
  - ins't quantitative (e.g., source term for D2PC)
  - responsibility for assessment not specified
  - lines of communication " "
- assessment't in case of injury to op. personnel?
  - explosions as special cases
  - back-up/redundancy

## AIR EMISSIONS - DISPOSAL PLANT

### DPEIS

#### Normal operations

Design - Incinerator and a.p.c. equipment

- comply with air quality standards
- dispersion calc's with EPA ISC model
  - generic, well within limits
  - need site-specific output to verify

#### Abnormal operations

- not specifically addressed
- procedures for a.p.c. equip. failures?
- proc. for monitoring alarms? false alarms?
- is D2PC model used for accidental releases?
  - procedures and responsibilities for above

### UMDA Air Application - State of Oregon

#### Control of agent emissions

- automatic cut-off conditions if detected
  - what happens then?
    - estimate of agent emitted
    - emergency actions?
    - dispersion calc's, procedures
- need scenarios developed for abnormal op's

Brines from a.p.c. equipment

- "agent free" needs to be defined
- capacity of LIC to handle brines?

#### Automatic control systems

- can be too sensitive (false alarms)
- adequate redundancy?
- false alarm scenarios?

# GROUNDWATER IMPACTS

**SWED**

## Normal Operations

- no discharges**

## Accidents

- spill to ground stated to be minor impact
- no supporting evidence for this
- stored at UMDA are: ton containers of VX
- bulk containers of GB and VX
- explosive releases (rockets, mines, etc.)
- could contaminate large area
- worst case scenarios?
- decontamination procedures not specified
- containment practices?
- hydrolysis reactions of agents in soils
- highly dependent on pH and solution comp.
- products are also toxic and persistent
- Were leaking storage tanks considered?
- monitoring?

### Existing groundwater resources in UMDA area

- 3 of 4 surrounding cities use wells
- upper alluvial aquifer unconfined
  - recharge from surface runoff and inflt.
- soils sandy, rapid infiltration rate

## EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW

### Background

On October 17, 1986, Congress enacted Title III, the Emergency Planning and Community Right-to-Know Act of 1986 as part of the Superfund Amendments and Reauthorization Act. It contains numerous requirements for federal, state and local governments as well as private industry in the areas of emergency planning, community right-to-know, hazardous emissions reporting, emergency notification and chemical accident prevention. These requirements build upon both EPA's chemical emergency preparedness program and Oregon's existing programs aimed at community right-to-know and emergency preparedness. The Act complements Oregon's programs and provides an opportunity for developing preparedness programs closely tailored to local needs.

This fact sheet has been developed by the Department of Environmental Quality and the State Fire Marshal's office to assist local officials in understanding their responsibilities under Title III. It summarizes the most significant provisions of the legislation and identifies those requirements and compliance dates affecting industry and local governments. It also provides an overview of the state program.

### Emergency Planning

An important objective of Title III is to improve local chemical emergency response capabilities, through the development of local emergency response plans. The Act addresses planning on two fronts - by (1) requiring the establishment of a state and local planning structure and process and (2) specifying the minimum contents of local plans.

The most important requirements include:

- (1) By April 17, 1987 the Governor must appoint a State Emergency Response Commission.
- (2) By July 17, 1987, the Emergency Response Commission is required to designate local emergency planning districts within the state and appoint members to local emergency planning committees for each of those districts by August 17th. The local committee membership should include representatives from state and local government, law enforcement, civil defense, fire-fighting, first aid, health, local environmental agencies, hospitals, transport industry, media, community groups and owners and operators of facilities affected by Title III.
- (3) By May 17, 1987, local industries which use chemicals in excess of quantities established by EPA must report their existence to the State Commission.
- (4) By September 17, 1987, local industries must provide the name of their emergency coordinator to the local committee.

- (5) By October 1988, local emergency planning committees are required to develop comprehensive emergency response plans which must be reviewed and updated at least annually thereafter. They must also establish procedures for providing the public with the chemical usage information received from local industry. Local response plans must at a minimum include the following elements: identification of chemical facilities; emergency response procedures, including notification and evacuation; designation of community and facility emergency response coordinators; descriptions of available response equipment and resources; and schedules for emergency response exercises and training.
- (6) Once developed, local plans must be submitted to the State Emergency Response Commission for a consistency review to insure coordination of all local plans within the state.

## THE STATE PROGRAM

### Emergency Planning

Governor Goldschmidt has designated the Interagency Hazard Communications Council (IHCC) to be the state emergency response commission. The IHCC was originally formed by the 1985 Legislature to oversee the activities of several state agency programs involved in hazardous materials. It is composed of 15 state agency heads and 4 members of the public at large, including industry and local government. The Department of Environmental Quality has been designated as the lead state agency for emergency planning activities, and the State Fire Marshal's office has been designated as the lead agency for community right-to-know activities. Currently, various alternative approaches to establishing local planning districts are being considered. The options range from having one planning district represent the entire state to one planning district for each local community. It appears that the most feasible approach is to have the districts established on a regional, geographic basis with perhaps 9 to 12 local districts. State agency representatives will be conducting informational meetings with each county in the latter part of April and early May and will solicit input from interested parties on the question of local planning district boundaries.

### Community Right to Know

The State Fire Marshal's office pursuant to ORS 453.307 to 453.372, passed by the 1985 Legislature, is in the process of completing the first phase of a hazardous substance survey similar to that mandated by Title III. The state community right-to-know program is actually more comprehensive than the federal program because it includes a larger number of employers. The major differences in the two programs are the reporting forms and notification requirements. The state will seek to modify its program to have it meet the intent of Title III reporting requirements. State agency representatives will also be discussing the state and federal community right-to-know programs during the county meetings. We encourage your input on this issue.

### Planning Schedule

- (1) April, 1987 - Governor designates the Interagency Hazard Communication Council as the State Emergency Response Commission.
- (2) Late April to early May, 1986 - Informational meetings will be held in each of the counties to solicit input on local planning district boundaries and local planning committee membership.
- (3) Late May to early June - Meetings will be held around the state to solicit final input on planning district boundaries.
- (4) July 17, 1987 - Local planning district boundaries are designated by the IHCC.
- (5) August 17, 1987 - Local planning committee members are appointed by the IHCC.
- (6) September, 1987 - The first meetings of the local planning committees are scheduled to begin.

### Information

For further information contact either:

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229-6047 or toll-free at 1-800-452-4011

or

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# H22-WET PLANNING COORDINATION

## TITLE III

| AREA OF COVERAGE        | PRINCIPAL INVOLVED GROUPS/AGENCIES                                                                                                                                                    | PROPOSED PLANNING BODIES                                                                                                                                                                                                                                                                                                                               | RESOURCES AVAILABLE                                                                                                                                                                                                                                                                   | PLANS OR PRODUCTS                                                                                                                                                                                                                                                                                                   |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNITED STATES           | <ul style="list-style-type: none"> <li>- Environmental Protection Agency (EPA)</li> <li>- Federal Emergency Management Agency (FEMA)</li> </ul>                                       | <p>National Response Team (NRT)</p> <ul style="list-style-type: none"> <li>- Federal agencies</li> </ul> <p>Regional Response Team (NRT)</p> <ul style="list-style-type: none"> <li>- Federal agencies</li> <li>- States in region</li> </ul>                                                                                                          | <ul style="list-style-type: none"> <li>- Planning assistance</li> <li>- Training assistance</li> <li>- Haz-mat expertise</li> <li>- Financial assistance</li> </ul>                                                                                                                   | <ul style="list-style-type: none"> <li>- National Contingency Plan</li> <li>- Regional Response Plan (Region 10)</li> <li>- Draft Hazardous Materials Emergency Planning Guide (NRT)</li> </ul>                                                                                                                     |
| STATE OF OREGON         | <p>DEQ - lead agency planning</p> <p>SWH - lead Community Right to Know</p> <p>ENO - all hazard coordination</p> <p>OSHD - health issues</p> <p>OOOE - radioactive mat. transport</p> | <p>State Emergency Response Commission</p> <ul style="list-style-type: none"> <li>- 15 state agency heads</li> <li>- 2 industry representatives</li> <li>- 2 local government reps.</li> <li>- 1 public interest group</li> </ul>                                                                                                                      | <ul style="list-style-type: none"> <li>- Planning assistance</li> <li>- Training assistance</li> <li>- Haz-mat expertise</li> <li>- Haz-mat data base</li> <li>- Cleanup fund</li> <li>- Financial assistance</li> <li>a) Response equipment</li> <li>b) Response expenses</li> </ul> | <ul style="list-style-type: none"> <li>- Oregon - Emergency Operations Plan</li> <li>- Annex 0 - Oil &amp; Hazardous Materials Emergency Response Plan</li> <li>- Proposed model local hazardous hazardous materials response plan</li> <li>- State agency procedures</li> </ul>                                    |
| REGIONAL PLANNING AREAS | Proposed regional haz-mat teams                                                                                                                                                       | <p>Local Emergency Planning Committee</p> <ul style="list-style-type: none"> <li>- state and local government</li> <li>- local elected officials</li> <li>- law enforcement</li> <li>- fire</li> <li>- civil defense</li> <li>- emerg. medical groups</li> <li>- local health/environment</li> <li>- hospital</li> <li>- facility operators</li> </ul> | <ul style="list-style-type: none"> <li>- Regional knowledge and expertise</li> <li>- Train the trainer assistance to local communities</li> <li>- Proposed regional haz-mat teams</li> </ul>                                                                                          | <ul style="list-style-type: none"> <li>- Proposed regional mutual aid agreements</li> <li>- Site regional response teams and determine membership</li> </ul>                                                                                                                                                        |
| LOCAL COMMUNITIES       | <p>Counties</p> <p>Cities</p> <p>Special Districts</p>                                                                                                                                | <p>Local Community Planners (may include):</p> <ul style="list-style-type: none"> <li>- fire</li> <li>- law enforcement</li> <li>- emergency coordinator</li> <li>- emergency medical</li> <li>- health</li> <li>- public works</li> <li>- local officials</li> </ul>                                                                                  | <ul style="list-style-type: none"> <li>- Local knowledge and expertise</li> <li>- First responders</li> <li>- Emergency medical</li> <li>- Shelter facilities</li> </ul>                                                                                                              | <p>Proposed local response plan consistent with Annex 0 that identifies:</p> <ul style="list-style-type: none"> <li>- Facilities with haz-mat</li> <li>- emergency response procedures</li> <li>- notification &amp; evas. guidelines</li> <li>- incident command</li> <li>- local mutual aid agreements</li> </ul> |

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