

6262

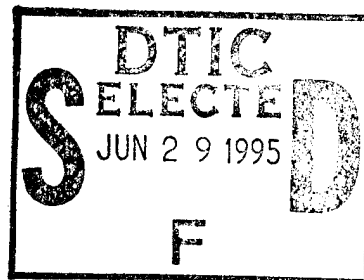


**U.S. Army  
Environmental  
Center**

USAEC Report No. SFIM-AEC-EC-CR-94004

**Evaluation of DERA Funded  
HAZMIN Projects, 1988-1991**

**Final Report  
Volume 2 (Appendices A, B, C, and D)**



Submitted to:

U.S. Army Environmental Center  
(USAEC),  
Aberdeen Proving Ground,  
Maryland

*Original contains color  
plates; All DTIC reproductions  
will be in black and  
white.*

January 31, 1994

This document has been approved  
for public release and sale; its  
distribution is unlimited.

Arthur D. Little, Inc.  
Acorn Park  
Cambridge, Massachusetts  
02140-2390

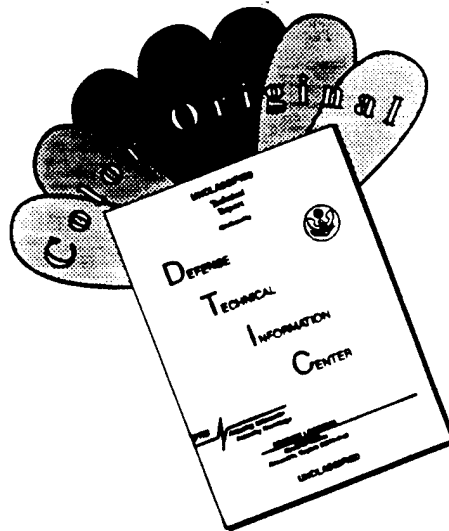
19950628 042

ADL Reference 67068

DTIC QUALITY INSPECTED 5

DAAA15-91-D-0016  
Delivery Order No. 8

# DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF COLOR PAGES WHICH DO NOT REPRODUCE LEGIBLY ON BLACK AND WHITE MICROFICHE.

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

|                                  |                                    |   |
|----------------------------------|------------------------------------|---|
| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE<br>January 31, 1994 | 3. REPORT TYPE AND DATES COVERED<br>Final 9/92-1/94 |
|----------------------------------|------------------------------------|---|

|   |                    |
|---|--------------------|
| 4. TITLE AND SUBTITLE<br>Evaluation of DERA Funded HAZMIN Projects, 1988-1991 | 5. FUNDING NUMBERS |
|---|--------------------|

|  |                    |
|--|--------------------|
| 6. AUTHOR(S)<br>A.A. Balasco, M.J. Bryant, C.E. Lamontagne,<br>J.L. Mahannah, M.A. Marando, J.F. O'Donnell | 5. FUNDING NUMBERS |
|--|--------------------|

|  |   |
|--|---|
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br>Arthur D. Little, Inc.<br>Acorn Park<br>Cambridge, MA 02140-2390 | 8. PERFORMING ORGANIZATION REPORT NUMBER<br><br>67068 |
|--|---|

|   |  |
|---|--|
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)<br>U.S. Army Environmental Center<br>ATTN: SFIM-AEC-ECA | 10. SPONSORING/MONITORING AGENCY REPORT NUMBER<br><br>SFIM-AEC-EC-CR-94004 |
|---|--|

11. SUPPLEMENTARY NOTES

|   |                        |
|---|------------------------|
| 12a. DISTRIBUTION/AVAILABILITY STATEMENT<br>Unlimited | 12b. DISTRIBUTION CODE |
|---|------------------------|

13. ABSTRACT (Maximum 200 words)

Since 1985, the U.S. Army has funded approximately 75 installations and activities to conduct various projects related to hazardous waste minimization (HAZMIN). This report describes the findings of a study to follow up on over 100 projects funded between 1988 and 1991 and address their fate and effectiveness in terms of waste reduction and cost savings.

These projects were categorized by project type (e.g., equipment purchase and installation, test and evaluation, etc.) and by targeted waste (e.g., solvents, metals, reactive, etc.).

In general, many of the HAZMIN projects were found to have resulted in apparent cost savings and waste reduction as well as less tangible benefits such as increased awareness of and involvement in HAZMIN initiatives.

In addition to an evaluation of successful HAZMIN projects, impediments to the success of HAZMIN projects were identified.

|   |                            |
|---|----------------------------|
| 14. SUBJECT TERMS<br>Waste minimization, Hazardous wastes, Army depots, Army ammunition plants, Army arsenals | 15. NUMBER OF PAGES<br>440 |
|   | 16. PRICE CODE             |

|   |  |   |  |
|---|--|---|--|
| 17. SECURITY CLASSIFICATION OF REPORT<br>Unclassified | 18. SECURITY CLASSIFICATION OF THIS PAGE<br>Unclassified | 19. SECURITY CLASSIFICATION OF ABSTRACT<br>Unclassified | 20. LIMITATION OF ABSTRACT<br>Unclassified/Unlimited |
|---|--|---|--|

Appendix A: Points of Contact for Evaluated Projects

|                    |                                     |
|--------------------|-------------------------------------|
| Accession For      |                                     |
| NTIS CRA&I         | <input checked="" type="checkbox"/> |
| DTIC TAB           | <input type="checkbox"/>            |
| Unannounced        | <input type="checkbox"/>            |
| Justification      |                                     |
| By _____           |                                     |
| Distribution/      |                                     |
| Availability Codes |                                     |
| Dist               | Avail and/or Special                |
| A-1                |                                     |



**Table A-1: Project List with Points of Contact**

| Project Number | Organization/MACOM | Brief Project Title                      | Installation/Performer | Point of Contact                                       |
|----------------|--------------------|--|------------------------|--|
| 1              | AMC                | HAZMIN Workshops                         | HQ AMC                 | Libbie Borgatti (703) 274-9016                         |
| 2              | AMC                | HAZMIN Audits                            | PBMA/INEL              | Maj Jeff Dell'Omo (703) 274-3890                       |
| 3              | AMC                | Solvent Distillation                     | Crane AAA              | Steve Schick (812)854-3404                             |
| 4              | AMC                | Reactive HW Thermal Treatment            | Kansas AAP             | Vicki O'Brien (316)421-7574                            |
| 5              | AMC                | Equip/Testing to Min Reactive Wastes     | Kansas AAP             | Vicki O'Brien (316)421-7574                            |
| 6              | AMC                | Incinerator Minimization Study           | Lone Star AAP          | David Self (903) 334-1308                              |
| 7              | AMC                | Paint Booth Filter                       | Louisiana AAP          | Doyle Williams (318)459-5108                           |
| 8              | AMC                | Pilot Test of UV/Ozone Tmt System        | Louisiana AAP          | Steve Flowers (318)459-5131                            |
| 9              | AMC                | Spent Carbon Regeneration at LAPs        | Louisiana AAP          | Steve Flowers (318)459-5131                            |
| 10             | AMC                | Trailerized Fuel Transfer Tank           | McAlester AAP          | Darrell Elliott (918)421-2551                          |
| 11             | AMC                | Dry Vacuum System for LAP                | Milan AAP              | Mike Harris (901)686-6577                              |
| 12             | AMC                | Activate Pilot Plant for Recovery of STB | Pine Bluff Ars         | James Hayley (501)540-2951                             |
| 13             | AMC                | Hazardous Waste Metal Shredder           | Pine Bluff Ars         | Phil Vick (501) 540-2810                               |
| 14             | AMC                | Spray Wash Cabinets                      | Stratford AEP          | John Fleming (203)385-3964                             |
| 15             | AMC                | Spray Cleaning Cabinets                  | Anniston AD            | Tim Garrett (205)235-6350                              |
| 16             | AMC                | Aluminum Ion Vapor Deposition (AIVD)     | Anniston AD            | Tim Garrett (205)235-6350                              |
| 17             | AMC                | Gas Chromatograph                        | Anniston AD            | Bobby Phillips (205)235-7241                           |
| 18             | AMC                | Equipment Maintenance                    | Anniston AD            | Tim Garrett (205)235-6350                              |
| 19             | AMC                | Acquisition and Assembly of Paint Booth  | Anniston AD            | Tim Garrett (205)235-6350                              |
| 20             | AMC                | Reclamation of Cr from Plating Baths     | Corpus Christi AD      | Jim Holiday (512)939-2214                              |
| 21             | AMC                | AIVD Equipment/Support                   | Corpus Christi AD      | Jim Holiday (512)939-2214                              |
| 22             | AMC                | Vapor Degreaser Distillation             | Letterkenny AD         | Dennis Reed (717)267-9506                              |
| 23             | AMC                | Solvent Distillation Systems             | Red River AD           | Mike Lockard (903)334-3559                             |
| 24             | AMC                | Used Oil Reclamation System              | Red River AD           | Mike Lockard (903)334-3559                             |
| 25             | AMC                | Solvent Recovery Facility                | Sacramento AD          | Rick Solander, John Swazo (916)388-2489                |
| 26             | AMC                | Acid/Base Neutralization                 | Seneca AD              | Mike Paprocki (607)869-1519                            |
| 27             | AMC                | Solvent Distillation                     | Seneca AD              | Mike Paprocki (607)869-1519                            |
| 28             | AMC                | LP/HV Paint Spray Systems                | Tobyhanna AD           | Mike Parrent (717)894-7090                             |
| 29             | AMC                | Paint Sludge/Walnut Dust Incineration    | Tooele AD              | Larry Fisher (801) 833-3506, Jay Bishop (801) 833-2825 |
| 30             | AMC                | Supercritical Fluid Demilitarization     | Redstone Ars           | Ron Hagler (205)876-6122                               |
| 31             | AMC                | Delisting/Treatment of HW                | CRDEC                  | Dave Renard (410) 671-4614                             |
| 32             | AMC                | New Toxicological Analytical Method      | CRDEC                  | Ronald Young (410) 671-4406                            |
| 33             | AMC                | Delisting of 3X/5X Material              | HQ TECOM               | Juan Lopez (410)278-1077                               |
| 34             | AMC                | Audit of CSTA's HAZMIN Program           | CSTA                   | Joe Ondek (410)278-5298                                |
| 35             | AMC                | Inventory of HW Generation               | Aberdeen PG            | Ken Stachiw (410)671-4841                              |

**Table A-1: Project List with Points of Contact**

| Project Number | Organization/<br>MACOM | Brief Project Title                    | Installation/<br>Performer | Point of Contact   |
|----------------|------------------------|--|----------------------------|--|
| 36             | AMC                    | Waste Oil Reduction                    | Aberdeen PG                | Ken Stachiw (410)671-4841                                |
| 37             | AMC                    | Liquid Waste Minimization              | Aberdeen PG                | Ken Stachiw (410)671-4841                                |
| 38             | AMC                    | Evaluation of Waste Streams            | Aberdeen PG                | Ken Stachiw (410)671-4841                                |
| 39             | AMC                    | Drum Storage Shed                      | Aberdeen PG                | Ken Stachiw (410)671-4841                                |
| 40             | AMC                    | Produce HAZMIN Video                   | Aberdeen PG                | Ken Stachiw (410)671-4841                                |
| 41             | AMC                    | Solvent Recovery Stills                | White Sands MR             | Harrison Orr (505)678-2224                               |
| 42             | AMC                    | Waste Minimization Opportunities       | White Sands MR             | Harrison Orr (505)678-2224                               |
| 43             | AMC                    | Stream Analysis                        | Yuma PG                    | Charles Botdorf (602) 328-2753                           |
| 44             | FORSCOM                | Waste Oil Collection Truck             | Ft. Campbell               | Jerry Merryman (502)798-3487                             |
| 45             | FORSCOM                | Jet Washers                            | Ft. Carson                 | Bob Mitchell (719)579-2895,-2896                         |
| 46             | FORSCOM                | Waste Oil Vacuum Truck                 | Ft. AP Hill                | Ms. Terry Banks (804)633-8255                            |
| 47             | FORSCOM                | Personnel Spt for HAZMIN Program       | Ft. Lewis                  | Cindy Trout (206)967-6546, 5337                          |
| 48             | FORSCOM                | Solvent Recycling Facility             | Ft. Lewis                  | Cindy Trout (206)967-6546, 5337                          |
| 49             | FORSCOM                | Paint Storage Cabinets                 | Ft. Lewis                  | Cindy Trout (206)967-6546, 5337                          |
| 50             | FORSCOM                | Vacuum Pump Truck                      | Ft. Meade                  | Paul Robert (301)677-3648                                |
| 51             | FORSCOM                | Equipment for Antifreeze Recycling     | Ft. Meade                  | Paul Robert (301)677-3648                                |
| 52             | FORSCOM                | Hot Water Jet Rinse Equipment          | Ft. Ord                    | Claire Murdo (408)242-2720                               |
| 53             | FORSCOM                | High Pressure Water Cleaning Equipment | Ft. Hunter Liggett         | Claire Murdo (408)242-2720                               |
| 54             | FORSCOM                | Sediment and Soil Drying Beds          | Ft. Polk                   | Jim Grafton (318)531-6011                                |
| 55             | USACE                  | HAZMIN Plans in Support of FORSCOM     | CERL/FORSCOM               | Shelah Roberts, FORSCOM, (404)669-7799                   |
| 56             | USACE                  | Personnel Spt for FORSCOM HAZMIN       | CERL/FORSCOM               | Shelah Roberts, FORSCOM, (404)669-7799                   |
| 57             | USACE                  | Equip to Spt HWMS at FORSCOM Instal.   | CERL/FORSCOM               | Shelah Roberts, FORSCOM, (404)669-7799                   |
| 58             | USACE                  | Development of Econ Analysis Model     | CERL                       | Keturah Reinbold (217) 398-5482                          |
| 59             | USACE                  | Hazardous Mat'l Tracking System        | CERL                       | Lynn Mikulich (217) 373-6749                             |
| 60             | USACE                  | Intra-Government Personnel Act         | CERL                       | Bob Riggins (217) 373-3320                               |
| 61             | USACE                  | Software Conversion for Comp w/AAEMIS  | CERL                       | Barbara Schmitt (410)671-1656                            |
| 62             | USACE                  | Integrated Hazardous Material Plan     | CERL                       | Steve Maloney (1-800) USA-CERL                           |
| 63             | USACE                  | Env Analy/Tech Assess/Database Dev     | DOE/ANL                    | Barbara Schmitt (410)671-1656                            |
| 64             | WESTCOM                | USARPAC HAZMIN Study                   | Ft. Shafter                | Ken Kramer (808)438-1526                                 |
| 65             | HSC                    | HAZMIN Surveys/Audits                  | AEHA                       | Brian Jones (410) 671-3652                               |
| 66             | HSC                    | Prep of MDI and Update                 | AEHA                       | Brian Jones (410) 671-3652                               |
| 67             | HSC                    | Laboratory Solvent Recycling           | Fitzsimmons AMC            | Sue Errett (303)361-3526                                 |
| 68             | MDW                    | HAZMIN Computer Tracking Equipment     | Ft. Belvoir                | Patrick McLaughlin (202) 475-2793                        |
| 69             | MDW                    | AAEMIS Development as ISM              | Ft. Belvoir                | Patrick McLaughlin (202) 475-2793                        |
| 70             | NGB                    | Purchase/Install PMB Equipment         | AV MSARNG                  | Charles Foster (410)671-1790/Joe Cassanova (703)746-6978 |
| 71             | TRADOC                 | HAZMIN Software/Hardware               | HQ TRADOC                  | Susan Stotts (804)727-2279                               |

**Table A-1: Project List with Points of Contact**

| <b>Project Number</b> | <b>Organization/<br/>MACOM</b> | <b>Brief Project Title</b>             | <b>Installation/<br/>Performer</b> | <b>Point of Contact</b>                  |
|-----------------------|--------------------------------|--|------------------------------------|--|
| 72                    | TRADOC                         | Fuel Tank Purge Study                  | Ft. Eustis                         | Helen Turner/Damon Doumale (804)878-2590 |
| 73                    | TRADOC                         | Oil Vacuum Truck                       | Ft. Eustis                         | Helen Turner/Damon Doumale (804)878-2590 |
| 74                    | TRADOC                         | PMB Equipment for Helicopter Stripping | Ft. Rucker                         | Jim Swift (205)255-2541                  |
| 75                    | TRADOC                         | In-House HAZMIN Audits/Support         | Ft. Sill                           | Cindy Sellers (405)351-3409              |

Source: Arthur D. Little, Inc. and Army Documentation

**Appendix B: Project Summaries**

**Project Number: 1**

**MACOM/Org: AMC**

**Installation/Location: N/A**

**Project Title: HAZMIN/Lessons Learned Workshop**

**Targeted Waste: General**

**Point of Contact: Libbie Borgatti, (703) 274-9016**

**DERA Hazmin Funding: \$20,000 (FY 88)**

### **Project Description**

In order to facilitate technology transfer and information exchange among AMC facilities, a HAZMIN/Lessons Learned Workshop was conducted. The objective of this workshop was to allow for the interchange of ideas, concepts, successes, and failures related to HAZMIN initiatives.

### **Discussion of Project**

A hazardous waste minimization workshop entitled "Lessons Learned in Hazmin" was conducted in September 1989 at Idaho Falls, Idaho. The host (and facilitator) of the workshop was EG&G Idaho, Inc., a Department of Energy (DOE) contractor for the operation of the Idaho National Engineering Laboratory. This arrangement allowed for input from EG&G (on behalf of DOE) with respect to HAZMIN initiatives and directions. Workshop attendees included representatives from command level offices, research and development activities, and installations (DESCOM, AMCCOM, and MICOM). Installation representation included environmental personnel, plant and facility engineers, and plant operators.

The workshop consisted of three distinct activities: (1) general presentations introducing hazardous waste concerns and waste minimization activities of the Army, DOE, and EG&G; (2) the conduct of several small discussion groups oriented toward specific waste streams and HAZMIN initiatives; and (3) a final summary of findings and conclusions drawn during the discussion group sessions.

Specific areas addressed in the course of the workshop included: electroplating; degreasing/solvent substitution; paint stripping; computer tracking; assessments and audits; critical fluid demilitarization; propellants/explosives/pyrotechnics; lab waste; and water treatment. Presentations of ongoing efforts in each of these areas were presented.

Discussion group sessions were conducted in the areas of: electroplating; degreasing/solvent substitution; paint stripping; computer tracking; and propellants/explosives/pyrotechnics. The discussion sessions allowed for input from installation personnel regarding research and development requirements; problems in implementation of HAZMIN initiatives; and recommendations for new HAZMIN initiatives and needs.

Among the benefits of the workshop were: installation personnel with similar activities and problems were brought together – often for the first time; the research and development community was given the opportunity to meet with installation personnel to better learn the needs and problems of the installations associated with waste reduction; and the successes and failures of HAZMIN initiatives were addressed (a technology transfer mechanism).

**Project Number:** 1 (Continued)

**MACOM/Org:** AMC

**Installation/Location:** N/A

**Project Title:** HAZMIN/Lessons Learned Workshop

**Targeted Waste:** General

**Point of Contact:** Libbie Borgatti, (703) 274-9016

**DERA Hazmin Funding:** \$20,000 (FY 88)

### **Project Motivation and Documentation**

The primary motivation behind this workshop was to facilitate technology transfer and information exchange among Army industrial facilities.

Proceedings of the workshop were prepared by EG&G.

**Project Number:** 2  
**MACOM/Org:** AMC  
**Installation/Location:** HQ AMC  
**Project Title:** HAZMIN Audits for AMC Installations  
**Targeted Waste:** General  
**Point of Contact:** MAJ Jeff Dell'Omo, (703) 274-3890  
**DERA Hazmin Funding:** \$1,950,000 (FY 89); \$1,090,000 (FY 91)

### **Project Description**

These funds were provided to AMC for the conduct of HAZMIN audits of AMC industrial facilities. The audits were conducted at 26 facilities and were designed to accomplish the following: identification and quantification of hazardous waste streams resulting from production and maintenance processes; identification HAZMIN opportunities for each production and maintenance process; and acquisition of waste stream data to be input to HAZMIN database.

### **Discussion of Project**

Funds for the conduct of the audits were provided to the Army Production Base Modernization Activity (PBMA) (\$1,169,000 [FY 89], \$955,000 [FY 91]) and to the Idaho National Engineering Laboratory (INEL) (\$781,000 [FY89], \$135,000 [FY91]). The PBMA audits were conducted under contract. The INEL audits were conducted by the INEL contractor – EG&G Idaho, Inc.

The audits were initiated in 1989 and essentially completed in 1991. They provided for an extensive assessment of waste-generating operations at AMC industrial facilities and a quantification of wastes resulting from those operations. In addition, recommendations for potentially applicable HAZMIN initiatives relative to specific operations were developed. In most cases, these recommendations were supported by estimates of waste reductions and cost savings likely to result if the recommendations were implemented.

Potential benefits resulting from the audits include: identification of waste sources at each of the industrial facilities surveyed; acquisition of waste generation data to provide a "baseline" for the identification of HAZMIN priorities and to facilitate the tracking of HAZMIN progress; and development of recommendations for HAZMIN initiatives to be pursued.

Based on a survey of five represented installations that were audited, it appears as though the perceptions and actual benefits of the audits were mixed. Few of the recommendations for HAZMIN initiatives were pursued based solely on the findings of the audits. As would be expected, a common complaint of installation personnel was that the audits were very demanding of their time. This factor apparently overshadowed any acknowledgement of the potential benefits that could be realized by the installations as a result of the audits.

See Section V of this report for a further discussion of these audits.

**Project Number: 2 (Continued)**

**MACOM/Org: AMC**

**Installation/Location: HQ AMC**

**Project Title: HAZMIN Audits for AMC Installations**

### **Project Motivation and Documentation**

The primary motivation behind the conduct of these audits was a need to identify and quantify AMC industrial operation waste streams in order to identify and prioritize opportunities for HAZMIN.

Detailed audit reports were prepared for each of the audits.



**Project Number:** 3  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Crane AAA  
**Project Title:** Purchase Equipment to Distill Used Solvents  
**Targeted Waste:** Toluene, MEK, Acetone and 1,1,1- TCA  
**Point of Contact:** Steve Schick (812) 854-3404  
**DERA Hazmin Funding:** \$36,500 (FY91)

### **Project Description**

A solvent distillation system is being installed to recover toluene, MEK, acetone and 1,1,1-TCA used in ordnance production operations. The solvents are used to remove residues from pipes as well as for cleaning tools. This solvent recovery system supports the production of the explosive PBXN-106.

### **Discussion of Project**

The 55 gallon solvent distillation still was purchased in 1991 and installation was completed in February 1993. The point of contact indicated that the equipment cost was \$15,089 and the installation cost was \$11,306. At the completion of the installation, excess funds (\$6,098) were returned to USATHAMA. The distillation system will be put into operation when the explosive production process begins in the spring of 1993. The point of contact indicated that 1,1,1-TCA may not be used in the production process and that other solvents may be used instead.

### **Waste Reduction and Cost Savings**

Prior to the initiation of the project, it was estimated that approximately 2640 fewer gal of paint waste would be generated per year. The point of contact indicated that this figure is reasonable. Since the process has yet to come on-line, no actual waste reduction and cost savings figures are available.

### **Project Motivation and Documentation**

Primary motivations for the project were a 50% waste reduction directive from HQAMC and a need to reduce air emissions.

A manual for operation of the equipment is maintained on-site.

### **Interviewer Comments**

Data should be gathered to determine the cost savings once the project does come on-line. This project may have potential applications at other ammunition facilities.

**Project Number:** 4  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Kansas Army Ammunition Plant  
**Project Title:** Design, Construct and Install Reactive Thermal Treatment Process  
**Targeted Waste:** Explosive Hazardous Waste  
**Point of Contact:** Vicki O'Brien (316) 421-7574  
**DERA HazIn Funding:** \$4,858 (FY88)

### **Project Description**

Initial project plans included the design, construction and installation of a thermal process to treat reactive wastes generated during munition load, assemble, and pack operations. The specific wastes to be treated included explosive spent carbon, explosive filter materials, and explosive wet sump materials. The initial funding increment (FY 88) was used to conduct a study of the efficacy of using a continuous flame system to treat these materials.

### **Discussion of Project**

The purpose of this project was to provide an alternative to landfilling of reactive hazardous wastes. The thermal treatment system considered was a continuous flame system that would treat the hazardous wastes to eliminate the characteristic of reactivity and allow for the disposal of treatment residues as nonreactive solid wastes. At the present time, the facility has a variance from the state of Kansas to open burning these reactive wastes. An initial evaluation of the continuous flame thermal treatment system indicated that open burning was far more economical and further pursuit of the thermal treatment system was abandoned. An additional increment of \$90,000 provided to Kansas in FY 91 to further the project was returned. The facility continues to open burn the reactive wastes.

### **Waste Reduction and Cost Savings**

Initial estimates indicated that a 70,000 kg/yr reduction in reactive wastes requiring off-site treatment and disposal would be achieved by treating the wastes to eliminate the characteristic of reactivity. Estimated cost savings were \$210,000/yr. As a result of the study, it was determined that thermal treatment was not economical compared to open burning.

### **Project Motivation and Documentation**

The motivation for the project was compliance with RCRA Land Ban Regulations that prohibit land disposal of reactive wastes.

### **Interviewer Comments**

Despite the availability of open burning as an option for treatment of these reactive wastes, alternatives to open burning should be sought in the event open burning is subject to stricter controls or prohibition. If open burning is prohibited by the Army in the future, it may be necessary to reevaluate the findings of the initial study phase of this project.

**Project Number:** 5  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Kansas Army Ammunition Plant  
**Project Title:** Purchase Equipment/Testing to Minimize Reactive Wastes  
**Targeted Waste:** Reactive carbon waste  
**Point of Contact:** Vicki O'Brien (316) 421-7574  
**DERA Hazmin Funding:** \$204,400 (FY91)

### **Project Description**

This project involves testing spent carbon and anthracite wastes contaminated with explosives and propellants from load, assemble and pack operations (LAP). This purpose of the testing is to determine the proper classification (reactive, nonhazardous, or hazardous) of the wastes allowing for the appropriate means of disposal to be taken.

### **Discussion of Project**

Testing of explosive-contaminated wastes was initiated at the end of 1992 and is continuing. Tests are performed to determine the following characteristics of the wastes: reactivity; metal content; total organic content (TOC); and toxicity (in accordance with the Toxicity Characteristic Leaching Procedure [TCLP]).

Of the funding received, approximately \$4,200 was used to purchase equipment required for the testing procedures (primarily for sampling). Batches of 12 to 16 drums of spent carbon and anthracite wastes have been subjected to testing. By implementing the testing procedure, the installation can identify: wastes that are reactive and can be open burned on-site; wastes that are nonhazardous and can be burned on-site in a waste processor; and wastes that are hazardous and must be treated and disposed of off-site. To date, the project is on budget and there have been no problems.

### **Waste Reduction and Cost Savings**

As a result of the testing procedures, the installation has been able to identify some of the generated waste as nonhazardous thereby reducing hazardous waste generation rates and disposal costs. The point of contact indicated that they are expecting a reduction in material classified as hazardous waste of approximately 80,000 lbs per year leading to a potential cost savings of \$200,000 in treatment and disposal costs.

### **Project Motivation and Documentation**

Kansas AAP has taken this initiative in reducing hazardous waste and achieving regulatory compliance with the support of the state regulators.

There is no project documentation available at this time.

### **Interviewer Comments**

In terms of the reduction of hazardous waste requiring off-site treatment and disposal, this project appears to be beneficial. The testing procedures followed may have application Army-wide for installations that generate carbon spent with explosives.

**Project Number:** 6  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Lone Star AAP  
**Project Title:** Incinerator Minimization Feasibility Study  
**Targeted Waste:** Waste Explosive and Explosive-contaminated Materials  
**Point of Contacts:** David Self, Raymond Jones (903) 334-1308  
**DERA Hazmin Funding:** \$28,257 (FY 88)

### **Project Description**

The project involved a study to determine which type of incinerator would be best suited for handling the explosive-contaminated waste generated at Lone Star AAP. The incinerator would replace the current practice of open burning and open detonation.

### **Discussion of Project**

Lone Star AAP is a GOCO operation whose primary mission is to load, assemble, and pack (LAP) ammunition items. The current method of disposal of wastes generated in this process is open burning (OB) and open detonation (OD). Lone Star currently operates their OB/OD processes under a permit issued by the state of Texas. However, the Army has publicly announced that they are moving toward eliminating OB/OD processes. As a result, Lone Star has begun the process of examining incinerator technology as an alternative to OB/OD.

The project was initiated in March 1990 and completed in May 1991. The estimated cost was \$30,000 and the actual cost was \$24,840. The conclusion of the study was that a rotary kiln was the most efficient incinerator for use at Lone Star AAP because of its versatility in handling the various types and sizes of wastes generated. Omnibus Funds have been requested from AMCCOM as of February 1993 to continue the effort in selecting/designing an incinerator for the facility.

### **Waste Reduction and Cost Savings**

Waste reduction and cost savings were not objectives of this stage of the overall project.

### **Project Motivation and Documentation**

The primary motivation is future compliance with Army's plans to eliminate OB/OD. However, despite the acknowledgement of the need for compliance, there is some belief that the OB/OD process is safer than incineration - especially when considering the potential for unexploded ordnance.

### **Interviewer Comments**

This project is an initial step in a larger process to design and implement a controlled alternative to OB/OD. The facility is making progress towards achieving the objective: the only obstacle appears to be the necessary funding required to move the project forward.

**Project Number:** 7  
**MACOM/Org:** AMC/AMCCPOM  
**Installation/Location:** Louisiana AAP  
**Project Title:** Paint Booth Filter  
**Targeted Waste:** Paint wastes  
**Point of Contacts:** Steve Flowers (318) 459 - 5131 Doyle Williams (318) 459-5108  
**DERA Hazmin Funding:** \$58,267 (FY 89)

### **Project Description**

This project involved the purchase and installation of a paint waste filtration unit to de-water paint wastes generated in water wall paint booths. With such a filtration system, water is removed and recirculated to the paint booth, and the paint solids are containerized and disposed of.

### **Discussion of Project**

The equipment was purchased in April 1991 and installed in June 1991. The actual cost of the equipment was \$45,830. There were no major difficulties involved in installing the equipment. One modification was required involving the addition of a lightning rod to the emission stack.

The purpose of the paint waste filtration system is to provide for the de-watering of paint sludge generated during the use of water wall paint booths. The system appears to be working as expected and has helped to reduce paint sludge volume requiring disposal.

The equipment involves the removal of water from paint sludges.

### **Waste Reduction and Cost Savings**

Prior to initiation of this project, it was estimated that a reduction of approximately 2700 gal/yr in paint sludge requiring disposal would be realized. A reduction of this amount was estimated to result in an annual cost savings of approximately \$8,100. The actual waste reduction and cost savings were not readily available; however, these estimated values were felt to be consistent with what was actually achieved.

### **Project Motivation and Documentation**

The state of Louisiana solid waste rules do not permit land disposal of wet sludges. This prohibition as well as the attendant increased cost of disposal of these paint sludges provided the motivation behind pursuit of this project.

**Project Number:** 8  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Louisiana AAP  
**Project Title:** Pilot Test of UV/Ozone Pinkwater Treatment Process  
**Targeted Waste:** Pinkwater/spent activated carbon  
**Point of Contacts:** Steve Flowers (318) 459-5131  
**DERA Hazmin Funding:** \$91,118 (FY 91)

### **Project Description**

The project was initiated to determine if the use of UV/ozone oxidation could replace activated carbon adsorption or reduce spent carbon generation in the pinkwater treatment system.

### **Discussion of Project**

The project was initiated in 1991 and completed in 1992. The estimated cost was \$91,118 and the actual cost was \$64,347.

The current pinkwater treatment system involves the use of activated carbon for removal of explosive residuals. The use of UV/ozone can potentially take the place of the carbon, or at least reduce the load to the carbon and thus reduce the volume of carbon requiring regeneration or disposal.

The test equipment was rented and the testing is complete. Preliminary analysis of the results indicate that the process was successful in treating the pinkwater. The data is still being evaluated, however. Part of the analysis will include examination power consumption that could make the use of UV/ozone less attractive due to the power requirements in the running of the UV lamps and the ozone generator.

### **Waste Reduction and Cost Savings**

The system has not yet been implemented, therefore, no actual data is available. The estimated cost savings provided in the EPA form includes a 90 to 100% reduction in spent carbon regeneration with a savings of \$196,000 to \$217,000. The cost of the electricity to operate the UV lamps and ozone generator are not be included in this analysis, and may be significant.

### **Project Motivation and Documentation**

The primary motivation behind this project was the reduction of land ban waste and associated disposal costs.

A final report has not yet been issued, but is expected.

### **Interviewer Comments**

This type of treatment has been pilot-tested by WES at Picatinny Arsenal with some success to treat groundwater contaminated with explosives. Power consumption data was developed during this pilot test. The successful implementation of the technology will provide an alternative to media transfer-type of treatment such as carbon adsorption, thereby reducing wastes generated and associated waste disposal/treatment costs.

**Project Number:** 9  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Louisiana AAP  
**Project Title:** Applicability of Spent Carbon Regeneration at LAP's  
**Targeted Waste:** Explosive-contaminated (spent) Activated Carbon (RDX and TNT)  
**Point of Contacts:** Steve Flowers (318) 459-5131  
**DERA HazIn Funding:** \$55,739 (FY ??)

### **Project Description**

Explosive-contaminated water at LAP's is typically treated by activated carbon adsorption. The resulting spent carbon must be regenerated off-site or disposed of as a hazardous waste. This project involved the investigation of the potential of regenerating the contaminated carbon on-site.

### **Discussion of Project**

The project was initiated in 1992 and completed in 1993. The estimated cost was \$55,739 and the actual cost was \$13,556.

The project involved the testing of controlled temperature thermal regeneration of spent carbon. A contractor was hired to thermally treat the carbon on-site. The process used did not involve the use of steam. The reactivated carbon seems to perform as well as the virgin carbon for adsorption of explosives from water. Final conclusions have not yet been drawn as the data is still being evaluated.

### **Waste Reduction and Cost Savings**

Prior to this project, the anticipated reduction in waste generated was estimated at 187,500 pounds of spent carbon per year. Cost savings related to the elimination of disposal costs as well as the reduction in virgin carbon requirements was estimated to be \$328,000 per year. The actual waste reduction is not attainable since the project has not yet been implemented.

### **Project Motivation and Documentation**

The motivation for this project was to reduce the amount of land ban hazardous waste and to reduce the amount of virgin carbon purchased.

A final report will be issued after full analysis of the data.

### **Interviewer Comments**

The results of this test could be transferred to other facilities which also utilize activated carbon for treatment of explosive-contaminated waste water as well as explosive-contaminated groundwater.

**Project Number:** 10  
**MACOM/Org.:** AMC/AMCCOM  
**Installation/Location:** McAlester AAP  
**Project Title:** Purchase of Trailerized 200 Gallon Fuel Transfer Tank  
**Targeted Waste:** Waste Oil  
**Point of Contact(s):** Darrel Elliot (918) 421-2551  
**DERA Hazmin Funding:** \$8,653 (FY89)

### **Project Description**

The purpose of this project was to facilitate the reclamation of waste liquids through waste segregation and underground storage tanks (UST) upgrades.

### **Discussion of Project**

The funds were used to purchase a trailer and tank and to construct berms and underground piping to allow for the segregation of waste liquids. The segregation system allows used oil and other liquids to be segregated and collected at the source according to their classification (i.e., used oil, diesel fuel, or antifreeze).

Current methods of recycling/disposal of these waste streams include:

- Used oil - recycled through the DRMO
- Antifreeze - recycled on-site
- Diesel fuel - transferred to on-site open burning grounds via 55 gallon drums.

The trailer and tank are apparently not used for their original purposes. The tank is believed to be in shop stock and the trailer is used for in-house removal of asbestos.

### **Waste Reduction and Cost Savings**

Prior to recycling the liquid wastes described above, the facility used an outside contractor to dispose of their wastes at more than \$2 per pound. Initial estimates were that a reduction of 2,000 to 4,000 pounds of waste requiring disposal per year might be realized at a corresponding cost savings of approximately \$10,000 per year. Data reflecting actual waste reduction and cost savings are unavailable.

### **Project Motivation and Documentation**

The motivation to this project was waste segregation allowing for regulatory compliance and improved capability for waste recycling. No project documentation is available.

### **Interviewer Comments**

The POC provided as much information as possible; however, the project was conducted prior to his assignment at the facility. The POC noted that the implementation of a hazmin program at the facility is complicated by a high staff turnover rate and large project diversity. The POC mentioned that an on-site hazmin audit as well as additional hazmin funding might be helpful.



**Project Number:** 11  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Milan AAP  
**Project Title:** Purchase of a Vacuum System to Reduce Pinkwater Generation  
**Targeted Waste:** Pinkwater  
**Point of Contacts:** Mike Harris (901) 686-6577  
**DERA Hazmin Funding:** \$289,933 (FY 89)

### **Project Description**

Milan AAP is a GOCO installation with a primary mission to load, assemble, and pack (LAP) ammunition items. As a result of their ammunition manufacturing operations, explosive-contaminated waste is generated. In the past, this waste was collected using wet vacuums in order to reduce the potential hazards associated with the explosives. These wet vacuums generated considerable quantities of pinkwater that requires treatment by activated carbon adsorption. This project was initiated to replace the wet vacuum systems with dry vacuums to reduce the amount of pinkwater generated as well as reduce the quantity of spent carbon generated.

### **Discussion of Project**

The project was funded in FY 89 for \$289,933. The equipment installation began in 1989 and was completed in November 1992. The budget estimates were very close: only a few thousand dollars were left over at the completion of installation.

The project objective was to change the wet vacuum waste collection system to a dry system. Explosive-contaminated wastes that are generated during pressing and drilling are collected in remote satellite collection areas to reduce the potential explosive hazards. The waste was previously collected using a vacuum system resembling a large shop vacuum that added water to the waste to reduce the potential of detonation. The resulting contaminated water is considered a hazardous waste and requires treatment by activated carbon adsorption.

The wet vacuum systems have been replaced with dry vacuum systems. The dry vacuum systems allow for the collected waste to be recovered and reused for detonating munitions. The use of the dry vacuum has essentially resulted in the elimination of a hazardous waste stream.

Safety issues were responsible for obstacles during the design and installation. Since the system is no longer operated in a wet mode, additional piping was needed to ensure that each vacuum unit would serve only a limited number of process areas. This would prevent any explosive propagation from one process area to another. This requirement for multiple vacuum systems required the construction of additional vacuum housing cubicles.

### **Waste Reduction and Cost Savings**

The equipment has been operating for only a short time and data reflecting waste reduction and cost savings are not yet available. However, it is anticipated that the project will be successful in both reducing wastes and decreasing costs. The new systems not only have eliminated the generation of a hazardous waste requiring treatment and disposal, but also have proven to be lower in operating costs. In order to allow for reuse of the explosives recovered from the wet vacuum system, the explosives had to be dried. This is not necessary with the dry system.

**Project Number:** 11 (Continued)  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Milan AAP  
**Project Title:** Purchase of a Vacuum System to Reduce Pinkwater Generation  
**Targeted Waste:** Pinkwater  
**Point of Contacts:** Mike Harris (901) 686-6577  
**DERA Hazmin Funding:** \$289,933 (FY 89)

The waste reduction and cost savings that were projected prior to project initiation were: a reduction in 2,380,500 gal/yr of pinkwater with a cost savings of \$2745 for carbon disposal and \$14,108 for waste explosive drying costs. These numbers are likely high because of decreases in production levels at MAAP.

### **Project Motivation and Documentation**

The motivation of the project was to reduce the amount of hazardous waste generated.

### **Interviewer Comments**

The project appears to be a success, however, additional follow up should be considered once the system has been operated for several months in order to verify its success as well as to develop waste reduction and cost savings estimates. It should also be noted that the point of contact emphasized that the potential safety implications in the use of the dry system must be carefully considered in its design and implementation.

**Project Number:** 12  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Pine Bluff Arsenal  
**Project Title:** Activation of a Pilot Plant to Regenerate Semi-Tropical Bleach  
**Targeted Waste:** Chemical agent wastes (Off-Spec Semi-Tropical Bleach )  
**Point of Contacts:** Jim Hayley (501) 540-2951  
**DERA Hazmin Funding:** \$345,000 (FY 89)

### **Project Description**

Off -specification Semi-Tropical Bleach (STB) is used as a chemical agent decontaminating solution. When the solution becomes too weak, it is no longer usable for decontamination and is disposed of or regenerated. Pine Bluff Arsenal has a pilot-scale regeneration plant; however, it has not been in operation for several years. In an attempt to reduce the quantity of STB requiring disposal, it was desired to reactivate the regeneration plant. The initial purpose of this project was to provide for the reactivation of this plant.

### **Discussion of Project**

Plans to reactivate the STB regeneration pilot plant were initiated in 1984. It is estimated that the project has required \$1.5 million since 1984 in \$100,000 to \$200,000 increments. DERA Hazmin funding has accounted for \$345,000 of the funding requirements.

A portion of the funding received from DERA in 1989 was used to distribute an RFP for reactivation of the pilot plant. However, no bids were received due to the significant degree of deterioration of the existing equipment during the extended period of inactivity. When the system was shut down, the tanks and pumps were not properly rinsed and corroded. In addition, the plastic pipe and tanks were sagging and embrittled due to chlorine attack. Therefore, the balance of the funds were used to purchase equipment for a new regeneration plant.

The equipment purchased for the new plant includes the following:

- 3 glass-lined reactor tanks (silicone-based glass) with covers and shafts for agitators, inlet and outlet ports and water jackets;
- Carpenter 20 stainless steel centrifuge for separating the rejuvenated bleach from the liquor; and
- Scrubber to scrub the offgases for return to the process.

In the regeneration process, compressed chlorine gas is bubbled into the solution. Lime and additional water are added. Scrubber fluid is returned to the process.

The system has not been operated to date due to lack of funding. Additional funding has been received to conduct small industrial scale tests; however, a contract to do so has not yet been awarded.

### **Waste Reduction and Cost Savings**

The system has not yet been operated, therefore, actual waste reduction and cost savings are not available.

**Project Number:** 12 (Continued)  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Pine Bluff Arsenal  
**Project Title:** Activation of a Pilot Plant to Regenerate Semi-Tropical Bleach  
**Targeted Waste:** Chemical agent wastes (Off-Spec Semi-Tropical Bleach )  
**Point of Contacts:** Jim Hayley (501) 540-2951  
**DERA Hazmin Funding:** \$345,000 (FY 89)

Prior to initiation of the project, the anticipated cost savings were estimated at \$1,828,200/yr in landfill cost avoidance. A more recent economic analysis was provided and is attached. This analysis indicates a savings of \$2.55 million (discounted) over a ten year period which results in a return of investment of 26% or \$435,000 each year (not discounted).

**Project Motivation and Documentation\***

The motivation was to eliminate landfilling of spent STB.

\*Supplemental information is provided in Appendix E.

**Project Number:** 13  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** Pine Bluff Arsenal  
**Project Title:** Purchase of a Waste Metal Shredder  
**Targeted Waste:** Metal Wastes  
**Point of Contacts:** Phil Vic (501) 540-2810  
**DERA Hazmin Funding:** \$80,000 (FY 89)

### **Project Description**

This project involved the purchase of a metal shredder to reduce the volume of metal waste being landfilled.

### **Discussion of Project**

Pine Bluff Arsenal generates a large quantity of scrap metal such as piping, old parts, drums. The primary purpose of the shredder is to reduce the volume of the waste and thus reduce disposal costs.

The shredder was purchased in the 1990-91 time frame. The equipment was purchased from the lowest bidder at \$87,000 thereby requiring additional funds.

There were no problems in the installation of the equipment since it was an off-the-shelf item.

The interviewer indicated that this equipment is used to process nonhazardous solid waste only because of the special permitting that would be required if hazardous waste were to be processed.

### **Waste Reduction and Cost Savings**

Disposal costs have reportedly been reduced; however a quantification of cost savings is not available. Prior to initiation of the project, anticipated cost savings were estimated as: a 50% savings in waste volume (2000 cu yd) resulting in a savings of \$1,092,000 per yr.

### **Project Motivation and Documentation**

To reduce the volume of metal waste requiring disposal and thus reduce disposal costs.

### **Interviewer Comments**

This project is not applicable to reductions in hazardous waste generation, but to solid waste reduction.

**Project Number:** 14  
**MACOM/Org:** AMC/AVSCOM  
**Installation/Location:** Stratford Army Engine Plant  
**Project Title:** Purchase of New Spray Wash Cabinets  
**Targeted Waste:** 1,1,1-Trichloroethane  
**Point of Contact:** Dr. John Fleming (203) 385-3964  
**DERA Hazmin Funding:** \$287,700 (FY91)

### **Project Description**

This project includes the purchase and installation of four spray cleaning cabinets for cleaning small parts with non-hazardous solvents. The equipment will eliminate the need for 1,1,1-trichloroethane, which is currently used with vapor degreasers to clean the parts.

### **Discussion of Project**

The equipment was purchased in October of 1992 and is currently being installed. The actual cost of the four pieces of equipment was \$207,600. This new equipment will allow for the replacement of vapor degreasers (employing 1,1,1-trichloroethane) currently used to clean small parts. The equipment employs an alkaline solution to clean the parts.

The new spray cleaning cabinets have all stainless steel parts to avoid corrosion that was observed in the operation of a steel demonstration unit.

There are no problems related to military specifications or other maintenance requirements. The plant personnel like to use the equipment and fewer residuals are left on the parts after cleaning.

### **Waste Reduction and Cost Savings**

The point of contact indicated that the previous estimates of reductions of 30,000 lb/yr of liquid solvent waste and 100,000 lb/yr of 1,1,1-trichloroethane emissions appeared realistic. Actual data are not yet available.

### **Project Motivation and Documentation**

HQ AMC was a primary driving force in implementing the project. Stratford Army Engine Plant is one of the top emitters of 1,1,1-trichloroethane in the nation and the facility is trying to reduce its emissions.

There is no project literature available at this time. Vendor literature is available from the point of contact.

### **Interviewer Comments**

The point of contact was optimistic about the ability of the new equipment to meet waste and emission reduction goals. Since the workers like the equipment, they are more likely to use it. Actual waste and emission reduction should be quantified when possible.

**Project Number:** 15  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Anniston Army Depot  
**Project Title:** Purchase of Spray Cleaning Cabinets  
**Targeted Waste:** Trichloroethylene  
**Point of Contacts:** Tim Garrett (205) 235-6350, Steve Guthrie (205) 235-6624  
**DERA Hazmin Funding:** \$146,900 (FY 89)

### **Project Description**

This project includes the purchase and installation of two spray cleaning cabinets for cleaning small parts with non-hazardous solvents. The equipment will eliminate the use of trichloroethylene which is currently used with vapor degreasers to clean the parts.

### **Discussion of Project**

The equipment was purchased in September of 1991 and one unit was installed in December of 1991 - the second unit has not been installed. The actual cost of the two pieces of equipment was \$124,056. This new equipment will replace the current use of trichloroethylene in vapor degreasers used in the cleaning of small parts. Installation of this equipment required an electrical upgrade to 440 Volt, 3 Phase service. The spray cleaning equipment uses high pressure water to clean the small parts. After operation commenced, it was realized that the small parts must be attached to fixtures to prevent the water pressure from bouncing them off each other. There are no problems related to military specifications. With the new fixtures in place, the equipment is cleaning the small parts effectively as expected.

### **Waste Reduction and Cost Savings**

The anticipated volume of waste reduction was estimated prior to initiation of the project at 22,050 pounds of trichloroethylene and steam waste per year, at an anticipated cost savings of \$16,097 per year. Actual volume reduction and cost savings are not available because they would have to remove and measure the volume of debris from the trichloroethylene vapor degreaser system or remove and measure the volume of debris from the high pressure water system in order to determine what the waste volume/debris volume actually was.

### **Project Motivation and Documentation**

The motivating force behind the purchase of this equipment was to reduce the volume of hazardous waste, maximize operational cost savings, and to increase levels of pollution prevention. To date, there has not been any project report regarding this effort, only vendor literature is available.

### **Interviewer Comments**

Actual volume reduction and cost saving values should be determined. How were the anticipated waste volume reduction and cost saving values developed if the actual quantification is so difficult?

**Project Number:** 16  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Anniston Army Depot  
**Project Title:** Aluminum Ion Vapor Deposition  
**Targeted Waste:** Cadmium Plating Wastes  
**Point of Contacts:** Tim Garrett (205) 235-6350, Steve Guthrie (205) 235-6624  
**DERA Hazmin Funding:** \$1,378,000 (FY 91)

### **Project Description**

This project includes the purchase and installation of an aluminum ion vapor deposition (AIVD) unit. It will be used to apply a thin layer of aluminum to steel parts to prevent corrosion in place of using cadmium plating methods. This will eliminate the associated cadmium plating generated wastes.

### **Discussion of Project**

The equipment was purchased in September of 1991 with installation still in progress. Anniston Army Depot already had another AIVD unit which has been operational for several years. The actual cost of the newest unit was \$979,452. These units will replace the cadmium-on-steel plating process which produces cadmium, cyanide, and industrial waste treatment plant wastes. Site installation of the AIVD equipment required the moving of other equipment, installation of a climate control system, and reinforcement of the floor. No difficulties are expected with the new machine since they already have experience with this kind of equipment. The AIVD process has not been approved in the military specifications, so each part must be fully inspected for approval. It is expected that MIL-SPEC approval will happen once enough statistical data is available from the current QA inspection process. The older AIVD machine has been a great success and has had an increase in the rate of QA acceptance when compared with the old cadmium plating process.

### **Waste Reduction and Cost Savings**

The AIVD machines are each expected to reduce the requirement for cadmium plating by 45%, for a total reduction of 90%. Actual waste reductions and cost savings are not available for the newest machine since it is still being installed, and there are no values for the older AIVD machine.

### **Project Motivation and Documentation**

The motivating force behind the purchase of this equipment are the new OSHA regulations which reduced the airborne levels of cadmium from 100 to 5 mg/m<sup>3</sup>. To date, there has not been any project report regarding this effort.



**Project Number:** 17  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Anniston Army Depot  
**Project Title:** Purchase of Gas Chromatograph for an Environmental Lab  
**Targeted Waste:** Organics in water samples  
**Point of Contacts:** Bobby Phillips (205) 235-7241  
**DERA Hazmin Funding:** \$40,000 (FY 89)

### **Project Description**

This project includes the purchase and installation of a gas chromatograph for the environmental laboratory which will be used to determine the type and concentration of contaminants which may be present in ground water samples. Some of the collected samples do not contain any hazardous contaminants but are still disposed of as hazardous waste. This equipment will allow the lab to separate the water samples to minimize the generation of hazardous waste.

### **Discussion of Project**

The purchase order for this equipment was placed on 29 April 1992 and arrived on site several months later. Installation is now in progress and is expected to be completed shortly without any unforeseen difficulties. This equipment was originally to be purchased in FY 89 but was too expensive and never ordered. The actual cost of the purchased equipment was \$37,587. Its primary use will be to analyze on-site ground water samples to determine if organics are present. These organics would typically be halogenated hydrocarbons or aromatics. If no organics are present, the sample can be disposed of as non-hazardous waste with a significant cost savings. The lab currently has one other gas chromatograph so no installation problems are anticipated. The only facility related work will be the installation of an additional plumbing line to supply a carrier gas (typically nitrogen).

### **Waste Reduction and Cost Savings**

The anticipated volume of waste reduction was estimated at 5% (real numbers are not available) due to the improved capability to discriminate between hazardous and non-hazardous wastes. Current disposal costs are \$500 per 100 milliliter sample. Actual waste reductions and associated cost savings will be available after the equipment is operational.

### **Project Motivation and Documentation**

The motivating force behind the purchase of this equipment was liability, and regulatory compliance. To date, there has not been any project report regarding this effort, but there should be after the equipment is operational.

**Project Number:** 18  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Anniston Army Depot  
**Project Title:** Procure Equipment/Site Preparation for Existing Equip. Maintenance  
**Targeted Waste:** Not Applicable  
**Point of Contact:** Tim Garrett (205) 235-6350, Steve Guthrie (205) 235-6624  
**DERA Hazmin Funding:** \$199,000 (FY 91)

**Project Description**

The points of contact have no idea what this project is.

**Project Number:** 19  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Anniston Army Depot  
**Project Title:** Disassembly, Removal & Reassembly of Paint Booth  
**Targeted Waste:** Paint waste  
**Point of Contacts:** Tim Garrett (205) 235-6350, Steve Guthrie (205) 235-6624  
**DERA Hazmin Funding:** \$25,000 (FY 91)

### **Project Description**

This project involves the disassembly and removal of a paint booth located at CHAAP, followed by its reassembly at ANAD. The paint booth will be used to replace the current practice of painting in the open air thereby reducing VOC emissions as well as reducing paint wastes by controlling their spread.

### **Discussion of Project**

The equipment was disassembled and transferred from CHAAP to ANAD in April of 1992, but has not been reassembled at ANAD. Reassembly is scheduled for July of 1993. The cost of the project is still estimated to be \$25,000. Once installed, this equipment will reduce paint wastes. A lack of available space for the reassembly and final location of the equipment is of concern to the points of contact but they do not expect any equipment difficulties or military specification problems.

### **Waste Reduction and Cost Savings**

The anticipated waste reduction and cost saving values have not been determined. Actual waste reduction and cost saving values are not available since the equipment has yet to be installed.

### **Project Motivation and Documentation**

The overall motivation for conducting this project is potential waste liability and regulatory compliance. There is no project documentation available.

**Project Number:** 20  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Corpus Christi Army Depot  
**Project Title:** Reclamation of Cr from Plating Baths  
**Targeted Waste:** Chromium plating wastewaters  
**Point of Contacts:** Jim Holiday (512) 939-2214  
**DERA Hazmin Funding:** \$80,000 (FY 89)

### **Project Description**

This project includes the purchase and installation of process equipment which will deionize plating bath waste water and reclaim captured chromium for recycle or reuse.

### **Discussion of Project**

The equipment was purchased in June of 1991 and installed in September of 1992. The cost of the equipment with installation was \$68,000, an additional \$17,000 was used for training of personnel and costs associated with acceptance of the equipment. This equipment will deionize plating bath waste water and reclaim captured chromium for recycle or reuse. The big site related problem was the lack of floor space. This forced the installation of the process equipment on the 2nd floor, the rinse tank on the first floor, and the collection tank in the basement. The large elevation related head loss can slow processing rates when tap water pressure is low. The process of chrome regeneration forms chlorine gas which caused one operator to require hospitalization, and the process to be shut down until proper ventilation could be installed. Therefore, there has been no chrome reclaimed at this site to date.

### **Waste Reduction and Cost Savings**

Prior to purchasing the equipment, there was an anticipated 94% reduction in chrome and rinse water waste, with an anticipated disposal cost savings of \$35,694 per year. The system is not operational yet so there are no actual reduction or cost saving values.

### **Project Motivation and Documentation\***

The motivating force behind the purchase of this equipment was cost reduction, waste elimination, and to validate a new technology.

### **Interviewer Comments**

The point of contact was very knowledgeable on this project and was optimistic concerning the success of waste reduction, chrome recovery, and cost savings. He felt that the anticipated values discussed earlier would be achieved.

\*Supplemental information is provided in Appendix E.

**Project Number:** 21  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Corpus Christi Army Depot  
**Project Title:** Aluminum Ion Vapor Deposition Equipment  
**Targeted Waste:** Cadmium plating wastes  
**Point of Contacts:** Jim Holiday (512) 939-2214  
**DERA Hazmin Funding:** Equipment - \$731,359 (FY 91)  
Site Prep - \$168,641 (FY 91)

### **Project Description**

This project includes the purchase and installation of vapor deposition equipment that will apply a thin coating of aluminum to the surface of steel parts to provide corrosion protection as an alternative to cadmium plating. The process will reduce the current reliance on cadmium plating and will reduce the associated plating wastes by approximately 80%.

### **Discussion of Project**

The equipment was purchased in December of 1991 and installation was completed in December of 1992. The actual cost of the equipment was \$731,359 with the following breakdown.

|           |                                    |
|-----------|------------------------------------|
| \$585,827 | Basic equipment                    |
| \$ 10,000 | Evaporator source                  |
| \$ 1,000  | Automatic shutdown/start-up option |
| \$ 85,570 | Training                           |
| \$ 48,962 | Other                              |
| -----     |                                    |
| \$731,359 | Total                              |

This equipment will apply an aluminum coating to steel parts to provide corrosion protection as an alternative to cadmium plating. There have been no site specific problems and no difficulties are expected with the equipment. There was a significant amount of site and facilities work required to prepare for the installation of the equipment. This site preparation work has progressed without difficulty. The anticipated and actual cost of the site and facilities work was \$168,641. There are no anticipated problems with the military specifications. Each part must now be inspected individually until statistical analysis will allow batches of parts to be selectively sampled for inspection. This new aluminum vapor deposition process is expected to be applied to approximately 80% of the parts that are currently being processed with a cadmium coating. The remaining 20% will continue to be processed with the cadmium plating process due to part geometries that will not accommodate the AVD process. The new AVD process has a higher anticipated rate of part acceptance which contributes to a projected program payback period of 0.91 years. The AVD equipment is just now coming on-line, so actual throughputs, part acceptance rates, operator costs, and maintenance costs should soon be available.

### **Waste Reduction and Cost Savings**

Anticipated waste reductions for this project include:

- waste rinse water flow = 2,400,000 gallons/year
- cadmium wet sludge disposal = 6,938 pounds/year
- calcium carbonate disposal = 193 pounds/year

A full annual cost analysis for both the old cadmium plating system and the new aluminum vapor deposition system is summarized below.

**Project Number:** 21 (Continued)  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Corpus Christi Army Depot  
**Project Title:** Aluminum Ion Vapor Deposition Equipment  
**Targeted Waste:** Cadmium plating wastes  
**Point of Contacts:** Jim Holiday (512) 939-2214  
**DERA Hazmin Funding:** Equipment - \$731,359 (FY 91)  
 Site Prep - \$168,641 (FY 91)

**Cadmium plating system**

|                            |           |
|----------------------------|-----------|
| Labor                      | \$404,601 |
| Rinse water                | 5,190     |
| Rinse water treatment      | 90,000    |
| Cadmium sludge disposal    | 3,209     |
| Calcium carbonate disposal | 3,240     |
| Chemical consumption       | 19,824    |
| Laboratory testing         | 23,076    |
| Oven stress relief         | 44,496    |
| Maintenance                | 13,602    |

-----  
 Total = \$607,238 per year

**Aluminum vapor deposition system**

|                   |           |
|-------------------|-----------|
| Labor             | \$129,479 |
| Maintenance       | 8,309     |
| Repair            | 6,286     |
| Utilities         | 4,488     |
| Aluminum source   | 5,386     |
| Argon process gas | 16        |

-----  
 Total = \$153,964 per year

Based on these system costs, the projected payback period is 0.91 years. It is anticipated that 80% of all parts requiring corrosion protection will be processed through the aluminum vapor deposition system, with the remaining 20% requiring the cadmium plating process due to AVD incompatible geometries. There are no actual waste reduction or cost saving values since the equipment was just installed in December.

**Project Motivation and Documentation\***

The motivating forces behind the purchase of this equipment was potential waste related liability, cost reduction, waste elimination, and a future compliance issue.

**Interviewer Comments**

The point of contact was knowledgeable and enthusiastic about this project and was optimistic concerning the success of waste reduction, cost savings, and the introduction of a new process which should increase the rate of QA acceptance of coated parts. Quantification of waste reduction and cost savings should be determined once the equipment becomes operational.

\*Supplemental information is provided in Appendix E.

**Project Number:** 22  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Letterkenny Army Depot  
**Project Title:** Purchase and Install Aux. Distillation Units on 6 Vapor Degreasers  
**Targeted Waste:** Trichloroethane  
**Point of Contacts:** Dennis Reed (717) 267-9506  
**DERA Hazmin Funding:** \$131,561 (FY 89)

### **Project Description**

This project includes the purchase and installation of auxiliary distillation equipment which will be used to distill trichloroethane from the sumps of vapor degreasers. for reuse.

### **Discussion of Project**

The equipment was purchased in January of 1991 but was never installed. A final cost benefit analysis was performed which concluded that the units would not pay for themselves since trichloroethane will not be used after January 1996. Higher excise taxes combined with the 1986 Montreal Protocol recommendations have forced Letterkenny to look at aqueous cleaning methods, and use of an outside contractor to handle their diminishing distillation requirements, therefore, the equipment was never installed. The actual cost of the distillation units was \$170,000.

### **Waste Reduction and Cost Savings**

The anticipated volume of waste reduction was estimated at 3,250 gallons of degreaser bottoms (trichloroethane) per year, and 7,310 gallons of coldwash basins (trichloroethane) per year which would result in a savings of \$83,725 per year (based on reductions in waste disposal and raw material makeup purchases).

### **Project Motivation and Documentation**

The motivating force behind the purchase of this equipment was to reduce the volume of hazardous waste, and to decrease the amount of raw material purchases. To date, there has not been any project documentation developed regarding this effort.

### **Interviewer Comments**

The equipment should have been returned to the manufacturer after it was realized the distillation units would not be installed.

**Project Number:** 23  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Red River Army Depot  
**Project Title:** Centralized Solvent Distillation System (2 Stills/Site Construction)  
**Targeted Waste:** 1,1,1 Trichloroethane (TCA)  
**Point of Contacts:** Mike Lockard (903) 334-3559  
**DERA HazmIn Funding:** \$259,565 (FY 89)

### **Project Description**

This project involved the purchase and installation of distillation equipment to reclaim TCA.

### **Discussion of Project**

The equipment was purchased in 1990 and installed in 1991. The project costs totaled approximately \$190,000 because one distillation unit was purchased. The project involved the construction of a central reclamation site to which all waste TCA was brought.

During construction, it was determined that the building did not have sufficient power, thus the project was delayed until the correct power leads were installed.

The solvent distillation system has worked well and the facility is happy with it. However, since its installation, the Army has mandated that TCA no longer be used, therefore, the stills will no longer be used. Red River is investigating the use of this equipment to reclaim other solvents such as paint thinner.

Red River has instituted a QC program to test all drums of waste TCA before being reclaimed in the central facility. This was done because of problems of contamination of TCA which had a low or high pH caused from contamination with dirt or other substances which causes corrosion of the equipment. TCA-filled drums brought in for reclamation are first tested, and if not satisfactory are disposed of as a hazardous waste.

The use of the solvent and the military specifications require that only 25% of the solvent can be reclaimed, the remaining 75% must be virgin. This has significantly reduced the potential waste reduction and savings that this project would bring. This requirement may be due to the purchasing specifications outlined in the Mil Spec which requires a rust inhibitor to be present in the solvent but which is not reclaimed in the distillation process.

### **Waste Reduction and Cost Savings**

Specific data regarding waste reduction and cost savings was not readily available. The projected reduction as shown in the EPA forms indicated a reduction of 64,700 kg of TCA resulting in a cost savings of \$114,000 (disposal costs) and \$77,000 (raw material requirements). This is likely based on the reuse of 100% of the reclaimed material, however, as discussed above this is not attainable. The cost savings are more realistically half of that estimated or \$55,000 (disposal) and \$35,000 (raw material requirements). The cost savings are also affected by the increased cost of TCA in the last few years since it is being phased out of use.



**Project Number:** 23 (Continued)  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Red River Army Depot  
**Project Title:** Centralized Solvent Distillation System (2 Stills/Site Construction)  
**Targeted Waste:** 1,1,1 Trichloroethane (TCA)  
**Point of Contacts:** Mike Lockard (903) 334-3559  
**DERA Hazmin Funding:** \$259,565 (FY 89)  
**Project Motivation and Documentation\***

The overall project motivation was as a hazmin/pollution prevention effort on the part of Red River AD in response to the Clean Air Act.

There is documentation available from the POC including vendor literature and design sketches.

#### **Interviewer Comments**

The project appears to have been an overall success. However, the ability to reuse only a portion of the reclaimed TCA was not known before the equipment was installed.

This installation, and others like it have spent funds to reclaim chlorinated solvents which will be phased out of use in 1993 leaving the reclaim equipment idle. Support should be given to these installations to find alternative uses for this equipment.

\* Supplemental information is provided in Appendix E.

**Project Number:** 24  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Red River AD  
**Project Title:** Used Oil Reclamation System  
**Targeted Waste:** Used oil  
**Point of Contacts:** Mike Lockard (903) 334-3559  
**DERA Hazmin Funding:** \$200,000 (FY89)

## **Project Description**

A used oil reclamation facility was constructed to reclaim the used oil from many sources via vacuum distillation and filtration.

## **Discussion of Project**

Two centralized used oil reclamation facilities were installed to handle the used oil generated at Red River AD. The equipment was purchased in 1990 and installed in 1991. Approximately \$160,000 was spent for the equipment. The first facility was for oil from depot vehicles and production equipment including primarily hydraulic and depot vehicle oils. The second facility was for engine oil generated from TECOM test vehicles. The equipment used for reclamation draws a vacuum on the used oil which pulls off the lighter fraction (the decomposition byproducts) and then processes the remaining oil through a filter to remove any particles.

The installation has encountered several problems in the operation of the units. The equipment was purchased as portable units, with pumps that appear to be too small or the oil too viscous to successfully pump the oil from the storage containers through the reclamation process. In addition, the micron rating of the filters is too large. These problems will have to be handled directly by Red River since the warranty on the equipment has expired. Red River feels confident that these modifications can be carried out and the facilities will run successfully.

In addition to operational problems, there is concern that the reclaimed oil may not meet military specifications limiting the future use possibilities of the reclaimed oil. Red River intends to run some tests and have analyses of the reclaimed oil conducted by an unbiased laboratory to determine if the reclaimed oil can meet military specifications. At a minimum, the reclaimed oil may be considered as a boiler fuel supplement.

To date the equipment has not been operated due to the problems outlined above.

## **Waste Reduction and Cost Savings**

No data is available on waste reduction and cost savings since the equipment has not been operated yet. A previous report by USATHAMA<sup>1</sup> indicated that this facility could reduce their oily waste by approximately one-third, or \$200,000. The POC felt this was a good estimate.

A majority of the used oil sent to the reclamation facility is very clean. One of the major sources of used oil is the test facility that tests rebuilt engines. The engines are essentially

1 Army Materiel Command, Hazardous Waste Minimization Program, Progress Report, 1985-1989, p103, July, 1991.

**Project Number:** 24 (Continued)  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Red River AD  
**Project Title:** Used Oil Reclamation System  
**Targeted Waste:** Used oil  
**Point of Contacts:** Mike Lockard (903) 334-3559  
**DERA Hazmin Funding:** \$200,000 (FY89)

new and there is little contamination in the oil making it very easy to reclaim. In addition, the quality of the oil will likely be very good.

### **Project Motivation and Documentation**

This project was part of a general pollution prevention effort at Red River AD.

Project documentation and vendor literature is available from the POC but is scattered and diverse. Specific requests for information should be made to the POC.

### **Interviewer Comments**

The POC offered the following lessons learned:

The command agency should be consulted prior to implementing any recycling and reclaiming efforts to ensure that the reclaimed product can and will be used.

Consider the amount of reclaimed material that can be reused when doing the economic analyses. If the reclaimed material cannot be 100% reused it will affect the economics.

**Project Number:** 25  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Sacramento Army Depot  
**Project Title:** Procurement of Solvent Recovery Facility  
**Targeted Waste:** Solvents  
**Point of Contacts:** John Swazo, Rick Solander (916) 388-2489  
**DERA Hazmin Funding:** \$25,200 (FY89)

### **Project Description**

Two solvent recovery systems were purchased in order to recover halogenated and non-halogenated solvents as thinners to be used in spray painting operations. The system is set up so that each still is able to recycle one 55 gallon drum in 8 hours. The solvents will be recycled in spray painting operations.

### **Discussion of Project**

Two solvent recovery stills were purchased in early 1990 and were installed in December of 1990. Each of the units cost approximately \$10,000 each. One still was intended for halogenated and one for non-halogenated solvents. The halogenated still is used to recover 1,1,1-trichloroethane and the non-halogenated still is used to recover methyl alcohol, ethyl alcohol, methyl ethyl ketone, and a product called "Poly-slow reducer" which consists of butyl acetate and cellusolve acetate.

Shortly after installation in December of 1990, California experienced a heavy freeze that resulted in ruptured pipes and equipment breakage. Repairs were made and the system has been running for six to eight months. At present facility engineers are obtaining operational data to allow for the process to be improved. All of the non-halogenated solvents are presently being mixed, but the depot is looking into segregating the distillation products.

### **Waste Reduction and Cost Savings**

Earlier estimates indicated that a reduction in 48,000 kg/yr of solvent waste would result in a cost savings of \$306,000 for disposal and raw material cost. The point of contact could not confirm these numbers and did not know if they would be accurate since originally they may have been based on having only one solvent still. Actual data are not available.

### **Project Motivation and Documentation**

The 50% hazardous waste reduction goal set by HQ AMC was the prime motivation for the project. No project documentation was known to be available.

### **Interviewer Comments**

The point of contacts were extremely helpful in trying to obtain the requested information. Waste reduction and cost savings should be quantified based on the apparent success of the distillation operation. This project appears to have potential for implementation at other Army facilities that generate a range of spent solvents.

**Project Number:** 26  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Seneca Army Depot  
**Project Title:** Treatment of Excess Hazardous Waste (Acid/Base Neutralization)  
**Targeted Waste:** Sodium hydroxide and battery acid  
**Point of Contact:** Mark Paprocki (607) 869-1519  
**DERA Hazmin Funding:** \$1,600 (FY90)

### **Project Description**

The project involved the purchase and use of a 55-gallon polyethylene drum in which waste sodium hydroxide from process streams would be used to neutralize waste battery acid. The neutralization of these wastes would allow for their disposal as nonhazardous wastes.

### **Discussion of Project**

The equipment was purchased in 1990 and was installed shortly thereafter. An explosion-proof motor was needed to complete the hook-up, but a suitable motor has not been identified.

Currently, waste sodium hydroxide is transported off-site for treatment as hazardous waste by a contractor and the used batteries are exchanged with a vendor.

### **Waste Reduction and Cost Savings**

Initial estimates indicated a potential savings of \$1,000 to \$4,000 per year as a result of implementing the neutralization process. Actual waste reduction and cost savings data are unavailable pending operation of the system.

### **Project Motivation and Documentation**

Desire to reduce the amount of hazardous waste requiring disposal.

### **Interviewer Comments**

It is not clear why the identification of an explosion-proof motor is proving so difficult. Assistance should be given the installation to identify and purchase the motor so that it can be determined if waste reduction goals can be met.

**Project Number:** 27  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Seneca Army Depot  
**Project Title:** Procurement of Equipment to Eliminate Waste Solvents  
**Targeted Waste:** 1,1,1-Trichloroethane, Trichloroethene  
**Point of Contact:** Mark Paprocki (607) 869-1519  
**DERA Hazmin Funding:** \$32,249 (FY89)

### **Project Description**

Solvent recovery stills were purchased in order to recover 1,1,1-Trichloroethane and trichloroethene from process streams.

### **Discussion of Project**

Two solvent recovery stills were purchased to recover the aforementioned solvents. The point of contact was unsure when the stills were procured, but one 15 gallon still was purchased for \$10,808 and one 55 gallon still was purchased for \$21,441. Soon after the procurement the solvents were phased out of the process streams. The point of contact said that the stills were never installed and believed that they were still in the boxes somewhere on the base.

### **Waste Reduction and Cost Savings**

Previous estimates indicated a potential \$40,000/year cost savings.

### **Project Motivation and Documentation**

Not applicable.

### **Interviewer Comments**

Support should be encouraged to find alternative uses for the equipment either at Seneca or at another facility. Other facilities may be exploring the use of stills to recover solvents and the equipment could be used to save a significant capital expenditure.

**Project Number:** 28  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Tobyhannah Army Depot  
**Project Title:** Four Systems to Reduce Overall Paint Sludge  
**Targeted Waste:** Paint Sludge  
**Point of Contacts:** Mike Parrent (717) 894-7090, Pat Tierney (717) 894-6724  
**DERA Hazmin Funding:** \$18,272 (FY 89)

### **Project Description**

This project includes the purchase and installation of four low pressure, high volume spray (LPHV) painting cabinets for painting various equipment. The equipment will reduce the amount of paint sludge which is generated through improving transfer efficiency, thus minimizing the amount of overspray.

### **Discussion of Project**

The equipment was purchased in June of 1989 and was installed in August of 1989. The actual cost of the four pieces of equipment was believed to be close to the \$18,272. The project has been a success, but not without some difficulties. Initially the spray guns were breaking, although the point of contact was unsure if this problem was from poor training of personnel or use of heavy paints. The spray nozzles had experienced high needle wear with the original hardened brass parts. This problem was solved when the parts were replaced with hardened steel. There have been problems while spraying polyurethanes with high viscosities and high solid epoxys. The turbines that deliver the air to the spray guns have been operating without breakage for three years. Operators also like to use the equipment.

### **Waste Reduction and Cost Savings**

Paint wastes were reduced by 34,962 kg in 1992 and \$16,400 has been saved in hazardous waste disposal costs. The cost savings of raw material and labor costs have not been calculated. These figures may be difficult to obtain, since the workload from year to year can vary substantially and the amount of overspray of paint can be variable depending on the size of the equipment.

### **Project Motivation and Documentation\***

The project motivation came from HQAMC, as well as additional directives from the commander. Additional reasons for implementing the project include lowering expenditures and potential regulatory requirements. To date, there has not been any project report regarding this effort, only vendor literature.

### **Interviewer Comments**

The point of contact was optimistic about the equipment's ability to achieve its goals and since the workers liked the equipment, they are more likely to use it. If possible, figures including the raw materials and labor should be calculated and also take into consideration the types of equipment (truck parts, communication shelter parts) that were painted.

\* Supplemental information is provided in Appendix E.

**Project Number:** 29  
**MACOM/Org:** AMC/DESCOM  
**Installation/Location:** Tooele Army Depot  
**Project Title:** In-House Study of Paint Sludge and Walnut Dust Incineration  
**Targeted Waste:** Paint Sludge and Walnut Dust  
**Point of Contacts:** Larry Fisher (801) 833-3506, Dr. Jay Bishop (801) 833-2825  
**DERA Hazmin Funding:** \$56,700 (FY88), \$17,765 (FY89)

### **Project Description**

This project consists of two separate studies: (1) incineration of waste paint sludge and (2) incineration of walnut dust resulting from the use of walnut shells as an abrasive paint stripper.

### **Discussion of Project**

Both studies were started in 1988. The walnut dust study was completed on July 16, 1991 and the paint sludge study is still in progress. A feasibility study for the paint sludge was completed in 1990 and the scale-up testing is still in progress. Total costs expended by TEAD for these studies are \$20,000 for the walnut dust study and \$90,000 for the paint study. An estimate of \$70,000 was said to be necessary in order to complete the paint sludge project. A special delivery system was needed for the paint sludge incinerator and the Depot is working on obtaining incineration permits.

### **Waste Reduction and Cost Savings**

Results indicate that incineration can reduce the walnut dust 50% by weight and the feasibility study indicated that the paint sludge can be reduced 90% by weight. Estimated cost savings are \$70,000/yr for walnut dust incineration and \$1,000,000/yr for paint sludge.

### **Project Motivation and Documentation\***

The primary motivation in this project was the 50% HQAMC reduction goal. The following four reports that describe the project are available from Dr. Bishop:

AED Project #T-32-89, Incineration of Walnut Dust  
AED Project #T-79-87, Incineration of Paint Sludge  
"Weight Reduction of Walnut Grit Paint Chip Mixture by Incineration,"  
J.L. Bishop PhD, July 16, 1991

### **Interviewer Comments**

Although incineration is a treatment process and therefore considered low-priority for waste minimization, these projects have indicated that a substantial reduction in wastes to be disposed is possible (with attendant cost savings). The results and recommendations of these reports should be distributed to all installations which could benefit.

\* Supplemental information is provided in Appendix E.



**Project Number:** 30  
**MACOM/Org:** AMC/MICOM  
**Installation/Location:** Redstone Arsenal  
**Project Title:** Supercritical Fluid Demilitarization  
**Targeted Waste:** Ammonium Perchlorate and nitramine propellants  
**Point of Contacts:** Ron Hagler (205) 876-6122, Dr William Melvin (205) 876-4096  
**DERA Hazmin Funding:** \$70,000 (FY 91) to support on-going R&D project

### **Project Description**

The objective of this R&D effort was to develop an innovative and environmentally safe demilitarization method to recover costly rocket motor propellants from the obsolete PERSHING II missile. The technology developed provides an environmentally responsible alternative to the current disposal method of open burning/open detonation of excess or obsolete rocket motors and provides a straightforward method for recovering costly rocket motor ingredients while minimizing the generation of hazardous wastes. The lab-scale testing of this technology has been highly successful and a \$6 million pilot plant is now being constructed in Utah.

### **Discussion of Project**

The DERA funding provided was used to support the ongoing R&D initiative that began in FY 87. The technology uses high pressure and high temperature in a subcritical condition to reclaim rocket motor ingredients. The bench-scale demonstrations for proof-of-concept were completed in FY 92, and the technology is now in transition from small-scale laboratory evaluation to large-scale pilot plant demonstration. The total estimated and actual cost of the bench scale demonstration was \$1.35 million, of which DERA funding provided \$70,000 in FY 91. The successful R&D development of this new demilitarization technology, combined with its potential environmental benefits, have provided the required funding basis for transition to the large-scale pilot plant. The construction contract for the pilot plant was awarded to Hercules in September of 1992 and construction is currently under way in Utah.

### **Waste Reduction and Cost Savings**

The waste reduction benefits from this program are anticipated to be substantial as it will provide an environmentally responsible alternative to the current open burn/open detonation practices. For Class 1.3 ammonium perchlorate composite propellants, 100% of the propellant ingredients are available for recovery/reuse. For Class 1.1 nitramine propellants, 60 to 70% of the ingredients are available for recovery/reuse. The anticipated and actual cost savings can not be estimated until the pilot plant facility has been fully demonstrated and realistic life cycle cost data are estimated.

### **Project Motivation and Documentation**

The total destruction of the Army PERSHING II missile inventory that was mandated under the INF Agreement focused public awareness for the need to develop environmentally acceptable alternatives to the current open burn/open detonation method of disposal of solid rocket motors. Current OB/OD disposal methods are to be severely restricted in the near future, and the national environmental Resource Conservation and Recovery Act (RCRA) legislation requires that recycle/reuse disposal methods be implemented to the greatest extent possible.

**Project Number:** 30 (Continued)  
**MACOM/Org:** AMC/MICOM  
**Installation/Location:** Redstone Arsenal  
**Project Title:** Supercritical Fluid Demilitarization  
**Targeted Waste:** Ammonium Perchlorate and nitramine propellants  
**Point of Contacts:** Ron Hagler (205) 876-6122, Dr William Melvin (205) 876-4096  
**DERA Hazmin Funding:** \$70,000 (FY 91) to support on-going R&D project

Project documentation on this technology program is available through the Joint Service Large Rocket Motor Disposal Office. The mailing address is:

U.S. Army Ammunition Center and School (USADACS)  
Joint Service Large Rocket Motor Disposal Office  
SMCAC-ESS  
Savana, IL 61074-9639

The office telephone number is (815) 273-8620 or DSN 585-8620.

#### **Interviewer Comments**

Super/sub critical fluid demilitarization systems have been popular areas of technological research recently with R&D funding currently provided by Navy, Army, DOE, DOD, and several of the national laboratories such as Sandia, and David Taylor Research. The technology appears to effectively isolate the propellants for recycle/reuse, but the high energy consumption is an issue of concern and could prove to be a significant system disadvantage. Both points of contact for this project were highly knowledgeable and appear to have spent the funding in a responsible manner with a significant level of technological gain.

**Project Number:** 31  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** CRDEC  
**Project Title:** Study of Delisting & Treatment of Hazardous Waste  
**Targeted Waste:** Chemical Agent Decontamination Solutions  
**Point of Contacts:** Dave Renard (410) 671-4614, Terry Mann (410) 671-4614  
**DERA Hazmin Funding:** \$199,935 (FY 88)

### **Project Description**

Waste solutions resulting from the neutralization and decontamination of chemical agent-contaminated items are declared a hazardous waste by the state of Maryland. As a result, the waste solutions can no longer be incinerated in the existing waste incinerator facility. These waste solutions were stored pending their delisting. The delisting petition was granted and the stored material was eventually incinerated.

### **Discussion of Project**

The state of Maryland declared the liquid mixture formed by the neutralization of the chemical agents GD, GA, GB, HD, VX and L and their decontamination solutions as a hazardous waste. Therefore, the decontamination solutions did not fall within incinerator permit allowances. In order to be able to continue to incinerate these wastes, they had to be formally delisted as a hazardous waste. This formal delisting procedure requires the development and presentation of data regarding: the characterization of the waste; treatment methods used; and demonstrations that the waste is not hazardous after treatment.

The project was initiated in December 1987 and was completed in February 1988. The estimated and actual costs of \$199,935 appeared to be consistent. All six agent decontamination solution treatment procedures were accepted by the Maryland Department of Environment and delisting was granted by the Code of Maryland Regulations (COMAR) 26.13.02.26.

### **Waste Reduction and Cost Savings**

The implementation of this project contributed to cost avoidance. If the material had required disposal as a hazardous waste, the disposal cost would have been very high. Approximately 75,000 gallons of decontamination solution waste is generated per year that would have required disposal as a hazardous waste.

### **Project Motivation and Documentation**

The project motivation was compliance with state of Maryland regulations. The only documentation available is the report presented to the state indicating the procedures and the work conducted in support of the delisting effort. The report is available from the POC and is entitled "Support for the Delisting of Decontaminated Liquid Chemical Surety Materials as Listed Hazardous Waste from Specific Sources (State) MD02 in COMAR 10.51.02.16-1", CRDEC-TR-009, Nov 88.

**Project Number:** 32  
**MACOM/Org:** AMC/AMCCOM  
**Installation/Location:** CRDEC  
**Project Title:** Development of Analytical Procedure to Minimize Toxicological Waste  
**Targeted Waste:** Toxic Laboratory Waste  
**Point of Contacts:** Ronald Young (410) 671-4406  
**DERA Hazmin Funding:** \$150,000 (FY91)

### **Project Description**

Current procedures employed to conduct toxicity tests on a variety of chemicals involve the use of large quantities of water. All of this water must be disposed of properly. An alternative analytical procedure is desired that would require the use of less water thus reducing the amount of waste generated.

### **Discussion of Project**

This project was initiated to develop and validate an alternative test procedure that would generate less wastewater during toxicological testing. The desired procedure would be automated and could be conducted at a much higher efficiency.

The project has been funded for approximately two years to the amount of \$300,000; however, funds are inadequate to validate the method and obtain approval for its use. It is estimated that an additional \$150,000 would allow for the completion of the project.

### **Waste Reduction and Cost Savings**

The amount of waste that is reduced is dependent upon the number of tests that are conducted. It is approximated that 20 to 30 tests are conducted per year each generating up to 10 to 20 gallons of contaminated water. The new test would generate approximately 1 gallon of wastewater per test, thus saving 400 to 550 gallons per year. The potential cost savings due to reduced disposal requirements was estimated at the time of funding request and is approximately \$309,000 above capital recovery.

### **Project Motivation and Documentation**

The primary motivation behind this project is the reduction of contaminated wastewater resulting from the use of current methods for toxicological testing in the laboratory.

**Project Number:** 33  
**MACOM/Org:** AMC/TECOM  
**Installation/Location:** HQTECOM  
**Project Title:** Develop Delisting Package for 3X/5X'd Material - Utah  
**Targeted Waste:** Decontaminated chemical agent wastes  
**Point of Contacts:** Juan Lopez (410) 278-1077  
**DERA Hazmin Funding:** \$250,000 (FY 91)

### **Project Description**

The state of Utah considers decontaminated chemical agent wastes as hazardous and requires that they be managed (stored and disposed) as such. This project involves the development of a plan whereby decontaminated chemical agent wastes generated at Dugway Proving Grounds are delisted.

### **Discussion of Project**

The project was conducted in two phases, the first being the development of a delisting plan. A total of \$500,000 was funded in \$250,000 increments in FY 91 and FY 92. The estimated cost was \$497,600 and the actual cost was \$439,653. The first phase of the project was initiated in June of 1991 and was completed in July of 1992.

The funds were allocated as follows:  
15% - Labor  
35% - Overhead and General  
50% - Travel, benefits, fees, etc.

Phase 2 of the project involves the implementation/execution of the plan developed in phase 1 once it has been approved by the state of Utah. This review is currently underway.

The delisting plan includes a description of the wastes and how they are unique to the Army. In addition, analytical methods to be used to verify that the wastes are nonhazardous are detailed. The project team has met with the state to discuss the requirements for approval; however, since there are no existing health standards relating to chemical agents it is difficult to anticipate specific requirements.

### **Waste Reduction and Cost Savings**

There are no details regarding the potential cost savings and waste reduction; however, there are some historical data and projections (some of which are classified). For example, the Program Manager for Chemical Demilitarization estimates that the disposal of 30,000 tons of decontaminated scrap metal generated at Tooele Army Depot costs approximately \$14.5 million. If this waste is delisted, usable scrap metal could be recycled with the unusable portion disposed of in a solid waste landfill. In this way, nearly the entire \$14.5 million could be saved.

### **Project Motivation and Documentation**

A large file of delisting documentation is retained by the POC and is available for review.

The project motivation was to reduce the liability for Dugway and to reduce disposal costs by allowing the management of the as a solid waste rather than a hazardous waste.

**Project Number:** 34  
**MACOM/Org:** AMC/CSTA  
**Installation/Location:** CSTA  
**Project Title:** Audit of CSTA's HAZMIN Program to Encompass Ammunition and Radioactive Wastes  
**Targeted Waste(s):** Ammunition and Radioactive Wastes  
**Point of Contact(s):** Joe Ondek (410)278-5294  
**DERA HAZMIN Funding:** \$66,930 (FY 88)

### **Project Description**

The State of Maryland indicated that their regulations of Low Level (LL) Radioactive waste would be changing with respect to the types of processes and waste streams that would be affected by the regulations. In order to prepare for changes in regulations, CSTA undertook this effort to identify ways in which management of these wastes could be improved.

### **Discussion of Project**

The project was initiated at the end of 1988/early 1989. A final report was issued in 1990. Final cost of the study is not available.

Results of the study provided for the identification of specific items that would have to be managed differently under the proposed Maryland regulations. According to the point of contact, the report provided a significant amount of clarification of the proposed law and additional information to support activities for changing current methods of managing these wastes. Some of the recommendations generated by the study included those reflecting delisting of specific wastes, recycling of generated wastes, and materials substitution.

### **Waste Reduction and Cost Savings**

The project (study) itself did not result in any waste reduction; however, it may help to avoid the classification of waste as hazardous and thus avoid costs associated with the disposal of hazardous wastes. There is no quantification of potential waste reduction or cost savings available.

### **Project Motivation and Documentation**

The primary motivation of this project was to understand the potential new state regulations and identify requirements for maintaining compliance and reducing hazardous waste disposal costs. In addition, it was desired to understand how the Maryland law would differ from the federal regulations that are expected to be promulgated in approximately 2 years (entitled the Federal Facility Compliance Explosives and Ammunition Act ) which will cover the same activities.

A copy of the report generated during this study has not been located.

### **Interviewer Comments**

The facility demonstrated foresight in addressing regulatory requirements and the need for compliance prior to the promulgation of the actual regulations.

**Project Number:** 35  
**MACOM/Organization:** AMC/TECOM  
**Installation/Location:** Aberdeen Proving Ground (APG)  
**Project Title:** Provide Inventories of Hazardous Waste Generation  
**Targeted Waste:** General  
**Point of Contact:** Ken Stachiw (410) 671-4841  
**DERA Hazmin Funding:** \$162,000 (FY 88)

### **Project Description**

This project was funded in order to determine the amounts and types of hazardous waste generated at APG and to develop plans to minimize these wastes.

### **Discussion of Project**

Aberdeen Proving Ground is a test and evaluation command with test, research, and development missions. Approximately 600 tons of hazardous waste are produced each year. At the time of funding, all hazardous waste was manifested to be shipped off-site to approved facilities. Ken Stachiw was unable to supply any more documentation or information concerning this project than was supplied through the EPA form 3500-7 because there was a change in personnel during that time period and relevant project records appear to have been misplaced.

### **Waste Reduction and Cost Savings**

Theoretically, the waste reduction attributable to this project was 50% by 1992 based on the AMC goal. However, there is no documentation available to quantify actual waste reduction or cost savings.

### **Project Motivation and Documentation**

According to the EPA Form 3500-7, prepared prior to initiation of the project, the overall motivation for this project was the AMC order for all installations to reduce hazardous waste generation by 50% by 1992. No project documentation is available.

**Project Numbers:** 36-40

**MACOM/Organization:** AMC/TECOM

**Installation/Location:** Aberdeen Proving Ground (APG)

**Project Title:** Reduce Waste Oil Generation (\$120,000)  
Liquid Waste Minimization (\$399,300)  
Analyze and Evaluate Waste Streams (\$195,600)  
Drum Storage Shed (\$12,600)  
Funds to Produce Video for Hazmin (\$10,000)

**Targeted Waste:** General

**Point of Contacts:** Ken Stachiw (410) 671-4841

**DERA Hazmin Funding:** (FY 88)

### **Project Description**

These projects were all part of the hazardous waste minimization plans for Aberdeen Proving Ground (APG) with one exception. The HAZMIN video was made for Forscom but the video shop at Aberdeen Proving Ground was used as the production center and therefore APG received the funds.

### **Discussion of Project**

Ken Stachiw was unable to find any additional documentation or information on these projects because at the time these were funded there was a change in personnel involved. All relevant records appear to have been misplaced. However, Tom Eccles noted that the HAZMIN video project was completed and is considered a success.

### **Waste Reduction and Cost Savings**

The waste reduction and cost savings attributable to these projects is not known.

### **Project Motivation and Documentation**

According to preliminary information submitted prior to receipt of funding, the overall motivation for these HAZMIN projects was the Army Material Command's order to cut hazardous waste generation 50% by 1992. There is no further documentation available for these projects.



**Project Number:** 41  
**MACOM/Org:** AMC/TECOM  
**Installation/Location:** White Sands Missile Range  
**Project Title:** Paint Solvent Recovery Stills  
**Targeted Waste:** Degreasers and paint solvents  
**Point of Contact:** Harrison Orr (505) 678-2224  
**DERA Hazmin Funding:** \$41,800 (FY 88)

### **Project Description**

This project includes the purchase and installation of three distillation units to be used in the purification of waste paint solvents and degreasing chemicals. The three units include a 20 gallon still and two 5 gallon stills.

### **Discussion of Project**

All three stills were purchased in the spring of 1989. The 20 gallon unit was installed in the summer of 1989 while the two 5 gallon units have not been installed due to personnel cutbacks. The cost of the equipment was \$41,600. The 20 gallon unit is being used to reclaim waste degreasers and paint solvents. The installed unit has been operating without problems and has been able to cut the degreaser and paint solvent waste streams by a minimum of 75%.

### **Waste Reduction and Cost Savings**

The point of contact (the waste reduction manager) was not aware of any waste reduction or cost savings determined prior to purchasing the equipment. After implementing the still, waste disposal volumes were reduced from approximately 275 gallons of liquid waste per year to less than 20 gallons per year. The associated disposal cost savings are \$2,500 per year.

### **Project Motivation and Documentation**

The motivating force behind the purchase of this equipment was waste disposal cost and volume reduction. There is no known documentation available regarding this project.

### **Interviewer Comments**

A reduction in personnel has limited the need for the equipment and thus reduced the volume of waste to be processed. Therefore, the current waste generation estimate of less than 20 gallons per year may not be representative because of reduced operations.

**Project Number:** 42  
**MACOM/Org:** AMC/TECOM  
**Installation/Location:** White Sands Missile Range  
**Project Title:** Waste Minimization Opportunities  
**Targeted Waste:** General  
**Point of Contacts:** Harrison Orr (505) 678-2224  
**DERA Hazmin Funding:** \$180,000 (FY 88)

### **Project Description**

This biannual study was conducted to assess work processes throughout the facility that generate hazardous wastes in order to identify and prioritize cost-justified HAZMIN projects.

### **Discussion of Project**

The study was initiated in the fall of 1988 and was completed in the fall of 1989. The estimated and the actual cost of the study was \$180,000. The point of contact (the waste reduction manager) does not believe that any of the recommendations that came out of the study were ever implemented due to the reduction of: site staff, process activity, and available funding. Since the completion of the project, the reduction in personnel has limited some activities at White Sands Missile Range.

### **Waste Reduction and Cost Savings**

Prior to the initiation of the study, the installation generated greater than 50 tons of hazardous waste per year. Since it appears that none of the study results were implemented, it is unlikely that waste generation was significantly reduced, except as a result of the reduction in facility operations.

### **Project Motivation and Documentation**

Project motivations included:

- RCRA;
- AMC waste reduction goal; and
- To identify, justify, and prioritize HAZMIN projects.

There is a final report titled "HAZMIN Plan Opportunities Survey - 1988" that was developed and is available from TECOM Headquarters in Baltimore.

### **Interviewer Comments**

The POC was able to provide only limited details on the project. Despite the relatively large expenditure, it appears that the study produced no results. It might be worthwhile to examine the report to identify potential applications for White Sands or other Army facilities.

**Project Number:** 43  
**MACOM/Org:** AMC/TECOM  
**Installation/Location:** Yuma Proving Ground  
**Project Title:** Stream Analysis  
**Targeted Waste:** General  
**Point of Contacts:** Charles Botdorf (602) 328-2753  
**DERA Hazmin Funding:** \$144,000 (FY 88)

### **Project Description**

In order to develop a hazardous waste management plan, this facility conducted a detailed waste stream inventory. This inventory became the backbone for their waste reduction efforts.

### **Discussion of Project**

The project received the funding in 1989 and was completed in December 1989. The estimated cost was believed to be \$150,000 and the actual cost was \$144,000.

Camp, Dresser, and McKee, Inc. conducted the inventories in a very detailed manner. The surveys and audits were conducted right at the level where the employees were doing their jobs. Flow diagrams were developed for each activity which indicated the type and quantity of waste generated. The contractor used a 7 step approach as follows:

1. Description/function
2. Tenants
3. PFD's
4. Waste volume and type
5. Sampling
6. Hazardous waste minimization proposals
7. Recommendations

The industrial areas were prioritized according to their level of risk. The following is a description of the areas starting with the highest risk.

Phase 1: Maintenance of vehicles, petroleum laboratory, telecommunications, and radiographic laboratory.

Phase 2: Craft shop, photo laboratory, maintenance.

Phase 3: Paint storage, insecticide storage, water treatment plant, welding shop, and gunner's shop.

Phase 4: Health clinic, calibration laboratory, systems test branch, electronics laboratory, and mobile maintenance.

Yuma was extremely pleased with the surveys and audits conducted. The results were used to establish a baseline and an idea of the future environmental concerns. The surveys have been used as the basis of their pollution prevention plan.

Among the recommendations that were implemented include reduction of the waste on hand, better housekeeping, and no storage "out of sight" - all waste on the site was disposed of. In addition to providing technical recommendations, this program also promoted the idea of pollution prevention and awareness to the level of the operators.

**Project Number:** 43 (Continued)  
**MACOM/Org:** AMC/TECOM  
**Installation/Location:** Yuma Proving Ground  
**Project Title:** Stream Analysis  
**Targeted Waste:** General  
**Point of Contacts:** Charles Botdorf (602) 328-2753  
**DERA Hazmin Funding:** \$144,000 (FY 88)  
**Waste Reduction and Cost Savings**

This type of project is very difficult to extrapolate any cost savings. However, the POC does believe that it has provided some cost avoidance in that it has reduced the number of compliance violations. In addition it has made Yuma a more attractive business center.

#### **Project Motivation and Documentation**

The project was conducted to provide a baseline understanding of the regulations and waste that required management on the site. Liability was a major factor. There were no specific compliance violations, but awareness of compliance was a motivation.

The documentation provided by the contractor is available, however, it is an extremely large document. The title is: "Hazardous Waste Management Report, Audit of Target Facilities", U.S. Army, Yuma PG, 1988-1989.

#### **Interviewer Comments**

The concept of operating a facility in an environmentally sound manner and how it enhances the attractiveness of it as a business center is very interesting. Especially with the proposed budget cutbacks making the competition between facilities likely a lot higher. This type of pay back is difficult to quantify but should be promoted.

**Project Number:** 44  
**MACOM/Organization:** FORSCOM  
**Installation/Location:** Ft. Campbell  
**Project Title:** Waste Oil Collection Truck  
**Targeted Waste:** Waste Oil  
**Point of Contacts:** Jerry Merryman (502) 798-3487  
**DERA Hazmin Funding:** \$87,400 (FY 89)

### **Project Description**

The waste oil collection truck is required to collect and transport waste oil from motor pools to the central holding facility. This truck replaces an old tank mounted on a truck that was not efficient because it was not capable of pumping the oil. Spills were more likely to occur before the vacuum pump truck was purchased because the individual barrels had to be transported to the tank and poured in. The old tank also had potential leaks due to its age. The new process is cleaner, takes less time, and prevents oil from being disposed of improperly.

### **Discussion of Project**

The truck was purchased in November 1989 and the actual cost was \$87,423. There were no inherent site or equipment related problems. However, one disadvantage is that the truck cannot pump ignitable fluids. It should be noted, however, that Jerry Merryman was not aware of any vendors that sell trucks capable of pumping ignitable fluids.

### **Waste Reduction and Cost Savings**

Despite the lack of data regarding the actual waste reduction and cost savings attributable to the purchase of this truck, it was considered a good investment. The only information available is the average amount of oil collected before and after the truck was purchased. Approximately 70,000 gallons of waste oil were generated with the old system whereas, in 1992, 90,000 gallons was collected. However, the difference may be due to an increase in oil use rather than an increase in collection efficiency.

### **Project Motivation and Documentation**

The project was initiated because the old tank mounted on a truck was inefficient, unsafe, and time consuming. No written documentation regarding this expenditure is available.

### **Interviewer Comments**

The project appears to have fulfilled its expectations but the lack of data and information prevents exact determination of the effectiveness of the truck in reducing waste generation.

**Project Number:** 45  
**MACOM/Org:** FORSCOM  
**Installation/Location:** Ft. Carson  
**Project Title:** Purchase Jet Washers  
**Targeted Waste:** 1,1,1-Trichloroethane  
**Point of Contact:** Bob Mitchell (719) 579-2895, -2896  
**DERA Hazmin Funding:** \$107,000 (FY89)

### **Project Description**

This project includes the purchase and installation of 12 jet washers for cleaning small machine parts and engines with non-hazardous solvents. The equipment will eliminate the use of 1,1,1-trichloroethane which is currently used with vapor degreasers to clean the parts.

### **Discussion of Project**

The equipment was purchased in 1990 and was installed in 1991. The 12 jet washers, called Tally degreasers, cost \$128,166 and the electrical and installation costs were \$26,445. Electrical modifications were made to the building to allow for 3 - phase, 480 volt capacity. The wash liquid drains into catch basins and feed into a common sump. The washers have been in operation for approximately 14 months. The operators are experimenting with a Calgon product that is creating some foaming problems. An anti-foam agent is being used to control this problem. Mechanics have noted that the washers do not clean as well as the vapor degreasers.

### **Waste Reduction and Cost Savings**

No waste reduction and cost savings were available at the time, although the point of contact said that they would be substantial. TCA-contaminated oil is expensive item to dispose of. TCA emissions have been eliminated from the cleaning process and any health problems associated with the TCA have also been eliminated.

### **Project Motivation and Documentation**

The primary motivation for the project was the potential health problems to the workers dealing with TCA. Extensive training manuals exist.

### **Interviewer Comments**

The project is a good example of not only reducing wastes and potentially saving costs, but also improving the safety of the work environment. Waste reduction and cost savings should be quantified. If it can be proven that the washers do an acceptable job (see mechanics note above), implementation of this equipment at other installations should be considered. This is particularly important in view of the phase out of the use of TCA.

**Project Number:** 46  
**MACOM/Organization:** FORSCOM  
**Installation/Location:** Ft. A.P. Hill  
**Project Title:** Waste Oil Pump Truck  
**Targeted Waste:** Waste Oil  
**Point of Contacts:** Terry Banks (804) 633-8255  
**DERA Hazmin Funding:** \$110,278 (FY 89)

### **Project Description**

The waste oil pump truck is generally used in an emergency capacity. The truck is used equally for two purposes: (1) to clean up oil spills; and (2) to pump a septic tank into the overflow tank if there is an equipment malfunction or if a storm causes an overflow.

### **Discussion of Project**

The truck was purchased on August 31, 1990 for \$110,278. There are no site or equipment related problems. The advantage of having the capability to respond to such emergency situations instead of hiring outside contractors is that the response is quicker and that paper work (and related time required) is less. A quicker response also leads to less potential for damage to the environment and lower cleanup costs.

### **Waste Reduction and Cost Savings**

The cost savings has not been directly calculated but it is possible to compare the cost of the truck to that of hiring an outside contractor. The cost of using an outside contractor may be approximately \$400 per incident. Assuming there are 10 incidents per year, the cost would be \$4000 per year. The actual waste reduction is not available but the potential for reduction in damage to the environment due to a quicker response should be taken into account.

### **Project Motivation and Documentation\***

Simple economy and convenience appear to be the motivation for this project. A copy of the contract and the description of the truck were obtained.

### **Interviewer Comments**

This project appears to have satisfied its purpose but does not address hazardous waste minimization issues directly.

\*Supplemental information is provided in Appendix E.

**Project Number: 47**  
**MACOM/Org: FORSCOM**  
**Installation/Organization: Ft Lewis**  
**Project Title: Personnel Support for the Management of Hazmin Program**  
**Targeted Waste: None**  
**Point of Contact(s): Randy Hanna (206) 967-5337**  
**DERA Hazmin Funding: \$151,500 (FY 89)**

**Project Description**

Unknown

**Discussion of Project**

Unknown

**Waste Reduction and Cost Savings**

Unknown

**Project Motivation and Documentation**

Unknown

**Interviewer Comments**

DERA Hazmin funding documentation cites that this funding was provided for the salary of a term employee. The POC was unable to confirm or disprove this.



**Project Number:** 48  
**MACOM/Org.:** FORSCOM  
**Installation/Location:** Ft. Lewis  
**Project Title:** Solvent Recycling Facility  
**Targeted Waste:** Solvents  
**Point of Contact(s):** Randy Hanna (206) 967-5337  
**DERA Hazmin Funding:** \$151,513 (FY90), \$21,122 (FY90), \$22,600 (FY91)

### **Project Description**

The funding was used to purchase two stills to recover 1,1,1-trichloroethane (TCA) for reuse and to construct a centralized facility to house the stills.

### **Discussion of Project**

The project was initiated in 1989 and completed in 1991. The actual cost of equipment purchase and construction is believed to be close to the amount funded.

Two stills were purchased and installed. There were several problems associated with use of the system. Evidently, the manner in which the stills were operated resulted in the generation of acid causing corrosion of equipment parts.

### **Waste Reduction and Cost Savings**

The system was only in use for approximately one year. It was confirmed that the use of the system did reduce the amount of waste; however, this was not quantified. Further, the facility no longer uses TCA as a result of the Army-wide mandate to discontinue the use of ozone-depleting chemicals, and thus the stills are no longer in use. The facility is considering the adaptation of the stills for use in reclaiming used ethylene glycol.

### **Project Motivation and Documentation**

The motivation behind this project was the reduction of waste TCA requiring off-site disposal and resulting cost savings.

No project documentation is available.

### **Interviewer Comments**

This project was viewed with frustration due to the operational problems experienced as well as the discontinuance of the use of TCA shortly after their procurement. The search for alternative uses of the distillation equipment should be supported.

**Project Number:** 49  
**MACOM/Org.:** FORSCOM  
**Installation/Location:** Ft. Lewis  
**Project Title:** Purchase Cabinets for Paint Storage  
**Targeted Waste:** Paint  
**Point of Contact (s):** Randy Hanna (206) 967-5337, Cindy Trout (206) 967 5337  
**DERA Hazmin Funding:** \$131,000 (FY 91)

### **Project Description**

Civilian and troop organizations at Ft. Lewis store paint outdoors at various locations. During the winter months, the paint freezes and becomes unusable. This waste paint must be disposed of as a hazardous waste. In order for the paint to be stored indoors to prevent freezing, it must be stored in paint cabinets that meet the fire code. Paint cabinets were purchased under this project to provide for such storage.

### **Discussion of Project**

Paint cabinets for use by the on-site civilian organizations were ordered in 1991 and arrived in late 1991. Not all of the DERA funding provided (\$131,000) was used for the purchase of these paint storage cabinets. The balance was used for the purchase of parts washers, jet spray aqueous washers for replacing vapor degreasing, and high pressure low volume (HPLV) paint guns. The replacement of the vapor degreasing process was conducted because all of the vapor degreasers are being phased out as of July 1993 due to the Clean Air Act Amendments.

It is believed that additional funding was received in 1992 for the purchase of additional paint cabinets for the storage of paints used by troop organizations at Ft. Lewis. As of early 1993, these cabinets have not arrived.

The goal of the POC is to have suitable protective cabinets at each generation point for both corrosives and flammables to protect them from freezing.

### **Waste Reduction and Cost Savings**

Paint that is wasted due to freezing is one of the base's largest waste streams, thus any reduction in the amount of waste generated is positive. There was no confirmation of the actual waste reduction or cost savings. The POC felt that the initial estimates of a cost savings of \$86,360/year based on a 65% reduction in paint waste (41,470 lbs/year) may have been low. There may be greater potential for cost savings depending on the exact quantities of waste paint involved.

### **Project Motivation and Documentation**

The project motivation included: the potential for cost savings; regulatory considerations (RCRA); and Department of Army policy to reduce hazardous waste. There is apparently no project documentation available.

### **Interviewer Comments**

The use of paint storage cabinets for storage of paint and prevention of freezing appears to be a valid and successful hazmin venture. However, further investigation may be warranted to identify alternative paints that are resistant to freezing or to identify the cause of the paints being declared waste (e.g., shelf life requirements).

**Project Number:** 50  
**MACOM/Organization:** FORSCOM  
**Installation/Location:** Ft. Meade  
**Project Title:** Purchase Vacuum Pump Truck  
**Targeted Waste:** Waste fuels/oils  
**Point of Contacts:** Paul Robert (410) 677-3648  
**DERA Hazmin Funding:** \$91,300 (FY 89)

### **Project Description**

This vacuum pump truck will be used on a routine basis to: collect and transport oil in support of the used oil recycling program; and to pump #2 fuel oil out of leaking underground storage tanks. In addition to these routine uses, the truck will be used in immediate response activities to prevent the spread of contamination as a result of fuel spills. In addition, the equipment includes a skimmer pump that can be used to remove oil from the surface of an on-site lake in the event of a major oil spill.

### **Discussion of Project**

The actual amount of funding for this project could not be verified although it is believed that the funding was allocated in FY 89. This truck replaces an older truck that was used only in emergency situations and was unreliable due to its age. Currently, waste oil generated at individual shops is collected with the vacuum pump truck and then burned in the boiler. Before the purchase of the vacuum pump truck, the barrels of oil from individual shops were transported to the central collection tank in pickup trucks. Not only was this less efficient, but it also increased the possibility of waste oil being spilled during transportation and transfer. In the case of a leaking underground storage tank, the recovered oil is collected and burned in the boiler. The only problem related to the project was that it was necessary to insure that the operators understood the operation of the system. For example, it is important not to mix the wastes that are to be burned to avoid potential violation of the air permit. The operators require hazardous waste training and a better system for testing the purity of the waste oil is necessary before the fuel can be used effectively in the boiler.

### **Waste Reduction and Cost Savings**

The person who initiated this project is no longer working at this installation and information regarding the project has been difficult to obtain. Information on the potential waste reduction and cost savings is currently being sought.

### **Project Motivation and Documentation**

This project was originally an initiative from the Directorate of Engineering and Housing in order to supplement the recycling program. However, new regulations on underground storage tanks were implemented in 1988 so the truck was designated for this purpose as well.

### **Interviewer Comments**

The POC felt that the project was a complete success.

**Project Number:** 51  
**MACOM/Organization:** FORSCOM  
**Installation/Location:** Ft. Meade  
**Project Title:** Purchase Glycerin Machine for Antifreeze Recycling  
**Targeted Waste:** Waste Antifreeze  
**Point of Contacts:** Paul Robert (410) 677-3648  
**DERA Hazmin Funding:** \$3,000 (FY 89)

### **Project Description**

The purpose of the funded equipment is to recycle spent antifreeze from Ft. Meade's fleet of vehicles for reuse.

### **Discussion of Project**

The equipment for this project was purchased in FY 89 but the actual amount funded and the actual cost could not yet be verified although \$3,000 appears reasonable. The recycling program was originally available both to the housing occupants at Ft. Meade and to the large fleet of Ft. Meade vehicles. However, after about 1 1/2 years of the program, the fleet of vehicles was put under the GSA's jurisdiction. Therefore, Ft. Meade was no longer responsible for the maintenance of these vehicles and could not recycle the spent antifreeze. In addition, around the same period of time, Ft. Meade's mission changed from a Battalion-centered base to mostly administration. As a result, the amount of heavy equipment at Ft. Meade was reduced. Currently, the recycling program is operating for the benefit of the personnel on the base. They are not yet losing money by using the recycling equipment but it is not being used to its full potential. Furthermore, there is no market for the recycled antifreeze so it is accumulating without any potential use. Ft. Meade may be forced to dispose of the recycled antifreeze regardless. Possible solutions being investigated include selling the equipment to another installation and selling the recycled antifreeze to either another installation or to a commercial source.

### **Waste Reduction and Cost Savings**

Quantitative values of waste reduction and cost savings are not available at this time. During the first year and a half, the project was very successful. The only impediment to its continued success is site-specific. The cost of operating the equipment was much less than the cost of disposing of waste antifreeze and the cost of purchasing new antifreeze.

### **Project Motivation and Documentation**

The exact motivation for this project is unknown but is most likely a Ft. Meade HAZMIN initiative.

### **Interviewer Comments**

This appears to have been a very successful investment. Based on its success, effort should be taken to identify appropriate solutions to the site-specific problems mentioned.

**Project Number:** 52  
**MACOM/Org:** FORSCOM  
**Installation/Location:** Ft. Ord  
**Project Title:** Hot Water Jet Rinse Equipment  
**Targeted Waste:** Trichloroethane  
**Point of Contacts:** Claire Murdo (408) 242-2720  
**DERA Hazmin Funding:** \$24,900 (FY 89)

### **Project Description**

This high pressure hot water spray equipment is being used to remove general residues from military vehicles. The process has replaced cleaning methods which utilize trichloroethane for under hood cleaning to remove accumulated oil and dirt. The hot water spray equipment can also be used to clean mud and dirt from the exterior of the vehicles as a general car wash method.

### **Discussion of Project**

Three high pressure hot water spray machines were purchased in 1989 and installed at Ft. Ord the same year. The purchase cost of this equipment is unknown but equivalent items today would cost approximately \$15,000 each or \$45,000 total. Use of this high pressure hot water spray equipment has replaced the use of a trichloroethane sprayer to remove general vehicle residue. There have not been any equipment or site-related problems, and the cleaning process is not affected by any military specifications. By using the hot water spray equipment all oily solvent residues have been eliminated and the generated oil and water waste stream is easily separated so that only the concentrated oily residue requires disposal.

### **Waste Reduction and Cost Savings**

The old method of cleaning vehicles using trichloroethane resulted in the generation of approximately twelve to fifteen 55 gallon drums of hazardous waste per year. The new high pressure hot water spray equipment results in the generation of only one 5 gallon can of oily waste per year. This represents a cost savings of about \$4,000 per year in hazardous waste disposal fees.

### **Project Motivation and Documentation**

The driving force behind this project was an Army command order and a State of California regulation that called for a required reduction in the generation of hazardous wastes. To date, there are no reports on the operation of this equipment and the location of the vendor literature is unknown.

### **Interviewer Comments**

Based on the 99% reduction in the generation of hazardous waste this project must be considered highly successful and should be evaluated for implementation at other facilities.

**Project Number:** 53  
**MACOM/Org:** FORSCOM  
**Installation/Location:** Ft. Hunter Liggett  
**Project Title:** Purchase High Pressure Water Cleaning Equipment and Stills  
**Targeted Waste:** Trichloroethane  
**Point of Contacts:** Claire Murdo (408) 242-2720  
**DERA Hazmin Funding:** \$65,000 (FY 91)

### **Project Description**

This high pressure water cleaning equipment will be used in place of conventional cleaning methods that utilize Stoddard solvent and mineral oils. The distillation stills will be used to purify and recover the remaining amounts of PD-680 cleaning solvent that will continue to be used.

### **Discussion of Project**

The high pressure water cleaning equipment and the distillation stills were purchased in April of 1992 but have not yet been installed. The purchase cost of this equipment was \$46,000. The high pressure water cleaning equipment will replace the Stoddard solvent and mineral oil that are currently used in the cleaning process. This equipment operates at high voltage (thought to be either 240 or 440 volts) and requires the installation of new electrical wiring since the desired location is equipped with 110 VAC only. There are no anticipated problems with the military specifications.

### **Waste Reduction and Cost Savings**

It is estimated that approximately 1,500 pounds of hazardous waste containing Stoddard solvent and mineral oils will be eliminated each year with the new cleaning equipment. The annual disposal fee savings are calculated to be \$645 based on the current disposal cost of \$0.43 per pound. Actual waste reduction and cost savings are not available since the equipment has yet to be installed.

### **Project Motivation and Documentation**

The driving force behind this project was an Army command order and a State of California regulation which called for a required reduction in the generation of hazardous wastes. To date, there are no reports on the operation of this equipment and the location of the vendor literature is unknown.

### **Interviewer Comments**

Although the equipment is not yet installed, the intended concept is sound and should be considered at other sites based on an economic analysis.

**Project Number:** 54  
**MACOM/Org:** FORSCOM  
**Installation/Location:** Ft. Polk  
**Project Title:** Install Sediment and Soil Drying Beds for Pretreatment to Land Farming  
**Targeted Waste:** POL contaminated soils  
**Point of Contact:** Jim Grafton (318) 531-6011  
**DERA Hazmin Funding:** \$170,000 (FY91)

### **Project Description**

These funds were used to build a structure above existing drying beds used to dry washrack sediments and soils contaminated with Petroleum, Oil, and Lubricants (POL) which have been washed from tanks. These sediments are dried prior to landfarming to degrade the contaminants. The building, which is about 30 feet in height, 60 feet wide and 160 feet long, was constructed to prevent rain water from flooding the drying beds. After the soil and sediments are dried, they are taken to a landfarm where they are allowed to degrade.

### **Discussion of Project**

The structure was completed in May of 1992. Tanks are allowed to drive into the structure and be washed. Hundreds of pounds of dirt contaminated with POL is washed off the tanks. The wash water is collected into a tank, pumped into a truck and taken to a wastewater treatment plant. The remaining washrack sediments and POL-contaminated wastes are allowed to dry. Dried sediment is loaded into dump trucks with hydraulic, telescoping boom loaders and then taken to a landfarm for treatment.

### **Waste Reduction and Cost Savings**

No cost savings were generated from this project. The project is designed to prevent the drying beds from overflowing. This area of Louisiana receives an average of 65 inches of rain every year which causes the problem.

### **Project Motivation and Documentation\***

The primary motivation for the project was compliance in response to complaints from EPA inspectors about the overflowing of the drying beds. No documentation on the building itself is available, however there is a report by Jackie L. Smith, James D. Grafton and Dr. Diane K. Mann on landfarming entitled "Landfarm Technology at Fort Polk, Louisiana: Lessons Learned" (USACERL Special Report N-92/11 March 1992).

### **Interviewer Comments**

Although this is not a traditional HAZMIN project, it does reduce the potential for spread of contamination due to inflow as well as reduces the potential for generation of contaminated leachate. In addition, although waste reduction and cost savings have not been quantified - there appears to be an implicit savings. The project has allowed for the maintenance of compliance.

\* Supplemental information is available in Appendix E.

**Project Number:** 55  
**MACOM/Organization:** FORSCOM  
**Installation/Location:** CERL  
**Project Title:** Preparation of 4 HAZMIN Plans to Support FORSCOM  
**Targeted Waste:** General  
**Point of Contacts:** Shelah Roberts (404) 669-7799  
**DERA HAZMIN Funding:** \$292,675 (FY 88)

### **Project Description**

This project entailed preparing hazardous waste minimization plans for a few of the installations at FORSCOM. Waste stream analysis and suggestions for waste reduction were included in the plans.

### **Discussion of Project**

CERL was funded to prepare HAZMIN plans for FORSCOM installations in FY 88. The actual cost of the project was reported as \$600,000, but it was believed that the funding may not have been all from DERA. The title for this project indicates that four HAZMIN plans were generated but in fact, five plans were prepared. It was too costly to prepare a plan for each of the 23 FORSCOM installations so five installations were chosen to be representative of all the installations. In this way, the remaining installations could base their individual plans on the five that were already prepared. The five representative installations selected represented those involving the following activities: heavy mechanized troop, aircraft and heavy training, light infantry, administrative, and administrative with hospital/laboratory. It is believed that the suggestions for minimization were appropriate but by the time the plans were finalized, many of the issues had already been addressed or were obsolete. In many cases, the individual installations had already taken the appropriate steps to rectify a problem or minimize the waste generated. An additional shortcoming of the HAZMIN plans was that the information and recommendations were often not adequately specific. All five plans were very similar.

### **Waste Reduction and Cost Savings**

No information is available on the waste reduction or cost savings attributable to this project.

### **Project Motivation and Documentation**

The primary motivation for this project was compliance and potential liability related to the signing of manifests attesting to the fact that HAZMIN plans exist and are in place. Each of the five plans are approximately 250 pages long and are available for review from Shelah Roberts.

### **Interviewer Comments**

It seems as though this project was not completely successful in terms of reducing wastes due to the time required to finalize the plans and the lack of specific recommendations included in the plans. No waste reduction or cost savings have been identified as directly attributable to this project. Despite the shortcomings, the plans do allow for a reduction of potential compliance concerns related to the signing of waste manifests.



**Project Number:** 56  
**MACOM/Organization:** FORSCOM  
**Installation/Location:** CERL  
**Project Title:** Personnel Support for the Management of Hazmin Program  
**Targeted Waste:** General  
**Point of Contacts:** Shelah Roberts (404) 669-7799  
**DERA Hazmin Funding:** \$123,800 (FY 89)

### **Project Description**

A contractor was hired to oversee the hazardous waste minimization program at FORSCOM Headquarters.

### **Discussion of Project**

The actual year funding was received, the amount funded, and the hiring date could not be verified but it is believed that the project was probably funded in FY 89 or 90. The funding amount specified in our records lists probably corresponds to one year of personnel support. At the time there was a hiring freeze, so CERL hired a contractor from the University of Cincinnati. Since then, at least two other people have been contracted through Georgia Tech.

### **Waste Reduction and Cost Savings**

It is not possible to calculate the waste reduction or cost savings attributable to this project.

### **Project Motivation and Documentation**

There was no regulation or command order that led to the implementation of this project; rather it appears to have been an in-house initiative brought on by a hiring freeze. No documentation is available concerning this project.

### **Interviewer Comments**

Project specifics (funding level and dates) were difficult to confirm. For example, it is unknown whether this is a yearly funding requirement or a one time-only need.

**Project Number:** 57  
**MACOM/Organization:** COE  
**Installation/Location:** CERL  
**Project Title:** Equipment to Support HWMIS at FORSCOM Installations  
**Targeted Waste:** General  
**Point of Contacts:** Shelah Roberts (404) 669-7799  
**DERA Hazmin Funding:** \$77,612 (FY 89)

### **Project Description**

This project involved purchasing computers for several FORSCOM installations so that the HWMIS software, which gives the user access to Material Safety Data Sheets for hazardous materials, could be utilized.

### **Discussion of Project**

The POC was unable to verify the funding amount or the actual cost of the equipment. However, she believes the project was funded and the equipment purchased in FY 89. No problems associated with the project were mentioned. The advantage to this project is more efficient access to information on Hazardous Wastes.

### **Waste Reduction and Cost Savings**

There is no data available regarding waste reduction or cost savings associated with the purchase of this equipment.

### **Project Motivation and Documentation**

The motivation for this project is unknown. There is no documentation available.

### **Interviewer Comments**

The POC believes that the software is helpful, but does not know if it is adequately user friendly to ensure that it is used to its maximum potential.

**ADL Project Number:** 58  
**MACOM/Organization:** COE  
**Installation/Location:** CERL  
**Project Title:** Development of Economic Analysis Model  
**Targeted Waste:** General  
**Point of Contacts:** Keturah Reinbold (217) 398-5482  
**DERA Hazmin Funding:** \$73,848 (FY 89)

### **Project Description**

This project entailed hiring personnel and developing software and documentation in order to provide a standardized method for performing life cycle cost analysis required in support of hazardous waste minimization projects.

### **Discussion of Project**

It is believed that this project was funded and initiated in FY 89 and completed in FY 90. Although the actual amount funded and the actual cost could not be verified, it was indicated that the actual cost probably exceeded the funding amount listed in our records. The primary problem with the completed software was that there was not enough time for the developers to add all the specific waste types or to refine the program once feedback from users was received. The developers had hoped to have a general program and then add six specific waste types including solvents, paint stripping, metal plating, industrial waste treatment plant sludges, used oil, and batteries. Initially, one of the problems with implementing the software was the various configurations of computers in use. This problem was eventually rectified. Unfortunately, time restraints were imposed by the fact that funds had to be completely used within the year or be returned.

### **Waste Reduction and Cost Savings**

The waste reduction and cost savings attributable to this project are not quantitative. A possible source of cost savings is the fact that the services of consulting firms will no longer be needed to perform the necessary economic analyses.

### **Project Motivation and Documentation\***

The Army Environmental Office initiated this project in order to provide an efficient, consistent procedure to be used for economic analyses. Two reports were generated: the technical documentation and the users manual. Copies of each are available from Keturah Reinbold at CERL.

### **Interviewer Comments**

There is considerable confusion regarding the exact funding requirements and funding use associated with this project. The source of this confusion is that additional HAZMIN projects (e.g. HWMIS and HMID development, workshop economic analysis, bar code tracking) were concurrently conducted and the precise breakdown of costs cannot be made.

\* Supplemental information is provided in Appendix E.

**Project Number:** 59  
**MACOM/Organization:** COE  
**Installation/Location:** CERL  
**Project Title:** Develop Hazardous Materials Tracking System  
**Targeted Waste:** General  
**Point of Contacts:** Lynne Mikulich (217) 373-6749  
**DERA Hazmin Funding:** \$38,998 (FY 89)

### **Project Description**

This project was intended to provide an automated system to track the flow of hazardous materials and hazardous wastes specific to individual generators and processes.

### **Discussion of Project**

The Army Environmental Office initiated this project in FY 89 and the work was performed by CERL. Both the Hazardous Waste Management Information System (HWMIS) and the Hazardous Materials Identification System (HMID) were developed at this time. The HWMIS is a management tool to aid the Environmental Manager (EM) at an installation in the management of hazardous waste, hazardous material and minimization programs. The HMID is a tool that provides the EM with information on hazardous materials procured and received at the installation. Records indicate that funding totalled \$200,000 for both the projects. The \$38,998 may have been for the HMID portion only. Several other similar projects were being conducted at this time causing some confusion as to the precise cost breakdown (e.g., Inventory of Hazardous Waste, Economic Analysis, and Bar Code Tracking). The advantage of the HWMIS system is that data can be collected on a more frequent basis (monthly rather than semi-annually). In this way, it can be more efficient and accurate. It is believed that this system is currently being used at at least eight installations (typically the smaller generators). It is very important to follow up the distribution of the new software with training. It was suggested that potential lack of training may be the reason that users believe it is not very widely used or very helpful. An additional problem that detracts from the success of this project is the lack of communication between various organizations. For instance, Red River AD developed a very good hazardous materials and waste tracking system independently from this effort. If resources had been pooled, an accurate, efficient, consistent system could have been developed at a lower cost to the Army.

### **Waste Reduction and Cost Savings**

No information is available regarding waste reduction or cost savings.

### **Project Motivation and Documentation\***

The Army Environmental Office originally initiated this project in order to provide a more accurate and efficient means of tracking hazardous materials.

### **Interviewer Comments**

There is considerable confusion regarding the funding specifics for this project. Primary observations regarding the success of this project are that adequate user training is critical and that a lack of communications between organizations has resulted in unnecessary duplication of efforts.

\* Supplemental information is provided in Appendix E.

**Project Number:** 60  
**MACOM/Organization:** USACE/AEO  
**Installation/Location:** CERL  
**Project Title:** Intra-Government Personnel Act (Executive Support Program)  
**Targeted Waste:** General  
**Point of Contacts:** Bob Riggins (217) 373-3320 and Victor Marty (217) 373-7205  
**DERA Hazmin Funding:** \$196,910 (FY 88)

### **Project Description**

Funding was provided for Project HXW (USACE Support of Hazardous Waste Minimization program) to provide for environmental executive support to the Headquarters of the Department of the Army Environmental Office through the Intra-Governmental Personnel Act (IPA).

### **Discussion of Project**

The Intra-Government Personnel Act is a vehicle through which one agency can borrow personnel services from other agencies on a temporary basis. However, the majority of the technical assistance arranged by CERL was not through other government agencies but through academia or industry. Therefore, the title Intra-Government Personnel Act did not accurately describe the program run by CERL to provide technical assistance to different MACOMs and organizations. Hence, it was renamed the Executive Support Program. This particular project, initiated through CERL's Executive Support Program, was originally allocated \$160,000 and then an additional \$40,000 was funded. Only \$196,910 was actually spent. This project arranged for environmental executives to support hazardous waste minimization projects in general at either FORSCOM or TRADOC installations. Although it is not clear exactly what the individual projects or targeted wastes were, surveys and management plans are likely projects performed.

### **Waste Reduction and Cost Savings**

There was no known waste reduction or cost savings attributable to this project.

### **Project Motivation and Documentation\***

This project was initiated through the Executive Support Program. Funding documentation was provided for this project.

\*Supplemental information is provided in Appendix E.

**Project Number:** 61  
**MACOM/Organization:** USACE/AEO  
**Installation/Location:** CERL  
**Project Title:** Convert Present Program to Format Compatible with AAEMIS  
**Targeted Waste:** General  
**Point of Contacts:** Barbara Schmitt (410)671-1656 & Lynne Mikulich (217)373-6749  
**DERA Hazmin Funding:** \$511,000

### **Project Description**

The objective of this project was to provide modifications and enhancements to the Hazardous Waste Minimization Information System (HWMIS) and Hazardous Materials Identification (HMID) in order to meet the demands of Army personnel using HWMIS. These modifications and enhancement to the HWMIS system will aid in the compliance and the HAZMIN emphasis within the Army Environmental Compliance Achievement Program (ECAP). Field tests by USATHAMA as well as internal and user documentation were included.

### **Discussion of Project**

The HWMIS and HMID systems were originally developed with FY 89 DERA funding of \$200,000 (See ADL project #72). During FY 90, USATHAMA and AEO sponsored the Structured Requirements Analysis Plan (IEM STRAP) in which several automation needs were addressed. As a result, the Army Automated Environmental Management Information System (AAEMIS) was designed to provide the integration of existing systems and the development of new environmental systems including HWMIS and HMID. One problem encountered was a schedule delay because USATHAMA and AEO were sponsoring the design and development of HAZTRK, under the Installation Support Module umbrella, and HWMIS needed to interface with HAZTRK as well as AAEMIS.

### **Waste Reduction and Cost Savings**

There is no waste reduction or cost savings directly attributable to this project.

### **Project Motivation and Documentation\***

The need to track hazardous materials from "cradle to grave" served as the motivation for this project. Additional funding documentation was provided.

\*Supplemental information is provided in Appendix E.

**Project Number:** 62  
**MACOM/Organization:** USACE/AEO  
**Installation/Location:** CERL  
**Project Title:** Preparation of an Integrated Hazardous Material Plan  
**Targeted Waste:** General  
**Point of Contacts:** Steve Maloney (800) USA-CERL  
George Carlisle (703) 696-8078  
**DERA Hazmin Funding:** \$59,839 (FY 89)

### **Project Description**

This project was policy oriented and was initiated to develop an integrated hazardous material management plan for the Army.

### **Discussion of Project**

The Army Environmental Office (AEO) contracted CERL to develop a hazardous material management plan for the Army. The project was funded approximately \$60,000 in FY 89 and approximately \$90,000 at a later time. These values and the source of funding have not been verified. The approach was to gather representatives from several MACOMs, field users, research organizations, and industry to define obstacles in managing hazardous waste. Then, they grouped the obstacles, proposed solutions, and assigned the solutions to the MACOMs. Thirteen areas and fifty nine actions were discussed. An example of an action was the review of military specifications which may have been out of date. The recommended actions were submitted to George Carlisle of AEO in the form of a report which was not made official. Before the recommendations in the report could be implemented, there was a requirement to develop a plan (Strategy 2000) that would override this one. However, several of the recommendations were incorporated in AEO's Strategy 2000 plan and into the pollution prevention action plan which is currently being developed. Despite the fact that the report to AEO did not become official, some of the actions that were discussed were implemented through the individual MACOMs. For instance, a pollution prevention office at AMC was created as a result of this project.

### **Waste Reduction and Cost Savings**

No waste reduction or cost savings can be directly attributed to this project.

### **Project Motivation and Documentation\***

This project was an AEO internal initiative. A copy of the report from CERL to AEO was provided. Additional documentation for this project is available through George Carlisle of AEO.

### **Interviewer Comments**

Although the plan was not finalized or made official due to the requirement for Strategy 2000, its findings, conclusions, and recommendations have been considered and, in some cases, implemented within the Army. The plan also provided input into Strategy 2000.

\*Supplemental information is provided in Appendix E.

**Project Number:** 63  
**MACOM/Organization:** USACE/AEO  
**Installation/Location:** DOE/Argonne National Laboratory (ANL)  
**Project Title:** Env. Analysis/Technical Assessment & Database Development  
**Targeted Waste:** General  
**Point of Contacts:** Barbara Schmitt (410) 671-1656  
**DERA Hazmin Funding:** \$400,000 (FY 88)

### **Project Description**

This project supported efforts by the Argonne National Laboratory to provide environmental analysis and technical evaluation in such tasks as: developing and finalizing program plans, environmental analysis and technology assessment, waste minimization, information database development, and environmental management analyses.

### **Discussion of Project**

Funding was originally awarded in FY 88 for \$100,000 and was increased to \$400,000. The funding was awarded for a variety of environmental analysis and technical evaluation tasks. It is unclear what specific projects were actually performed or what the cost breakdown was. Efforts to follow-up with an alternate point of contact were unsuccessful.

### **Waste Reduction and Cost Savings**

The waste reduction and cost savings attributable to these tasks are not known.

### **Project Motivation and Documentation\***

The motivation for this project is not known. Funding documentation for this project was provided to us and contains additional information.\*

### **Interviewer Comments**

The only source of information for this project is the funding documentation supplied by Barbara Schmitt.

\*Supplemental information is provided in Appendix E.



**Project Number:** 64  
**MACOM/Org:** WESTCOM  
**Installation/Location:** Fort Shafter  
**Project Title:** USARPAC Hazmin Study  
**Targeted Waste:** Solvent Wastes  
**Point of Contacts:** Ken Kramer (808) 438-1526  
**DERA Hazmin Funding:** \$145,000 (FY88); \$3,000 (FY90)

### **Project Description**

This project involved the inventory of solvent use within the installation to identify and evaluate options to reduce the quantities of hazardous waste generated.

### **Discussion of Project**

The project was initiated in October 1988 and completed in September of 1989. No specifics were available regarding how the funds were spent. Reportedly a contract (contract number DACA 83-88-D-0127) was awarded for the conduct of the project. The contractual point of contact, Ed Yamada (808) 438-5421, was contacted but was unable to provide any additional information.

One recommendation from the study is known to have been implemented involving the installation of parts washers to replace vapor degreasers.

### **Waste Reduction and Cost Savings**

Not available.

### **Project Motivation and Documentation**

A summary report entitled "HI Army Solvent Study" by Woodard-Clyde Consultants was identified; however, the availability of this report is unknown.

### **Interviewer Comments**

This project was difficult to evaluate due to the lack of available information.

**Project Number:** 65  
**MACOM/Org:** HSC  
**Installation/Location:** AEHA  
**Project Title:** HAZMIN Surveys  
**Targeted Waste:** General  
**Point of Contact:** Brian Jones, (410) 671-3652  
**DERA Hazmin Funding:** \$120,900 (FY89); \$25,043 (FY90)

### **Project Description**

These funds were provided to AEHA for the conduct of HAZMIN surveys of various Army facilities (including those of AMC, FORSCOM, TRADOC, HSC, and AVSCOM). The surveys were conducted at 23 facilities to identify waste generation and disposal activities and provide recommendations for HAZMIN initiatives. These surveys were primarily qualitative in nature.

### **Discussion of Project**

The surveys were initiated in 1989 and completed in 1990. The surveys were short term (approximately 4 days each), relatively low cost, and primarily qualitative in nature. The recommendations developed typically represent practical and low cost initiatives.

### **Project Motivation and Documentation**

The primary motivation was to provide consultation support for installations with respect to recommended future HAZMIN efforts.

Reports of each of the surveys are available from the point of contact. A summary of each of the surveys is provided in Appendix D of this report.

**Project Number:** 66  
**MACOM/Org:** HSC  
**Installation/Location:** AEHA  
**Project Title:** Preparation of Military Item Disposal Instructions (MIDI) Database  
**Targeted Waste:** Medical wastes  
**Point of Contact:** Brian Jones, (410) 671-3652  
**DERA Hazmin Funding:** \$130,000 (FY89); \$97,200 (FY91)

### **Project Description**

These funds were provided to AEHA to develop and update a database designed to provide hazardous and nonhazardous medical item disposal guidance and other environmental and regulatory information related to such disposal. Further updates of the database will address the disposal of non-medical items as well.

### **Discussion of Project**

The MIDI database is a CD-ROM-based system designed to provide information relating to methods of destruction and disposal of hazardous and nonhazardous items used within DoD. Originally developed to address medical items, the database is being expanded to include non-medical items. Specific information provided by the CD-ROM database includes: the MIDI database (including National Stock Numbers of medical items and information from the Material Safety Data Sheets for these items); Department of Transportation Emergency Response Guides, AEHA Fact Sheets, Commander's Guides to Hazardous Waste Minimization and Infectious Waste Management; AEHA Technical Guide 126 providing waste disposal instructions; and the HSC Model Medical Waste Regulation.

### **Project Motivation and Documentation**

The motivation behind the development of the MIDI database system is the provision of guidance for the safe and proper disposal of outdated chemical and medical items as necessary to maintain compliance.

A summary of the MIDI database system as provided by the point of contact follows this Project Summary. Additional information on the database system may be obtained from the point of contact.

**Project Number:** 67  
**MACOM/Org:** HSC  
**Installation/Location:** Fitzsimmons AMC  
**Project Title:** Purchase Equipment to Recycle Pathology Department Solvent Waste  
**Targeted Waste:** Medical solvent wastes  
**Point of Contacts:** Sue Errett (303) 361-3526  
**DERA Hazmin Funding:** \$12,000 (FY 91)

### **Project Description**

The project involved the purchase and installation of solvent stills to recover xylene, ethanol and methanol used in laboratory analyses.

### **Discussion of Project**

The equipment was purchased in 1991 and installed in 1991. The solvent stills operate very well most of the time and are successful in reclaiming much of the waste laboratory solvents. The facility now has three such solvent stills, all of which are operating well.

The only difficulties encountered are those that are to be expected and cannot be avoided such as glassware breakage, blown fuses, and waiting for replacement parts.

### **Waste Reduction and Cost Savings**

The project was able to provide immediate payback by reclaiming the solvents and savings in disposal fees. Estimates on cost savings and payback were provided and are attached. Each system has a purchase price of \$13,000 to \$18,000 and provides for an annual savings of \$9,000 to \$11,000. The hazardous waste reduction is approximately 80%, and the payback period is less than 1.5 years.

### **Project Motivation and Documentation\***

Reduce the amount of solvent waste requiring disposal and reduce requirements for new solvents.

### **Interviewer Comments**

This effort appeared to be very simple and effective and successful from a waste reduction standpoint.

\* Supplemental information is provided in Appendix E.

**Project Number:** 68  
**MACOM/Organization:** MDW  
**Installation/Location:** Ft. Belvoir  
**Project Title:** HAZMIN Computer Tracking Equipment  
**Targeted Waste:** General  
**Point of Contacts:** Patrick McLaughlin (202) 475-2793  
**DERA Hazmin Funding:** \$12,500 (FY 89)

### **Project Description**

This purpose of this project was to provide computer equipment to inventory and track hazardous waste generation and disposal as well as to identify and prioritize potential areas for hazardous waste reduction.

### **Discussion of Project**

According to Patrick McLaughlin of Ft. Belvoir, computer equipment was received through the Department of the Army around FY 89 and \$12,500 is probably the correct cost. He is unaware of any DERA funding received by Ft. Belvoir. It is possible, however, that DA received the DERA funds to purchase the computer equipment and then sent the equipment to Ft. Belvoir.

### **Waste Reduction and Cost Savings**

There is no known waste reduction or cost savings attributable to this project.

### **Project Motivation and Documentation**

The motivation for the purchase of this computer equipment was an in-house initiative. No documentation of this project is available.

**Project Number:** 69  
**MACOM/Organization:** MDW  
**Installation/Location:** Ft. Belvoir  
**Project Title:** Development of AAEMIS as Part of Installation Support Module (ISM)  
**Targeted Waste:** General  
**Point of Contacts:** Patrick McLaughlin (202) 475-2793  
**DERA Hazmin Funding:** \$175,000 (FY 91)

### **Project Description**

According to funding documentation, this project provided for the development of the Army Automated Environmental Management Information System (AAEMIS).

### **Discussion of Project**

Patrick McLaughlin has no record of this project.

### **Waste Reduction and Cost Savings**

There is no available information on the waste reduction or cost savings attributable to this project.

### **Project Motivation and Documentation**

The motivation for this project is unknown and there is no documentation available.

**Project Number:** 70  
**MACOM/Org:** NGB  
**Installation/Location:** AV MSARNG  
**Project Title:** Purchase/Install Plastic Media Blasting Equipment  
**Targeted Waste:** Paint stripping wastes  
**Point of Contacts:** Charles Foster (410) 671-1790  
**DERA Hazmin Funding:** \$4,400 (FY 89), \$633,600 (FY 91)

### **Project Description**

This project includes the purchase and installation of plastic media blasting equipment. The equipment will be installed at four locations including sites in Mississippi, Connecticut, Missouri, and California. The purpose of the project is to replace chemical paint stripping operations of aircraft and ground mobile vehicles with plastic media blasting. The equipment required in plastic media blasting operations is similar to that used in sand blasting. The process will not replace chemical stripping completely since the use of plastic media blasting is geometry specific.

### **Discussion of Project**

Equipment was purchased for the Mississippi site in early 1992, and installed in mid-1992. Purchase and installation of equipment at the Connecticut site is scheduled for 1993, while actions for the Missouri and California sites are anticipated to be initiated in 1994. Actual cost of the equipment installed at Mississippi was \$325,000. The projected cost for the Connecticut site is \$375,000. The additional cost is due to the need for intake air heaters to allow for year round operation at the Connecticut facility. In addition to temperatures, humidity levels of the intake air is another potential site-specific problem. High humidity at Mississippi year-round and the in summer months at Connecticut require dehumidification of intake air to prevent the plastic beads from sticking together and clogging the spray equipment. Dry air conditions typically encountered during the winter months call for humidification of the intake air to prevent the buildup of a static charge that can also clog the spray equipment. There are no problems anticipated with the military specifications since the Air Force and the Navy have been using plastic media blasting to remove old paint for several years. The equipment installed at the Mississippi site is now in operation and will soon begin to provide waste and cost reduction data.

### **Waste Reduction and Cost Savings**

Plastic media blasting is expected to reduce the use of chemical paint strippers by an estimated 90%. The remaining use of chemical strippers is due to part geometry. Estimated waste reductions were 37,850 gallons per year with an associated annual disposal savings of \$302,900. The chemical paint stripping process produces 40,205 gallons of liquid waste per year at a disposal cost of \$396,400 per year. Initial actual waste generation and disposal costs for the plastic media blasting process at the Mississippi facility have been estimated at a generation of 2,665 gallons of dry waste per year at a disposal cost of \$93,500 per year. This results in a waste reduction of 37,540 gallons per year and an annual disposal savings of \$370,125.

### **Project Motivation and Documentation\***

The motivation for implementing this project was economic necessity since the disposal cost of the chemical waste was simply too much. The on-site (Mississippi) point of contact is Lt. Col. Jervis Parker (601) 868-6262.

**Project Number:** 70 (Continued)  
**MACOM/Org:** NGB  
**Installation/Location:** AV MSARNG  
**Project Title:** Purchase/Install Plastic Media Blasting Equipment  
**Targeted Waste:** Paint stripping wastes  
**Point of Contacts:** Charles Foster (410) 671-1790  
**DERA Hazmin Funding:** \$4,400 (FY 89), \$633,600 (FY 91)

#### **Interviewer Comments**

This project is proceeding at a consistent rate with what appears to be a full and proper site specific engineering evaluation. The technology of plastic media blasting has been used successfully for several years by both the Air Force and Navy, so it is doubtful that any serious problems will develop with implementation of the process at these four installations.

\* Supplemental information is provided in Appendix E.



**Project Number:** 71  
**MACOM/Organization:** TRADOC  
**Installation/Location:** TRADOC Headquarters  
**Project Title:** Purchase Hardware and Software for HQ TRADOC and Installations  
**Targeted Waste:** General  
**Point of Contacts:** Susan Stotts (804) 727-2279  
**DERA Hazmin Funding:** \$53,500 (FY 89)

### **Project Description**

This project entailed purchasing computer equipment and software for hazardous waste minimization program management.

### **Discussion of Project**

This project was a joint effort between the Department of the Army and three MACOMs (TRADOC, AMC, and FORSCOM). The software was developed under the direction of CERL. Installations can acquire copies of the software by contacting CERL. Two programs were developed: the Hazardous Waste and Materials Inventory System (HWMIS) and the Hazardous Materials Identification (HMID). In the opinion of the POC, the use of the programs has been held back due to the fact that they are not adequately user-friendly and are too slow in processing information. It is believed that this software is not used at any of the installations. The amount funded, the actual cost of the project, or the year the funding was awarded could not be verified.

### **Waste Reduction and Cost Savings**

There is no data available on the waste reduction or cost savings attributable to this project.

### **Project Motivation and Documentation**

The motivation for this project is unknown. There is no documentation available.

### **Interviewer Comments**

There is not adequate information available to confirm funding levels or project implementation.

**Project Number:** 72

**MACOM/Organization:** TRADOC

**Installation/Location:** Ft. Eustis

**Project Title:** Evaluation of Hazmin Technologies for Fuel Tanker Purging at Ft. Story

**Targeted Waste:** Diesel, gasoline, and aviation fuels

**Point of Contacts:** Damon Doumlele (804) 878-2680 and Sgt. Cullen (804) 422-7273

**DERA Hazmin Funding:** \$104,462 (FY 88)

### **Project Description**

This project was a study to determine the best techniques for minimizing wastewater generated when tanker trucks are purged in order to change the fuel being carried.

### **Discussion of Project**

The subject of this project, for which the DERA funding was actually awarded, was originally "Dewater-Decontamination of Aviation Fuel/Hazmin Audits/Support." After the funding was awarded the environmental office at Ft. Eustis decided that fuel tanker purging was a much more pressing issue to be investigated. This study was initiated during the beginning of calendar year 1989 and was completed in June 1989. CH2M Hill was contracted to perform the study through the US Army Engineering and Housing office at Ft. Belvoir under contract #DACA31-87-D-0057, delivery order #0005. Unfortunately, despite numerous phone calls, no one at Ft. Belvoir has been able to verify the amount funded or the actual cost of the study. At the time the funds were awarded, there was a problem with the tanker trucks at Ft. Story when the trucks were required to carry different types of fuel. Residual fuel had to be pumped out and the tank had to be washed before new fuel could be added. Washing consisted of filling the tanker with water and driving the water-filled truck to agitate the contents. The resulting water and residual fuel was then removed and disposed of as hazardous waste. The two primary recommendations resulting from the study included dedication of individual tankers to one fuel, and using an off-site contractor to clean the tanks when necessary. By dedicating the trucks to just one fuel, the need for purging is minimized. If the need arises to switch fuels and in the case of routine maintenance, use of a contractor would minimize the wastewater generated because the contractor would supply the proper high pressure equipment needed to clean with minimal water use. In addition, since the contractor will dispose of the wastewater generated, there will be no delays. Both recommendations have been implemented.

### **Waste Reduction and Cost Savings**

Reduction in amount of wastewater used is now that contractors have been hired to perform any necessary purging using proper equipment. No quantitative information is available.

### **Project Motivation and Documentation\***

The original procedure for fuel tanker purging was time consuming, wasteful, and inefficient. Delays were occurring because the wastewater had to be stored in the tanks before it could be disposed. The entire report generated by CH2M Hill is approximately 40 pages long and can probably be acquired through CH2M Hill or Ft. Belvoir. A copy of the conclusions and recommendations was provided.

**Project Number:** 72 (Continued)

**MACOM/Organization:** TRADOC

**Installation/Location:** Ft. Eustis

**Project Title:** Evaluation of Hazmin Technologies for Fuel Tanker Purging at Ft. Story

**Targeted Waste:** Diesel, gasoline, and aviation fuels

**Point of Contacts:** Damon Doumlele (804) 878-2680 and Sgt. Cullen (804) 422-7273

**DERA Hazmin Funding:** \$104,462 (FY 88)

### **Interviewer Comments**

It is not clear if this was a one time problem or an on-going problem. Site personnel believed that this was an on-going problem which was solved by implementing the two recommendations. Sargent Cullen indicated that when the tanker trucks were first assigned to him they were completely filthy, had several inches of dirt at the bottom, and had to be cleaned before they could be used. In his opinion, this is what the study was based on. Nonetheless, truck dedication, and routine cleaning by an off-site contractor has prevented any further problems.

\* Supplemental information is provided in Appendix E.

**Project Number:** 73  
**MACOM/Organization:** TRADOC  
**Installation/Location:** Ft. Eustis  
**Project Title:** Purchase Oil Vacuum Truck  
**Targeted Waste:** Oily waste, sewage, wastewater treatment plant sludge etc.  
**Point of Contacts:** Damon Doumlele (804) 878-2590 and David Sills (804) 878-3754  
**DERA Hazmin Funding:** \$43,600 (FY 89)

### **Project Description**

This project included the purchase and implementation of an oil vacuum pump truck to pump out bilge tanks on ships, septic tanks, and oily wastes from an oil/water separator.

### **Discussion of Project**

The pump truck was purchased from the Lely Corporation for \$43,441 in FY 90. It was originally intended to improve separation of oil pumped from oil/water separators in order to reduce the amount of waste oil to be disposed. In reality, the truck is most often used to pump out bilge tanks on ships because very often the pumps on the ships are broken. The wastewater is sent through a water/sludge separator and is then sent to the wastewater treatment plant. A contractor has agreed to take the waste oil for recycling at no cost. Occasionally, the tank is used to pump out septic tanks. On average, the truck is used three times per week. The only problem cited by the Sanitation Department Supervisor, David Sills, is that they would have preferred an automatic transmission to a standard transmission.

### **Waste Reduction and Cost Savings**

The reduction of waste oil to be disposed is not directly attributable to the purchase of the truck but to the hiring of a contractor to recycle the oil waste. However, the reduction in wastewater to be disposed and cost savings due to the use of the truck to pump out bilge tanks is significant. Before the truck was purchased, a contractor had to be hired to pump out the ships at which point the wastewater would simply be disposed. Related costs were typically in a range of \$50 to \$500 per truckload. Currently, the only cost associated with this is the \$2500 to \$3000 per year required to clean the water/sludge separator. There is no disposal cost associated with the waste oil because it is being recycled by a contractor at no charge.

### **Project Motivation and Documentation\***

The original motivation for this project was to provide a means to reduce the amount of waste oil that required disposal. Project documentation in the form of the quotation/order form for the truck has been provided.

### **Interviewer Comments**

Although the project was originally initiated to allow for a reduction in the generation of waste oil, the use of the truck for on-site use in the pumping out of bilge tanks has reduced the amount of wastewater disposed by allowing for its treatment.

\*Supplemental Information is provided in Appendix E.

**ADL Project Number:** 74  
**MACOM/Org:** TRADOC  
**Installation/Location:** Ft. Rucker  
**Project Title:** Purchase/Install Plastic Media Blasting Equipment for Helicopter Stripping  
**Targeted Waste:** Chemical paint stripping wastes  
**Point of Contact:** Jim Swift (205) 255-2541  
**DERA Hazmin Funding:** \$30,000 (FY 88), \$319,000 (FY 91)

### **Project Description**

This project includes the purchase and installation of plastic media blasting equipment. The purpose of the project is to replace helicopter chemical paint stripping operations with plastic media blasting. The equipment required in plastic media blasting operations is similar to that used in sand blasting. The process will not replace chemical stripping completely since the use of plastic media blasting is geometry specific.

### **Discussion of Project**

Equipment was purchased in November 1992 and is in the process of being installed as the building is being fabricated. The actual cost of the equipment was \$319,000. This project is intended to replace chemical paint stripping activities as the primary method of helicopter paint removal. The method uses large volumes of air and one concern is the high level of humidity typical at Ft. Rucker. This may require dehumidification of the intake air to prevent the plastic beads from sticking together and clogging the spray equipment. There are no problems anticipated with the military specifications since the Air Force and the Navy have been using plastic media blasting to remove old paint for several years.

### **Waste Reduction and Cost Savings**

Plastic media blasting is expected to reduce the use of chemical paint strippers by an estimated 90%. The remaining use of chemical strippers is due to part geometry. Estimated waste reduction volumes were unknown but associated annual disposal savings have been projected at \$5,000 with a savings of \$84,600 per year in labor costs due to the use of the lower labor intensive process and the reduction in waste related tracking and paperwork. The currently used chemical paint stripping process produces an unknown quantity of liquid waste per year. Actual waste generation and disposal costs for the plastic media blasting process is not known yet since the system is still being assembled.

### **Project Motivation and Documentation**

The motivation for implementing this project was potential liability and general waste reduction. There is no project documentation relating to this project since the equipment is in the process of being installed.

### **Interviewer Comments**

This project is proceeding at a consistent rate with what appears to be a full and proper site specific engineering evaluation. The technology of plastic media blasting has been used successfully for several years by both the Air Force and Navy, so it is doubtful that any serious problems will develop with the installations.

**Project Number:** 75  
**MACOM/Org:** TRADOC  
**Installation/Location:** Ft Sill  
**Project Title:** Hazmin Audits and Support  
**Targeted Waste:** Unknown  
**Point of Contacts:** Cindy Sellers (405) 351-3409  
**DERA Hazmin Funding:** \$74,878 (FY88)

**Project Description**

Unknown

**Discussion of Project**

The POC was unaware of this project. A 1990 report entitled "Evaluation of Hazmin Techniques for Fort Sill" was identified as perhaps relating to this project. The report was written by O'Brien and Gere and summarized the Hazmin techniques in practice at Fort Sill.

**Waste Reduction and Cost Savings**

Unknown

**Project Motivation and Documentation**

Unknown

**Interviewer Comments**

It was not possible to verify the use of these funds at Ft. Sill. The report referenced above is available for review from the POC.

## Appendix C: Trip Reports

| Site Visit   | Page  |
|--|-------|
| Anniston Army Depot, June 1993 .....                 | C-2   |
| Mississippi National Guard - AVCRAD, June 1993 ..... | C-6   |
| Corpus Christi Army Depot, June 1993 .....           | C-30  |
| Fort Carson, July 1993 .....                         | C-70  |
| Milan Army Ammunition Plant, July 1993 .....         | C-80  |
| Pine Bluff Arsenal, July 13, 1993 .....              | C-93  |
| Red River Army Depot, July 15, 1993 .....            | C-121 |
| Stratford Army Engine Plant, July 1993 .....         | C-137 |
| Yuma Proving Ground, August 1993 .....               | C-181 |

## **DERA HAZMIN Project Effectiveness**

### **Site Visit: Anniston Army Depot, June 1993**

Arthur D. Little personnel (Janet Mahannah and Mike Bryant) participated in meetings and a tour of the facilities at the Anniston Army Depot (ANAD) on June 15, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN-funded projects at ANAD including: funding request procedures; equipment procurement and installation; day-to-day operation and maintenance of the equipment; operator acceptance; and HAZMIN results and cost implications. Additionally, details were gathered regarding issues including: the timeframe and difficulties involved in initiating and completing a HAZMIN-funded project; the impact MIL-SPECs have on HAZMIN efforts; employee awareness of, and participation in, the HAZMIN program; and the transfer of technology between Army facilities.

Our primary point of contact (POC) at ANAD was Tim Garrett (Environmental Engineer). In addition, we met with and were provided a site tour by Kevin Milner of the Environmental Office. The site tour included a facility walkthrough to observe the HAZMIN equipment and discussions of process and equipment-related issues with the various process equipment operators.

The purpose of this trip report is to document the information obtained during the site visit. The trip report is presented in four sections to clearly identify and address the important issues.

#### **Site Description**

The majority of the industrial operations at ANAD focus on tank overhaul and maintenance. These operations generate the major portion of hazardous and oily waste at the facility. Other hazardous waste generating activities include the maintenance and supply of combat vehicles, missiles, small arms, munitions, and spare parts.

Tank overhaul is performed after approximately 2,000 hours of vehicle operation. The overhaul is a very complete process consisting of disassembly, cleaning, inspection, machining and grinding of used parts, metal finishing, and assembly using both reworked and new parts. At peak operation, ANAD has rebuilt 700 tanks per year, along with approximately 1700 spare tank engines.

#### **Discussion of DERA-Funded Projects**

The four DERA HAZMIN funded projects addressed in this site visit included: high pressure water-based spray cleaning cabinets to replace vapor degreasing systems; aluminum ion vapor deposition (AIVD) equipment to replace cadmium plating for corrosion protection; a gas chromatograph to be used to identify and characterize organic wastes for segregation purposes; and a paint spray booth to replace open air painting. The two projects that have shown the greatest reduction in hazardous waste generation and appear to have the greatest potential for more widespread Army application include the high pressure water-based spray cleaning cabinet and the AIVD system. The two other projects are in the process of being implemented and were therefore not discussed in detail.

The high pressure water-based spray cleaning cabinet is capable of accepting a complete tank engine for general cleaning of grease and dirt. After general cleaning is complete, the engine is disassembled and components such as the engine block, cylinder head, and



manifold are cleaned before overhaul inspection activities begin. Discussions with the equipment operators verified that the process is highly effective at removing all forms of oil and dirt from the parts and it quickly cleans tapped blind holes that typically require cleaning by hand. The operators also expressed their pleasure regarding the elimination of the use of vapor degreasing solvents. These operators were involved in the early discussions regarding vapor degreaser equipment replacement and received training on the operation of the high pressure cleaning cabinet. The site POC felt that early operator involvement in the equipment replacement process was highly beneficial towards achieving effective equipment transition and developing a feeling of operator "ownership".

The AIVD equipment purchased and installed as part of the DERA-funded project was the second unit to be put into operation at ANAD. This additional unit will allow for an increase in metal parts processing capacity. The AIVD process deposits a thin coating of aluminum on the surface of steel parts to provide the corrosion protection otherwise provided by cadmium plating. The AIVD process significantly reduces the amount of wastes previously generated with cadmium plating. Unfortunately, the applicable coating MIL-SPEC (MIL-C-83488) has not been upgraded to accept the AIVD process, which means that every aluminum-coated part must be individually inspected which is a labor intensive operation. To date, the level of QA acceptance of AIVD processed parts has been extremely high (greater than 95%) which, when combined with a longer in-field service life of AIVD compared to cadmium plating, helps to justify the acquisition of the second AIVD unit.

#### **Other Areas of Interest**

General discussions with site personnel revealed several issues of concern regarding the implementation of HAZMIN initiatives. The most significant issue affecting ANAD is the reduction in on-site skilled trades people that has taken place in recent years. The number of plumbers has been reduced from over 30 in 1990 to around 10 today, while the number of electricians has dropped from over 35 to approximately 15 over the same time period. The current number of employed trades people allows for general maintenance and upkeep at the facility but does not allow for timely installation of newly purchased equipment. Accordingly, long delays in the installation of HAZMIN related equipment have been experienced. Examples of these delays include:

- The AIVD equipment was purchased in 1991 and is just now approaching operational status; and
- Ten high pressure water-based spray cabinets were purchased in September 1991. Of these ten units, one unit was installed in December 1991. The remaining nine units await installation pending the availability of trades people.

Discussions relating to the contracting of outside trades people to complete the installation of HAZMIN equipment revealed the probability of long delays due to the discovery of unexpected items (such as corroded process water pipes requiring replacement or disconnected electrical wiring requiring extensive rewiring) resulting in the need for time-consuming contract modifications.

The point of contact revealed that obtaining DERA HAZMIN funding is not a difficult process. However, problems may arise due to the need for the installation to obligate

funds within the fiscal year (prior to September 30) when those funds are not received by the installation until late second quarter (or later).

The POC discussed the repeated frustrations and difficulties encountered in procuring equipment. Typically, the FAR does not allow a requisitioner to specify a manufacturer or piece of equipment by model number and therefore requires that a fine balance be made between providing detailed specifications to guide Army procurement officers to purchase the desired items, while providing adequately general specifications to allow for a proper competitive bid process to occur. The POC said that completion of procurement action requires an extensive learning curve to avoid the procurement of useless and unwanted items that must then be warehoused or given to other Army facilities.

Discussions regarding MIL-SPECs revealed that many of the documents are very old and call for specific processes to be performed that may not be in the best interest of hazardous waste reduction efforts. The level of effort and timeframe required to rewrite and receive modification approvals of the MIL-SPECs is recognized to be monumental and not practical due to rapidly changing technologies, materials, and processes within disciplines such as cleaning methods, coating technologies, and painting materials which would make many MIL-SPEC changes obsolete before the approval process was even complete.

The current disposal of hazardous waste is handled through the local DRMO via a DLA contract. The DLA system is cumbersome and removal of generated waste in a timely manner is essential to maintaining compliance. ANAD feels that it should be solely responsible for its own hazardous waste disposal because of related cost savings and responsibility for its compliance posture.

Discussions relating to technology transfer revealed that personnel from facilities within DESCOM will typically meet or have contact with each other several times each year. Activities such as the quarterly meetings of installations involved in the DESCOM Center for Technical Excellence (CTX), one or two annual trade shows, and two or three annual technology seminars allow for detailed discussions of technology and equipment-related issues between personnel from the numerous installations. Through such interactions, ANAD has even provided HAZMIN-related equipment to other Army facilities when it is no longer needed on site.

When questioned about the status of the recommendations that resulted from the HAZMIN Audit and Report (dated June 1991), the POC said that most of the items on the list of recommendations developed in the report were provided by ANAD to the auditing team in the form of items that the installation hoped to address in the coming years. Therefore, it was felt that the overall value of the audit effort was minimal and rather time consuming.

The final topic of discussion addressed the site activities regarding a HAZMIN training program, a recognition/reward system, and an employee awareness and participation program. Current practices require all employees who use hazardous waste materials to complete an on-site RCRA training course which is taught by a site maintenance department employee and an off-site attorney who donates his time and knowledge of hazardous wastes issues to the site training program. The POC was very pleased with the effectiveness with which the pair of instructors conveyed information to the

personnel and the resulting level of knowledge that the personnel are able to apply to everyday activities. This level of knowledge has led to numerous HAZMIN suggestions from the employees and has initiated or added to a variety of HAZMIN efforts. The Directorate of maintenance also provides a \$250 award to be given to an employee and their supervisor in recognition of outstanding HAZMIN efforts. Additionally, a portion of the annual employee performance appraisal review is based on hazardous waste related issues and a site-wide rapsheet that tracks department and employee hazardous waste efforts, successes, and problems.

### **Conclusions**

Significant issues and concerns conveyed during the site visit include: the lack of on-site trades people that has lead to significant delays in the installation of DERA-funded HAZMIN equipment; MIL-SPECs are often obsolete and require extensive revision to allow for new HAZMIN processes and equipment to be more effectively utilized; the individual depots should be given more control regarding the handling and disposal of hazardous wastes; and, the time frame inherent in the DERA funding process (i.e., only a few months are allowed for the obligation of funds) is often very difficult to accomodate and results in the risk of having to return the unobligated funds.

## **DERA HAZMIN Project Effectiveness**

### **Site Visit: Mississippi National Guard - AVCRAD, June 1993**

Arthur D. Little personnel Joyce O'Donnell and Mike Bryant participated in meetings and a tour of the facilities at the Mississippi Army National Guard - Aviation Classification Repair Activity Depot (AVCRAD) in Gulfport on June 24, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN funded project at the facility including funding request procedures, equipment procurement and installation, day-to-day operation and maintenance of the equipment, operator acceptance, HAZMIN results, and cost implications. Additionally, details were gathered regarding issues such as: the time frame and difficulties involved in completing a HAZMIN-funded project; the impact MIL-SPECs have on HAZMIN efforts; employee awareness of and participation in the HAZMIN program; and the transfer of technology between Army facilities.

Our primary point of contact (POC) at AVCRAD was Lt. Connie Essex who arranged for a joint meeting and tour with Col. Robert Johnson (Depot Commander) and MSG Blair Albrecht. Col. Johnson provided us with detailed discussions and an extensive site tour to view actual operation of HAZMIN equipment and discuss process and equipment related issues with a number of equipment operators and process technicians.

The purpose of this trip report is to document the information obtained during the site visit. The trip report is presented in four sections to clearly identify and address the important DERA HAZMIN-related issues.

#### **Site Description**

The primary mission of AVCRAD is the repair, overhaul, and maintenance of helicopters. The current average workload at the paint shop facility is approximately 80 helicopters per year. AVCRAD is operated by the Mississippi Army National Guard and is located at the municipal airport in Gulfport, Mississippi approximately 5 miles inland from the Gulf of Mexico. The site experiences a hot and humid climate typical of the coastal gulf region.

#### **Discussion of DERA Funded Projects**

The DERA HAZMIN-funded project addressed in this site visit involved the purchase and installation of plastic media blasting (PMB) equipment. The primary purpose of the project was to replace chemical paint stripping and cleaning operations with abrasive blasting using plastic media. In typical operations, paint stripping and cleaning chemicals (including methyl ethyl ketone, acetone, and toluene) were used at a combined average rate of 105 gallons per aircraft skin (based on the UH-1H helicopter). Use of these chemicals was eliminated once PMB was implemented resulting in an average annual reduction of 8,400 gallons of chemicals. Further waste reductions were achieved by replacing the chemical paint stripping of components (e.g., starter motors, generators, rotor heads, alternators, etc.) with PMB. This latter replacement resulted in the reduction of chemical stripper usage by approximately 71,600 gallons per year.

The facility began pursuing PMB technology in the 1980's in response to a desire to reduce the use of paint stripping chemicals. At that time they converted a sand blasting glovebox unit to PMB to evaluate its abilities and limitations. In the late 1980's, Randy Williams from Corpus Christi Army Depot (who had been working on PMB paint stripping applications at that facility) contacted AVCRAD inquiring about their PMB

testing results. The two facilities then began to compile test results and decided that there was a legitimate application for PMB in stripping aircraft.

AVCRAD initially approached the Mississippi National Guard (MNG) to obtain funding for the purchase of PMB equipment. Unfortunately, the National Guard Bureau (NGB) requires a payback period of 3 months or less be demonstrated before any QRIP Program funding can be considered. The payback period for PMB at AVCRAD was estimated at 5 1/2 months. AVCRAD then requested and received funding from DERA for the purchase and installation of PMB equipment. The State of Mississippi has been very supportive of the PMB initiative and the MNG, and despite their inability to provide funding, has continued their support of the project since successful implementation of PMB would reduce the MNG-generated hazardous waste volume by 60%.

The PMB equipment was purchased in Fiscal Year (FY) 1991 at an actual cost of \$292,000 and installation was completed in July 1992. Initial testing showed that the high summer temperatures that are characteristic at AVCRAD had no effect on the new PMB process; however, the high humidity present in the intake air caused the plastic beads to stick together. This problem caused the spray guns to clog and generally slowed the stripping rate by as much as 75%. Dehumidification equipment installed with the PMB equipment allowed the intake air to be conditioned to prevent clogging. It was also noted that dry air conditions, which may be encountered during the winter months, may require humidification to prevent the buildup of a static charge that can also clog the spray equipment and/or reduce stripping rates.

Plastic media blasting was expected to reduce the use of chemical paint strippers and clean-up solvents by an estimated 90%. The remaining 10% was assumed to be required to strip parts for which PMB was thought to be ineffective due to part geometry. Actual operations have shown that AVCRAD is able to use PMB exclusively and eliminate all chemical stripping operations for helicopter and component paint stripping applications. Further reductions in waste generation are accomplished by making "forms" that can be applied on the aircraft to areas that do not require painting or repainting. These forms can be reused and reduce the preparation time.

In addition to waste reductions achieved in paint stripping, AVCRAD has demonstrated that PMB can also serve as an effective cleaner. This has further reduced the requirement for cleaning solvents.

The overall labor required to strip paint from the aircraft using PMB is approximately equal to that required for chemical stripping. However, worker health and safety protection is enhanced due to reduction in exposure to hazardous chemicals. The waste that is generated from the PMB process consists of broken pieces of plastic media and paint particles. This waste is separated from the reusable media and collected in 55 gallon drums. Approximately 20 gallons of plastic media waste and paint particles are collected each day. The material can be disposed as a solid waste in a municipal landfill (it is not hazardous).

## Other Areas of Interest

General discussions with site personnel revealed several other evolving areas of waste minimization. These initiatives have resulted in a reduction in hazardous waste generation of nearly 100%. These initiatives include:

- Replacement of freon for parts cleaning with solvent PD 680 Type II (petroleum-based);
- Installation of a filtration system with PD 680 part cleaning tanks to extend the solvent change interval from 3 months to a minimum of one year;
- Replacement of some applications of PD 680 with a biodegradable solvent;
- Batch paint of small component parts to achieve quantity and justify mixing a paint kit;
- Utilization of excess paint from helicopter painting to paint component parts;
- Use of a more effective line cleaner for cleaning paint gun lines;
- Monitoring of paint mixing operations to ensure excess paint is not mixed;
- Reuse of paint overspray protective paper when painting component parts;
- Elimination of excess tape usage when preparing aircraft for stripping and painting;
- Conversion of paint operations to High Velocity Low Pressure (HVLP) spray gun to reduce overspray;
- Substitution of acetone for operations that do not specifically call for Methyl Ethyl Ketone (MEK); and
- Incineration of fuel oils and other lubricants via a contractor.

The MNG is continually searching for alternative ways to reduce hazardous waste. One avenue that is currently being pursued is the donation of wastes to universities who will accept responsibility for and conduct testing on the waste. In addition, MNG is looking into a waste exchange program where wastes are exchanged to facilities that can use them in their process.

Discussions regarding MIL-SPECs revealed that some of the documents (i.e. Technical Manuals) are very old and call for specific processes to be performed (such as using MEK for paint stripping operations) that conflict with EPA requirements (restricting use of MEK) and are often not in the best interest of hazardous waste reduction efforts. The level of effort and time frame required to rewrite and receive modification approvals of the MIL-SPECs is recognized to be monumental. Such changes may not be practical due to rapidly changing technologies, materials, and processes within disciplines such as cleaning methods, coating technologies, and painting materials making many MIL-SPEC changes obsolete before the approval process is complete.

Discussions relating to technology transfer revealed that personnel from numerous DOD facilities typically meet or have contact with each other several times each year providing for good technical transfer. Activities such as quarterly meetings between the Army, Navy, and Air Force; and two or three annual technology seminars (such as JDEP, JTEG, etc.) allow for detailed discussions of HAZMIN technology and equipment-related issues between personnel from the numerous sites. The MNG has also begun to promote the use of electronic mail to post bulletins and further promote technical transfer.

The AVCRAD is a unique facility in that it does not have a full time staff member with the primary responsibility of dealing with environmental issues. However, the staff was very knowledgeable of environmental requirements and were proud of their accomplishments. A formal HAZMIN program, as mandated by the Army, is in effect with a goal of reducing facility waste by 10%. In addition, process change recommendations made by workers at AVCRAD are strongly encouraged by management.

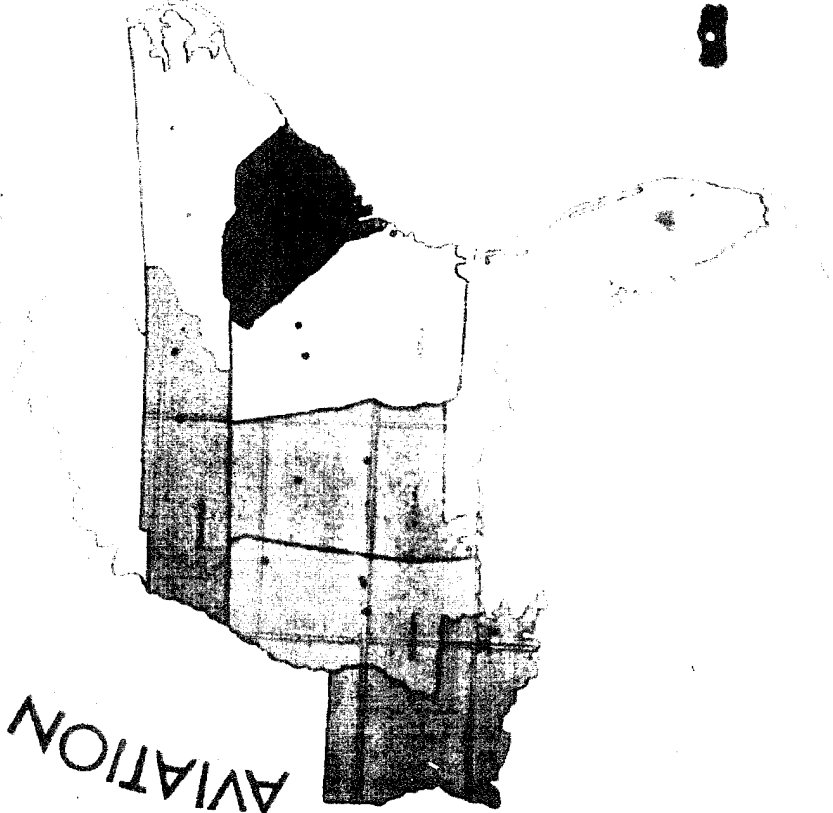
AVCRAD currently disposes of all site-generated hazardous waste through a Mississippi State contract with a hazardous waste handling firm. This vehicle allows rapid response to disposal requirements and therefore eliminates potential violations for storage of hazardous wastes as imposed by RCRA.

A camera was brought into the AVCRAD facility with prior permission and was used to take photographs of HAZMIN equipment and in-process operations.

### **Conclusions**

The only issue of concern conveyed during the site visit was that MIL-SPECs are obsolete and require revision to allow for the rapid implementation of new HAZMIN processes and equipment to be more effectively utilized.

AVIATION CLASSIFICATION REPAIR ACTIVITY DEPOT  
AVCRAD  
GULFBORT, MS

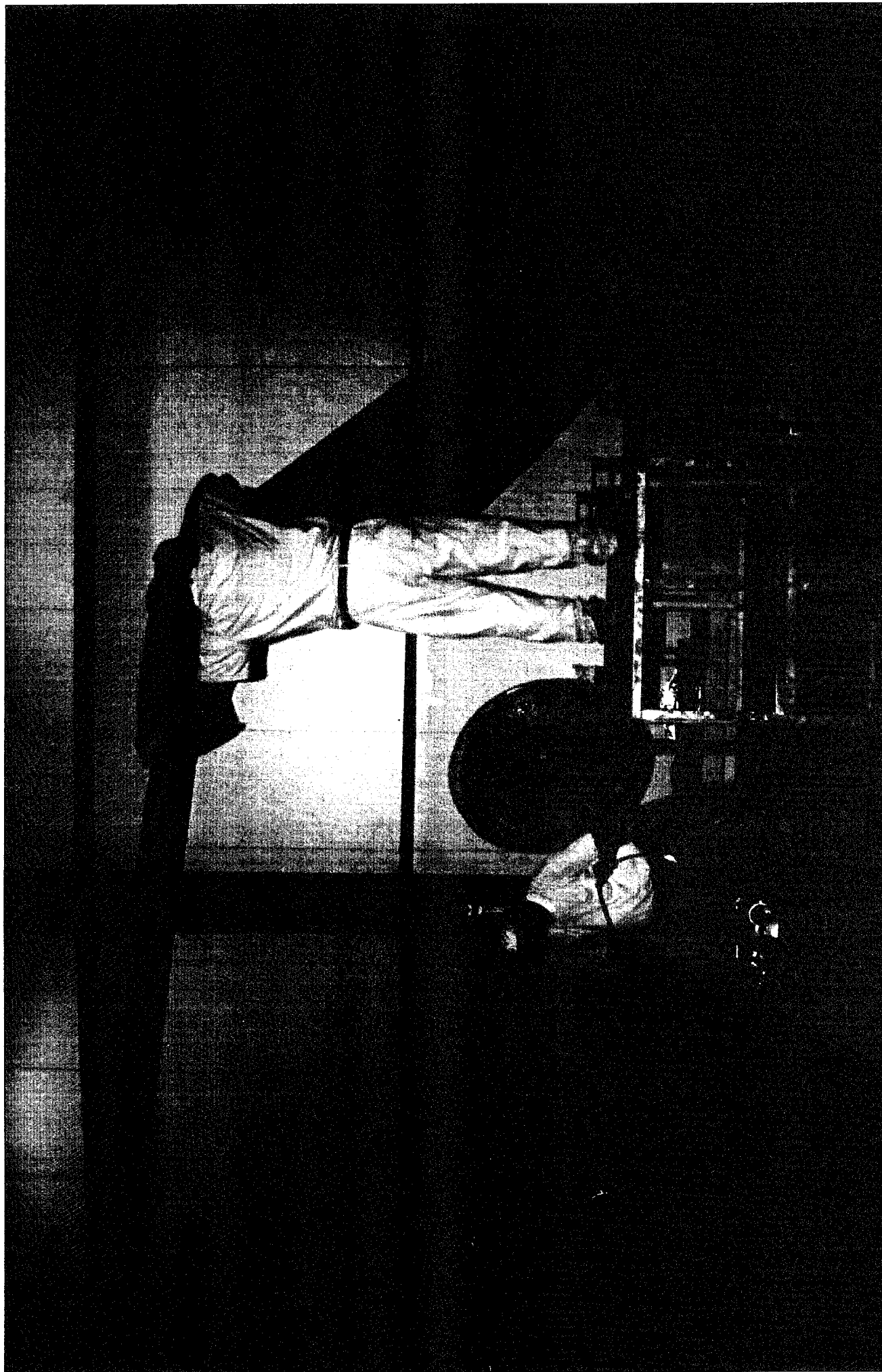


A facility sign at Mississippi Air National Guard - Aviation Classification Repair Activity Depot (AVCRAD)

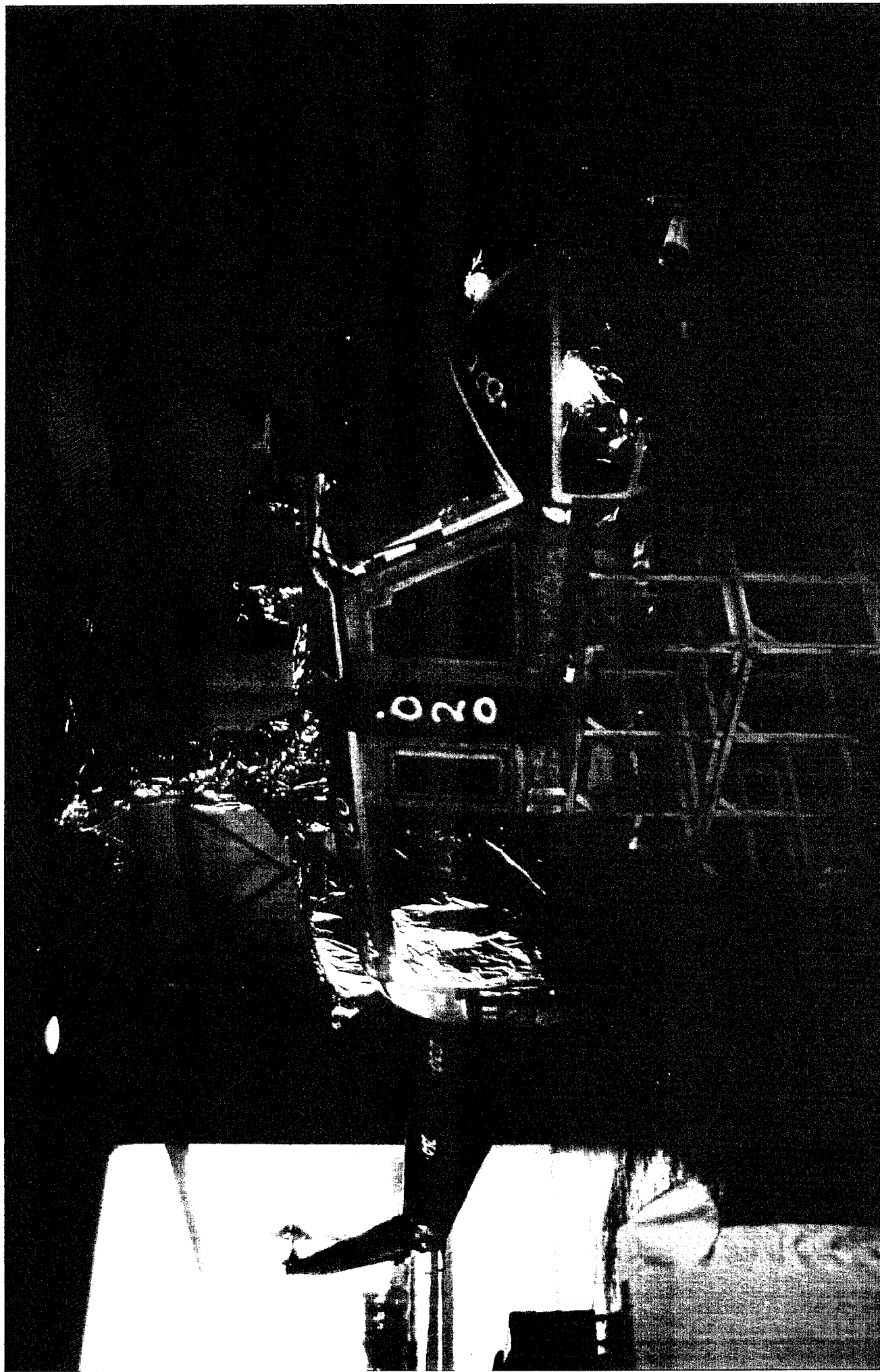




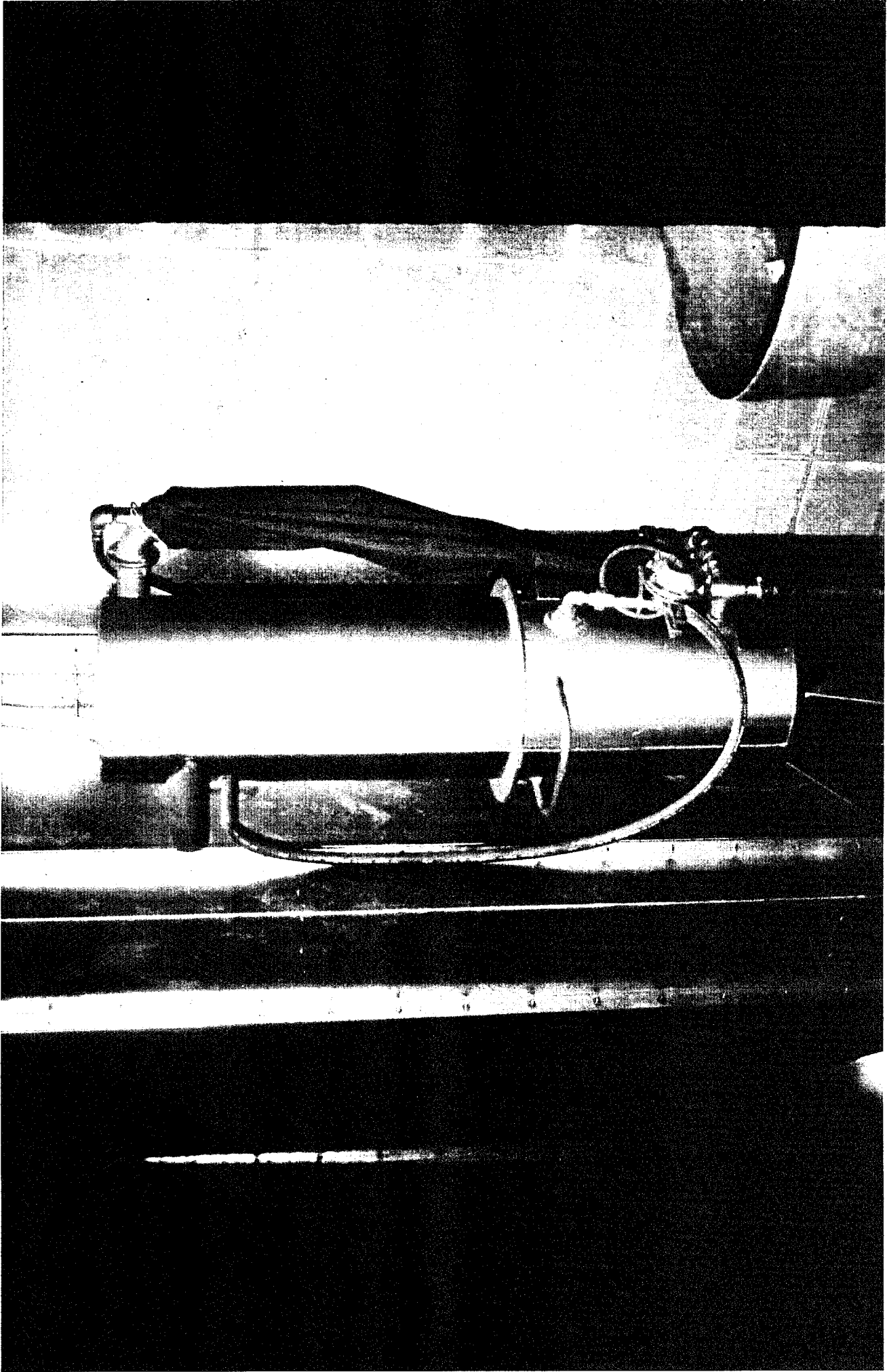
A helicopter being masked with kraft paper prior to painting at AVCRAD



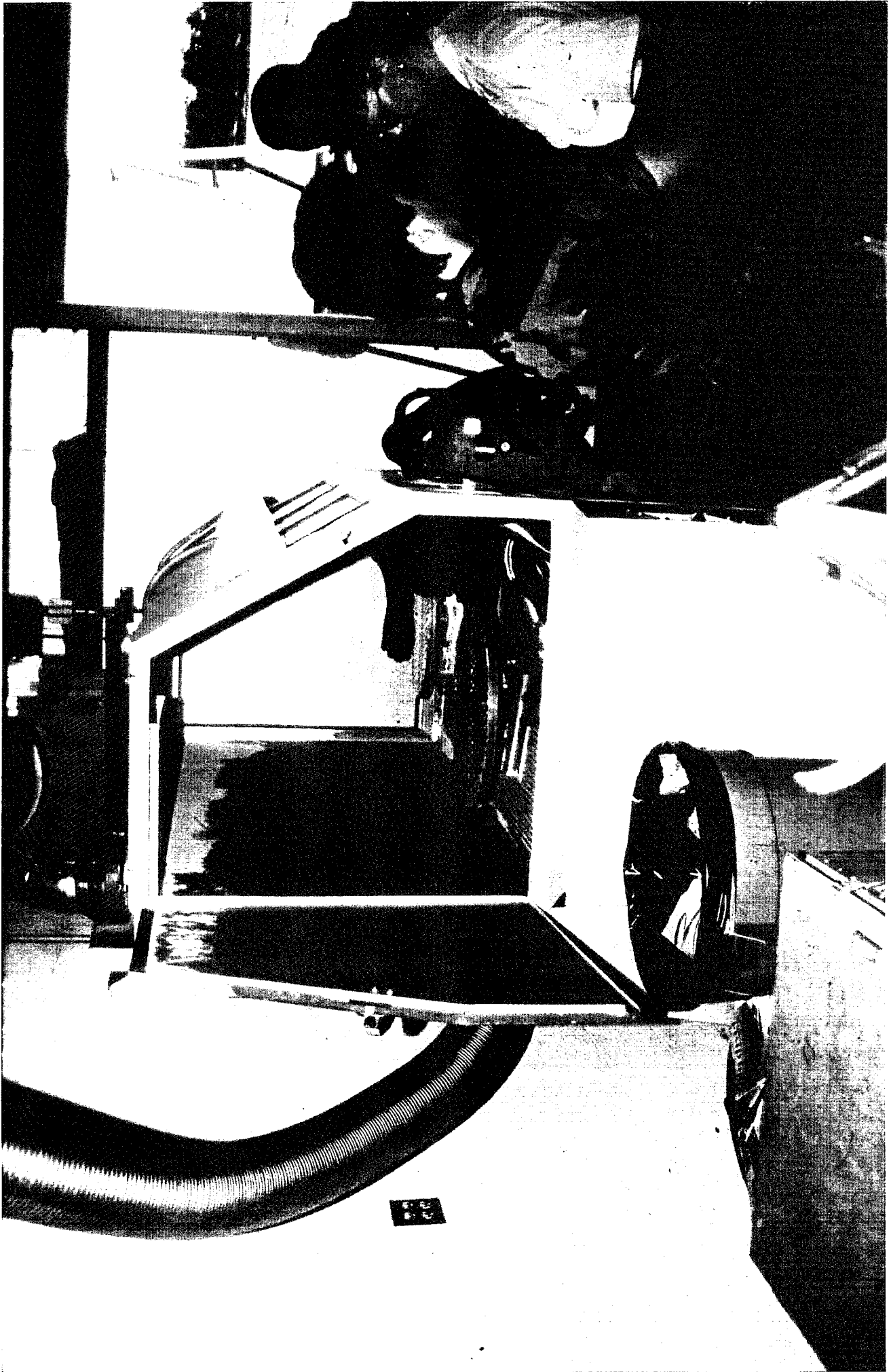
A worker slipping a canvas cover over helicopter blades prior to PMB at  
AVCRAD



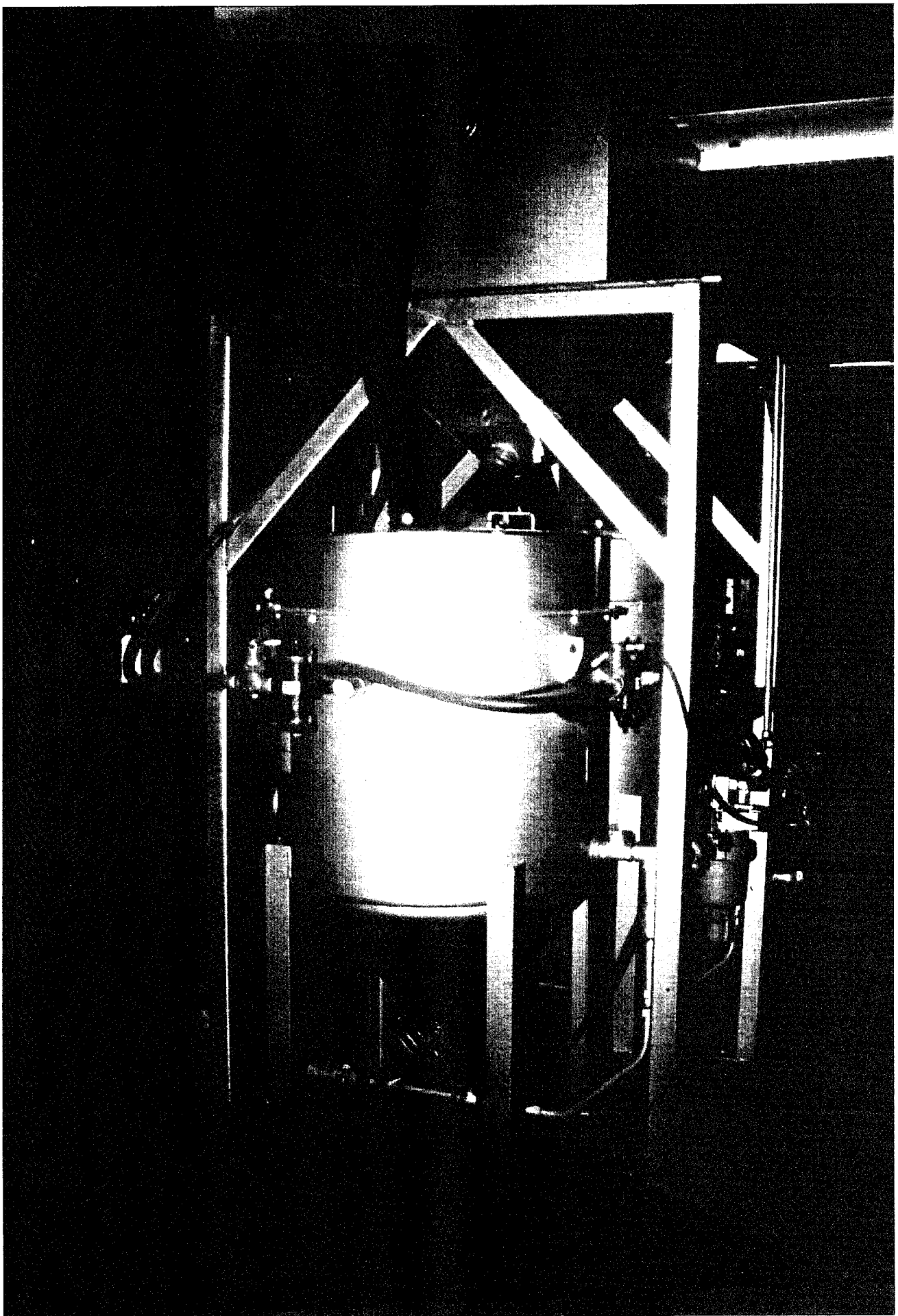
A helicopter masked with aluminum material prior to PMB. The spray painted numbers tell PMB operators the thickness of the craft's skin.



Portable PMB equipment used for small jobs at AVCRAD

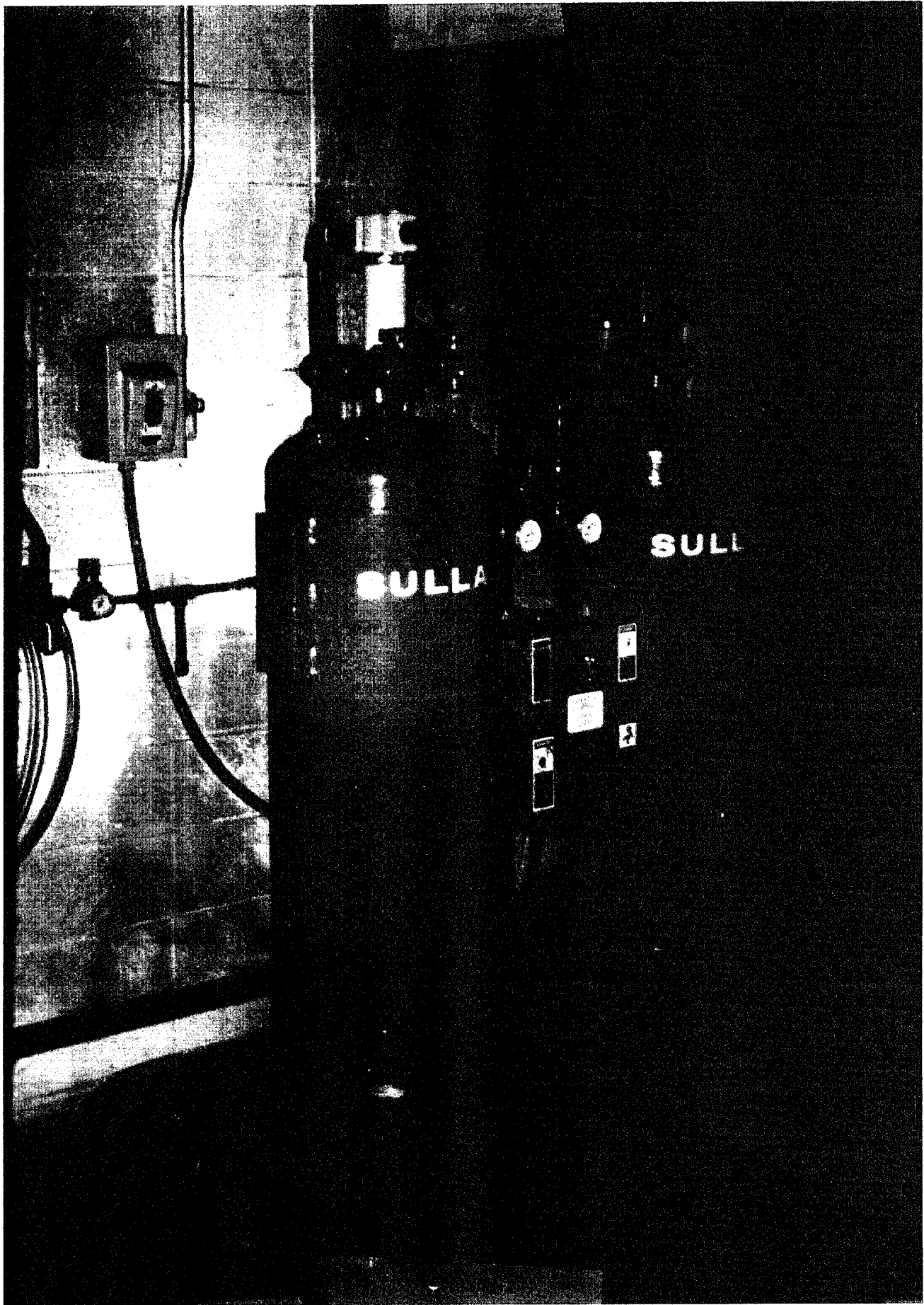


An old sandblasting unit at AVCRAD which was converted to utilize PMB

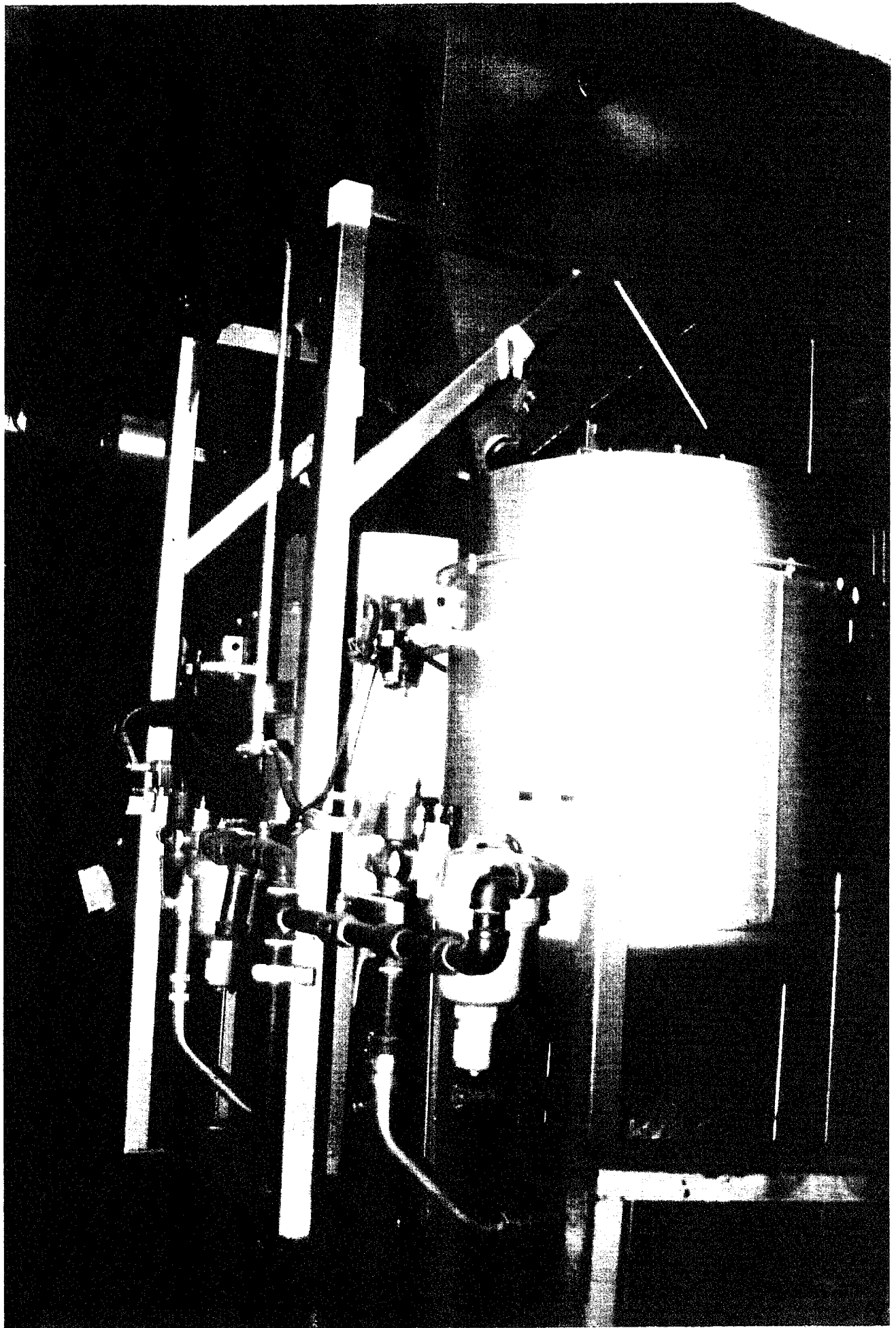


**A PMB cyclone separator used to recycle used PMB material at AVCRAD**





Dual Sullair compressors used for PMB at AVCRAD



Cyclone separators used to recycle used PMB material at AVCRAD





**PMB media separation storage and air handling components at AVCRAD**

## DERA HAZMIN Project Effectiveness

### Site Visit: Corpus Christi Army Depot, June 1993

Arthur D. Little personnel Joyce O'Donnell and Mike Bryant participated in meetings and a tour of the facilities at the Corpus Christi Army Depot (CCAD) on June 22-23, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN-funded projects at CCAD including funding request procedures; equipment procurement and installation; day-to-day operation and maintenance of the equipment; operator acceptance; HAZMIN results; and cost implications. Additionally, details were gathered regarding issues such as: the time frame and difficulties involved in completing a HAZMIN funded project; the impact MIL-SPECs have on HAZMIN efforts; employee awareness of and participation in the HAZMIN program; and the transfer of technology between Army facilities.

Our primary point of contact (POC) at CCAD was Jim Holiday (Chemical Engineer) who has worked at the facility for the past 7 1/2 years. We were provided with detailed discussions relating to the HAZMIN projects as well as an extensive site tour to view actual operation of HAZMIN equipment and discuss process and equipment related issues with a number of equipment operators and process technicians.

The purpose of this trip report is to document the information obtained during the site visit. The trip report is presented in four sections to clearly identify and address the important DERA HAZMIN-related issues.

#### Site Description

The primary mission at CCAD is to repair, overhaul, and maintain helicopters with an average current workload of approximately 45 helicopters a month. CCAD is a tenant activity occupying 188 acres of the Corpus Christi Naval Air Station. The Navy maintains all of the required operating permits (RCRA, NPDES) but CCAD holds its own air permits.

The Army operates the hazardous waste storage area for the entire installation of which 95% of the waste comes directly from CCAD operations. The work performed at CCAD is obtained through a competitive bid process; as a result, there is a strong incentive to lower operating costs to remain competitive when bidding against other Army depots. One of the means of reducing operating costs (and thereby improve competitiveness) is reducing the volume of hazardous waste generated at the facility.

#### Discussion of DERA Funded Projects

The two DERA HAZMIN funded projects addressed in this site visit included: the purchase and installation of process equipment to deionize plating bath waste water and reclaim captured chromium for recycle or reuse; and the purchase and installation of vapor deposition equipment that will apply a thin coating of aluminum to the surface of steel parts to provide corrosion protection as an alternative to existing cadmium plating practices.

**Chromium Recovery System.** The chromium reclamation equipment was purchased from IONSEP in June of 1991 and installed with operation commencing in September of 1992. The process includes ion exchange and electro dialysis systems for the removal and recovery of contaminants from chromium rinse tanks. These contaminants include both cations (e.g., metal ions) and anions (e.g., chromates).

The spent resin in the cation exchange column is regenerated with sulfuric acid. The sulfuric acid laden with metal contaminants is treated in the industrial waste pretreatment plant for heavy metals removal and pH adjustment.

The anion exchange resin is regenerated with sodium hydroxide. The resulting chromate-laden regenerant is also processed in an electro dialysis unit. The electro dialysis allows for the reformation of chromic acid which is separated from the sodium hydroxide. In this way, the chromic acid can be reused in the plating operation, and the sodium hydroxide can be recycled for reuse in subsequent ion exchange resin regenerations.

When in full operation, this IONSEP system will result in the elimination of water discharges from chromium rinse tank operations while generating minimal metal hydroxide sludge that will require disposal.

The lack of available floor space in the plating shop area caused equipment installation problems. The facility was forced to install the process equipment in a storage room on the second floor directly above the plating shop, while locating the rinse water collection tank in the basement directly below the plating shop. This tri-level arrangement and 40+ foot elevation-related head loss slows processing rates when city water pressure is low and has resulted in periodic tank overflows. A second problem developed after the chromium rinse system began operation using untreated city water as makeup. Electro dialysis of the cation regeneration solution results in the conversion of any chloride (present in the city water and carried over into the ion exchange column) into chlorine gas necessitating the installation of a proper ventilation system. The site is currently trying to purchase a water deionization system that will eliminate the source of the chloride and therefore eliminate any potential chlorine gas-related concerns. Until the new deionization system is installed, however, this portion of the system is not being operated, and the sodium chromate regenerant solution is being discharged to the industrial wastewater treatment plant.

The rinse water currently being recycled from this process is of much higher quality than that in two other chromium rinse tanks not undergoing purification, and the facility is pleased with its operation. CCAD is in the process of designing and building a new plating facility which will utilize the IONSEP process to treat and recycle all chromium rinse water. When the system is fully operational with no waste water discharge, it is estimated that the cost savings will be \$35,694 per year and will provide a payback period of 2.53 years. Projections of waste reductions resulting from the implementation of the IONSEP recovery system include:

- 1.728 million gal/yr of rinse water
- 19,213 lbs of wet sludge/year

A comparison of the costs for current chromium rinse tank operations employing one-through rinsing and those employing the IONSEP process are summarized below:

Once-through rinsing:

|                          |              |
|--------------------------|--------------|
| • Makeup water cost      | \$ 2,989     |
| • Rinse water treatment  | 34,560       |
| • Chrome sludge disposal | <u>7,109</u> |
|                          | \$44,658 /yr |

New IONSEP Process:

|                          |              |
|--------------------------|--------------|
| • Makeup water cost      | \$ 0         |
| • Rinse water treatment  | 0            |
| • Chromic acid makeup    | (3,558)      |
| • Maintenance and repair | 5,780        |
| • Utility cost           | <u>6,742</u> |
|                          | \$8,964/yr   |

Total annual operating cost savings are estimated at \$35,694.

CCAD has investigated other uses of the electro dialysis process for reducing wastes. One of these uses is the purification of the chromic acid plating bath. The electro dialysis unit removes any metal impurities in the bath such as iron from the steel parts and copper from the bus bars. The process results in the precipitation of metals as hydroxides which are collected in a 55 gallon drum. The purified chromic acid solution is recycled to the plating bath. The unit has resulted in very consistent bath chemistry requiring very little adjustment from the plating chemist. A third electro dialysis unit is planned for installation in the caustic-based chrome strip tank. This electro dialysis unit will allow for the reformation of chromic acid that can be separated from the caustic allowing for the reuse of each component. The chromic acid can be recycled to the plating bath, and the sodium hydroxide can be recycled to the strip tank.

**Aluminum Ion Vapor Deposition (AIVD).** The aluminum ion vapor deposition (AIVD) process equipment deposits a thin coating of aluminum on the surface of steel parts to provide corrosion protection. This process is used in place of cadmium plating. This new AIVD process significantly reduces the amount of wastes previously generated with the cadmium plating process as well as reduces chemical exposure to the operators. Corpus Christi purchased an AIVD from IVI Corporation in December of 1991, and installation was completed in December of 1992.

The AIVD equipment at Corpus Christi is manufactured by a different vendor than a system previously installed at Anniston Army Depot (ANAD). The CCAD equipment is believed to be better designed and has more operational flexibility. The primary advantages with the unit at CCAD are:

- Use of freon (HCFC) instead of process water refrigeration coils on the diffusion vacuum pump to decrease chamber pump down times, and increase system throughput rates;
- The entire system is computer controlled (with manual override) allowing automatic system start-up, operation, shutdown, and recording of system parameters;

- The computer control allows the operator to vary nearly all process parameters; and
- The internal cooling coils are located against/within the back cover plate of the vacuum chamber which allows unrestricted use of the entire chamber volume. This is in contrast to the ANAD unit which has cooling coils running the entire internal length of the chamber. These coils are suspended from the top of the unit at both 1 and 11 o'clock orientations consuming potentially valuable chamber space and limiting process part size.

The operators of the AIVD at Corpus Christi wrote their own training materials based on their experience in operating the equipment. In addition, the operators wrote the process standard required for having the system approved by the Army Aviation Command (the customer). The operators have begun processing parts in the AIVD for training purposes and for developing further process control guidelines. Overall, the operators displayed great pride in the AIVD system and supporting documentation.

Acceptance of the AIVD process by Army Aviation Command is required before any aluminum coated parts can be installed in aircraft. Process acceptance is expected in the coming months on a part-by-part basis with non-critical items receiving initial acceptance; however, to date no parts have been approved. If Aviation Command is not willing to grant acceptance of the process or acceptance for specific parts, the site is prepared to approach the helicopter manufacturers (Bell, Sikorsky, etc.) to obtain process approval. It is acknowledged that this approach could meet significant resistance because the manufacturers have little or no known experience with the new process. AIVD is currently being used for corrosion protection on a variety of parts manufactured by McDonnell Douglas Corp., and is currently used on 123 parts that were previously cadmium plated in the C-130 military transport aircraft operated by the U.S. Air Force.

Anticipated waste reduction values realized by using AIVD in place of cadmium plating operations are expected to include:

- Waste rinse water flow = 2,400,000 gallons/year
- Cadmium wet sludge disposal = 6,938 pounds/year
- Calcium carbonate disposal = 193 pounds/year

The complete operating cost comparison analysis for both the old cadmium plating system and the new aluminum ion vapor deposition system are itemized below and are based on the following:

- A twenty year economic life will apply to all equipment;
- The plating shop workload will remain constant over the life of the project;
- Straight-line depreciation will be assumed;
- Cost estimates were obtained from equipment manufacturers;
- Electrical equipment is 80% efficient;
- Hazardous waste disposal costs do not increase over the life of the project; and
- Eighty percent of the cadmium plating workload can be converted to the AIVD process.

### Cadmium plating system

|                            |                    |
|----------------------------|--------------------|
| Labor                      | \$404,601          |
| Rinse water                | 5,190              |
| Rinse water treatment      | 90,000             |
| Cadmium sludge disposal    | 3,209              |
| Calcium carbonate disposal | 3,240              |
| Chemical consumption       | 19,824             |
| Laboratory testing         | 23,076             |
| Oven stress relief         | 44,496             |
| Maintenance                | 13,602             |
| Total =                    | \$607,238 per year |

Twenty percent of the present cadmium workload cannot be processed using AIVD since it is ineffective at coating the internal portion of bores that are deeper than 1.5 times the bore diameter. Therefore, only 80% of the cadmium plating operating costs can be eliminated when using the AIVD process. The adjusted plating operating cost then becomes  $\$607,238 \times 0.80 = \$485,790$  per year.

In addition, the cadmium electroplating process produces hydrogen gas that can be trapped within the cadmium coating and in the surface pores of the part being coated. When the part is placed back into service, the trapped hydrogen can lead to a reduction in the tensile strength of the part due to the development of premature microfractures. This process is known as hydrogen embrittlement. To reduce the effects of hydrogen embrittlement, the part must be uniformly heated in an oven to allow the hydrogen to escape through pores in the cadmium coating. The process is complicated when using high tensile strength metals since they must be baked at proportionately higher temperatures for a longer period of time to allow for the effective removal of hydrogen. Ultimately, there is a point at which an increase in baking time and temperature will not relieve hydrogen embrittlement and parts which fall into this category must be replaced when the helicopter is overhauled. The annual cost of this parts replacement process is \$762,212. Therefore, the true total annual cost of cadmium plating becomes  $\$485,790 + \$762,212 = \$1,248,002$ .

### Aluminum Ion Vapor Deposition System

|                   |                    |
|-------------------|--------------------|
| Labor             | \$129,479          |
| Maintenance       | 8,309              |
| Repair            | 6,286              |
| Utilities         | 4,488              |
| Aluminum source   | 5,386              |
| Argon process gas | 16                 |
| Total =           | \$153,964 per year |

The annual cost difference is  $\$1,248,002 - \$153,964 = \$1,094,038$ . When adjusted by the AIVD purchase cost factors, a projected payback period of 0.91 years is anticipated. Given the short payback period, the higher anticipated rate of part acceptance (95%), and better overall corrosion protection (due to the surface formation of aluminum oxide which results in a longer in-field service life when compared to the current cadmium

plating process), CCAD feels that approval of the AIVD parts protection process is imminent.

CCAD hopes to eliminate the use of cadmium plating by 100% in the new plating facility which is currently being designed. They feel that the combination of AIVD and nickel/zinc plating can replace cadmium plating entirely.

### **Other Areas of Interest**

#### **Availability of Trades People**

General discussions with site personnel revealed several issues of concern. The current number of on-site skilled trades people is only at a level which allows for day-to-day maintenance activity. Installation of new equipment is handled by the POC on an individual basis by paying the trades people to work on an overtime basis. This 'overtime' approach has limited installation delays on HAZMIN-related equipment.

#### **HAZMIN Funding Process**

The point of contact revealed that obtaining DERA HAZMIN funding is a difficult and time consuming process. The "Reality Test" used at CCAD to internally identify whether a new concept or project makes practical and economic sense includes the following steps:

- Development of a Benefits Analysis that consists of developing a qualitative summary ranking of the technological alternatives in a variety of applicable categories (such as reduction of landfill liability, corrosion protection, conservation of water, employee safety, etc.).
- Development of a Sensitivity Analysis that is used to evaluate what happens if your project constraints change (such as, only 60% of the parts can be processed using AIVD, not the 80% initially assumed).
- Development of a Cost Analysis that quantitatively details operating costs of the existing process compared with the capital and operating costs of the desired process (including depreciation and terminal value, based on the economic life of the desired process).

If the concept passes the "Reality Test", then funding is actively pursued as follows:

- Develop an detailed Economic Assessment (EA) of the desired project which is basically an combination of the Benefit, Sensitivity, and Cost Analysis noted above, to justify the level of funding requested;
- Apply for the project funding dollars;
- Receive award of DERA funding dollars in May/June;
- Obligate funding (signed Purchase Order) by September 30 (end of Fiscal Year) or funding must be returned to DERA.

A problem with the funding sequence described above lies in the final two steps that typically allow the site only 3 to 4 months to obligate the funds received or be required to return the funding only to repeat the entire effort in the next Fiscal Year. This short time frame will often create difficulties in procuring equipment due to the requirements of the Federal Acquisition Regulations (FAR). The FAR typically does not allow a requisitioner to specify a manufacturer or piece of equipment by model number. Therefore, a fine balance must be made between the preparation of detailed

specifications to guide Army procurement to purchase the desired items and making specifications general enough to allow for a proper competitive bid process to occur.

Currently, the POC must write a specification for the equipment to be procured. Then, contracting will go through the competitive bid process and purchase the equipment sometimes without giving the POC an opportunity to conduct a final prepurchase review of the selected vendor/equipment model. An example of this process occurred several years ago when the POC requisitioned the purchase of a small oil separator for use in the machine shop. After completing the equipment request form required by his contracting office, he received a copy of the confirmed purchase order. It was found at that time that the oil separator purchased was a large piece of equipment that could not be transported down a 36 inch wide aisle-way for installation in the machine shop. Attempts were made to cancel the purchase order but cancellation was not allowed. When the equipment arrived, an alternative application for it had to be identified. Another acquisition request had to be made for the appropriate oil separator – this request was successful as a result of a better understanding of the procurement process. The POC does not have a copy of the FAR and although he has made numerous requests to obtain a copy, he has yet to receive one.

After the equipment has been installed and is operational for a reasonable period of time, the CCAD Resource Group develops a Post Investment Analysis Report in which:

- Savings generated by this new process are documented by monitoring the number of parts processed through the equipment with the number of hours of operation;
- The amount of chemicals used/saved are obtained directly from chemists' records;
- The amount of hazardous waste generated/saved is obtained from logbooks;
- Maintenance and repair costs are obtained from the Depot Equipment Division; and,
- Utility costs are calculated from the number of hours of operation.

The facility then uses this report to evaluate the accuracy of their Economic Assessment data to help place them higher on the "learning curve".

### **Military Specifications**

Discussions regarding MIL-SPECs revealed that many of the documents are very old and call for specific processes to be performed that may not be in the best interest of hazardous waste reduction efforts. The level of effort and time frame required to rewrite and receive modification approvals of the MIL-SPECs is recognized to be monumental and not practical due to rapidly changing technologies, materials, and processes within disciplines such as cleaning methods, coating technologies, and painting materials which would make many MIL-SPEC changes obsolete before the approval process was even complete.

### **Technology Transfer**

Discussions relating to technology transfer revealed that personnel from facilities within DESCOM will typically meet or have contact with each other several times each year. Activities such as the quarterly meetings of the DESCOM Center for Technical Excellence (CTX); quarterly meetings between the Army, Navy, and Air Force; and two or three annual technology seminars (such as JDEP, JTEG, etc.) allow for detailed



discussions of HAZMIN technology and equipment related issues between personnel from the numerous sites.

### **Facility HAZMIN Program**

The site is required by the Army to have a HAZMIN Plan. The CCAD plan initially targeted the largest waste streams: paint, abrasives, and cleaning. The next three large waste streams include plating waste, solvents, and oils. Currently, there are HAZMIN projects in progress to address all of these areas. Another topic of discussion addressed the employee awareness and participation in the HAZMIN program. The POC said that site workers are exposed to several forms of HAZMIN and hazardous waste handling training activities each year with both on-site and off-site formal education programs. This increased level of worker knowledge has led to numerous HAZMIN suggestions which have added to or initiated a variety of HAZMIN efforts. The POC is often found in the manufacturing areas working directly with and soliciting opinions from the workers. The POC's opinion is that 'the people on the floor have the best working knowledge of what works and what doesn't and they know what modifications need to be made to increase local productivity. We (the engineering staff) know the process parameters and how the trends and regulations will effect our site activities in the future. Working together, we can make the entire process work effectively and economically in an environmentally acceptable way.' This two-way open dialogue between the workers and engineering staff has allowed the Depot to make timely and effective modifications to equipment and processes which have led to ongoing reductions in the generation of hazardous waste. The POC has also found that the most successful way to select operators for HAZMIN projects is on a volunteer basis from personnel who are interested in the project.

When asked about the value and benefits of the HAZMIN Audit performed in 1991, it was revealed that several related beneficial actions resulted. The major area of audit activity was a study of the layout, activity, and efficiency of the existing plating shop. This resulted in a recommendation to construct a new plating shop utilizing current state-of-the-art processes. An award was then made to TMSI Inc. to design a completely new dedicated plating shop building including full specifications of the new plating processes and equipment. This new facility was to include AIVD as an integral process in plating technology. To date, the facility design and equipment layout process is scheduled to be complete by August 1994 and ground breaking activities are scheduled to begin in January of 1995.

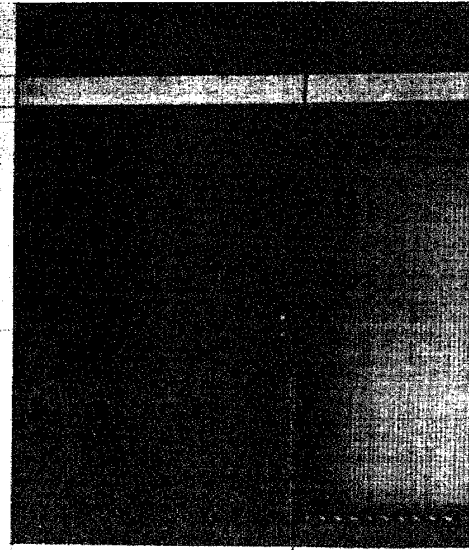
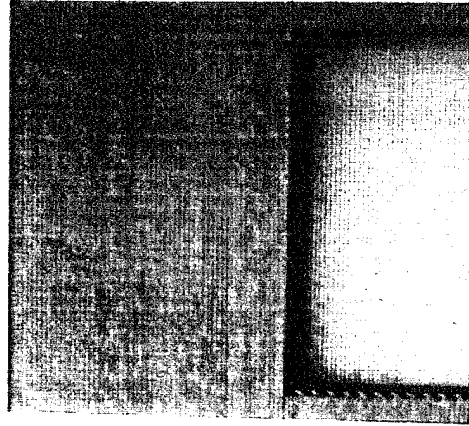
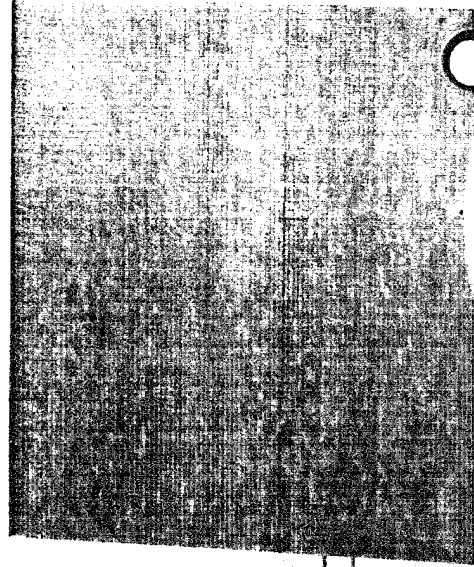
A camera was brought into the CCAD facility with prior permission and was used to take photographs of HAZMIN equipment and in-process depot operations.

### **Conclusions**

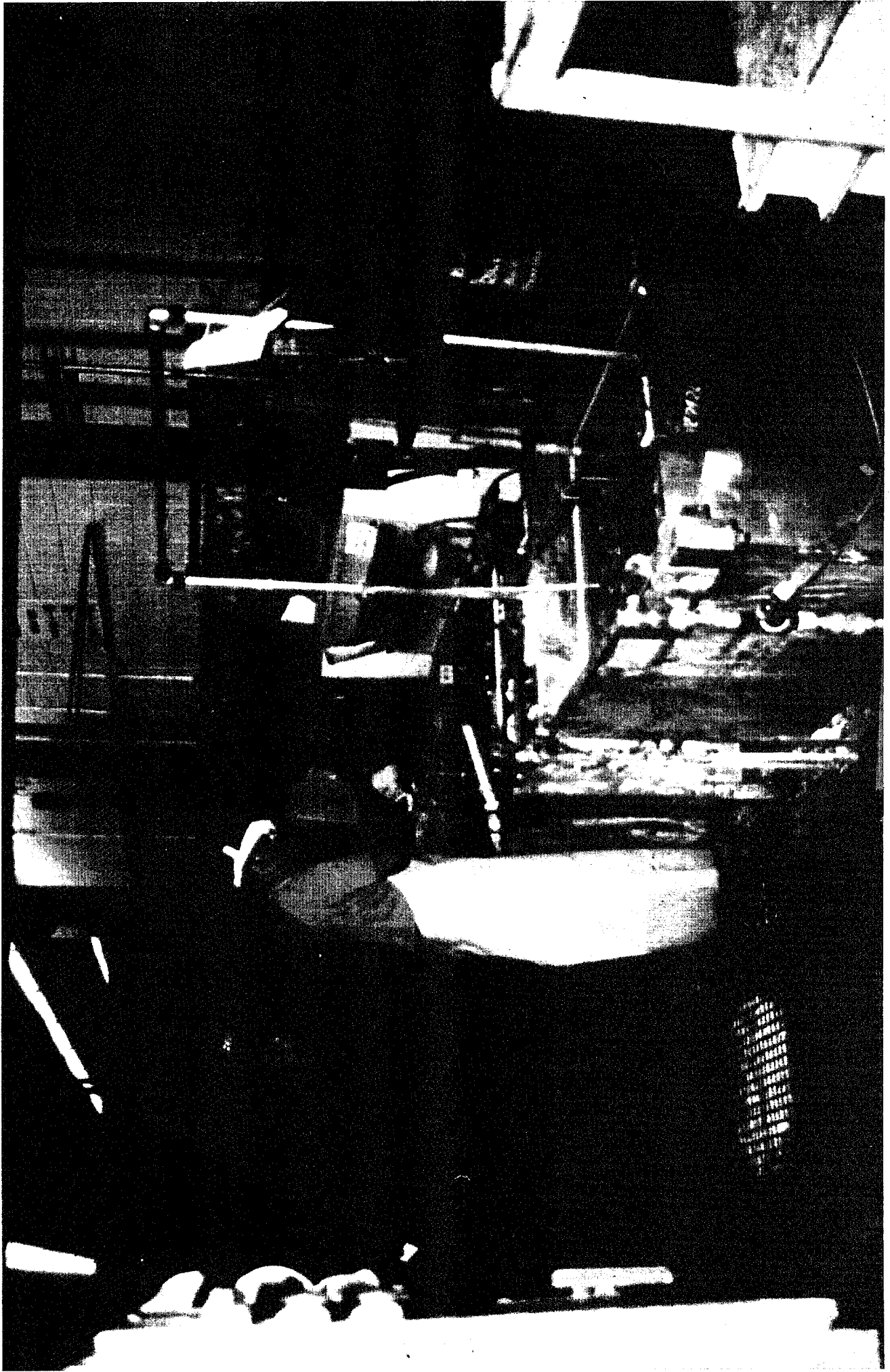
The DERA HAZMIN-funded projects at CCAD have been effectively (and enthusiastically) planned and implemented. The significant issues of concern conveyed during the site visit were: MIL-SPEC's are obsolete and revisions are necessary to allow for the rapid implementation of new HAZMIN processes and allow for existing equipment to be more effectively utilized; and the time frame inherent in the DERA funding process (request for project funding/award/completion of FAR/purchase order obligation by September 30 of the FY) is often very difficult to complete in the allotted time and failure to complete results in the allocated money being returned while the entire process starts over again in the next FY.

WELCOME TO

CORPUS CHRISTI  
ARMY DEPOT



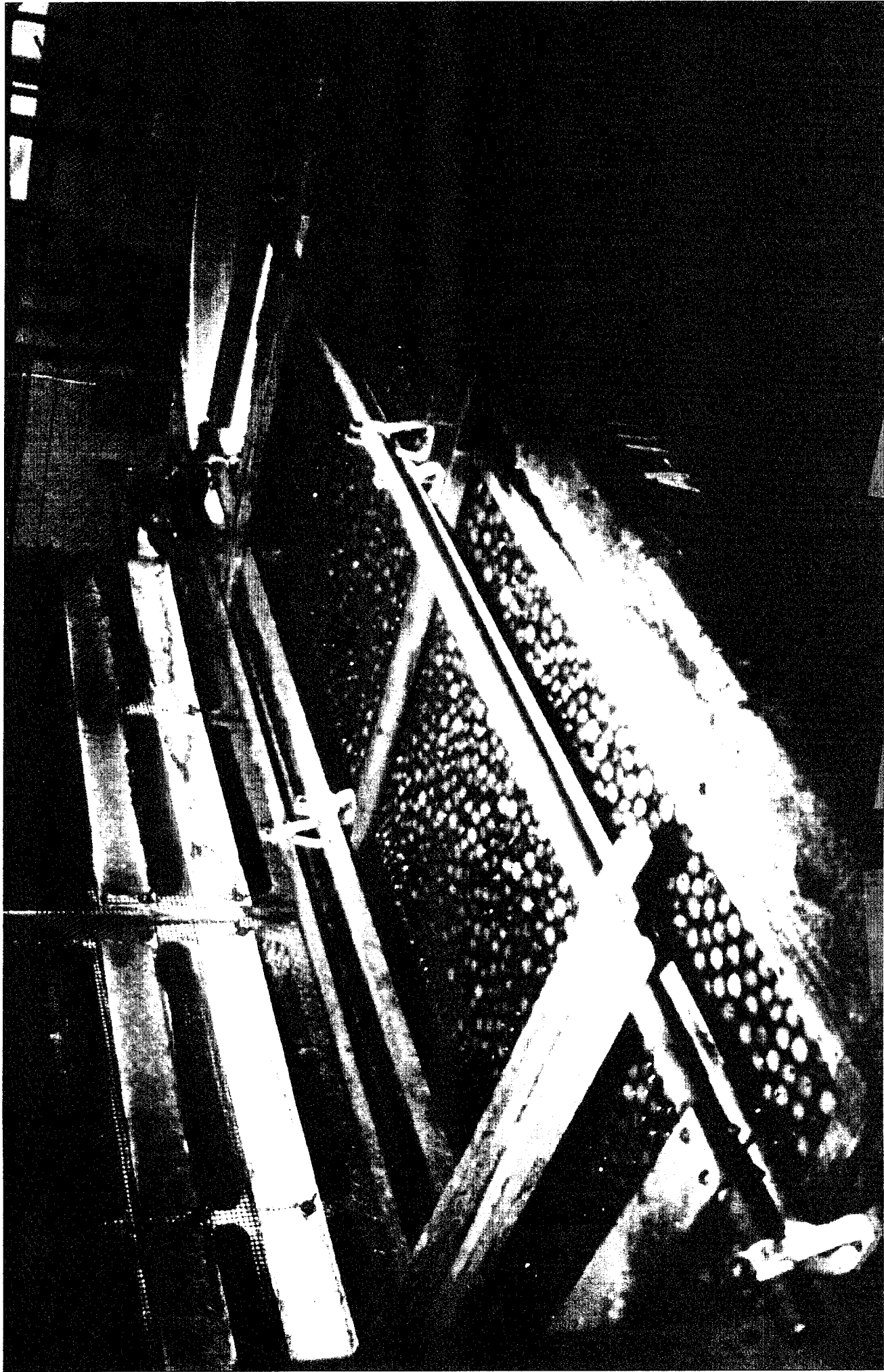
Site identification sign at Corpus Christi Army Depot



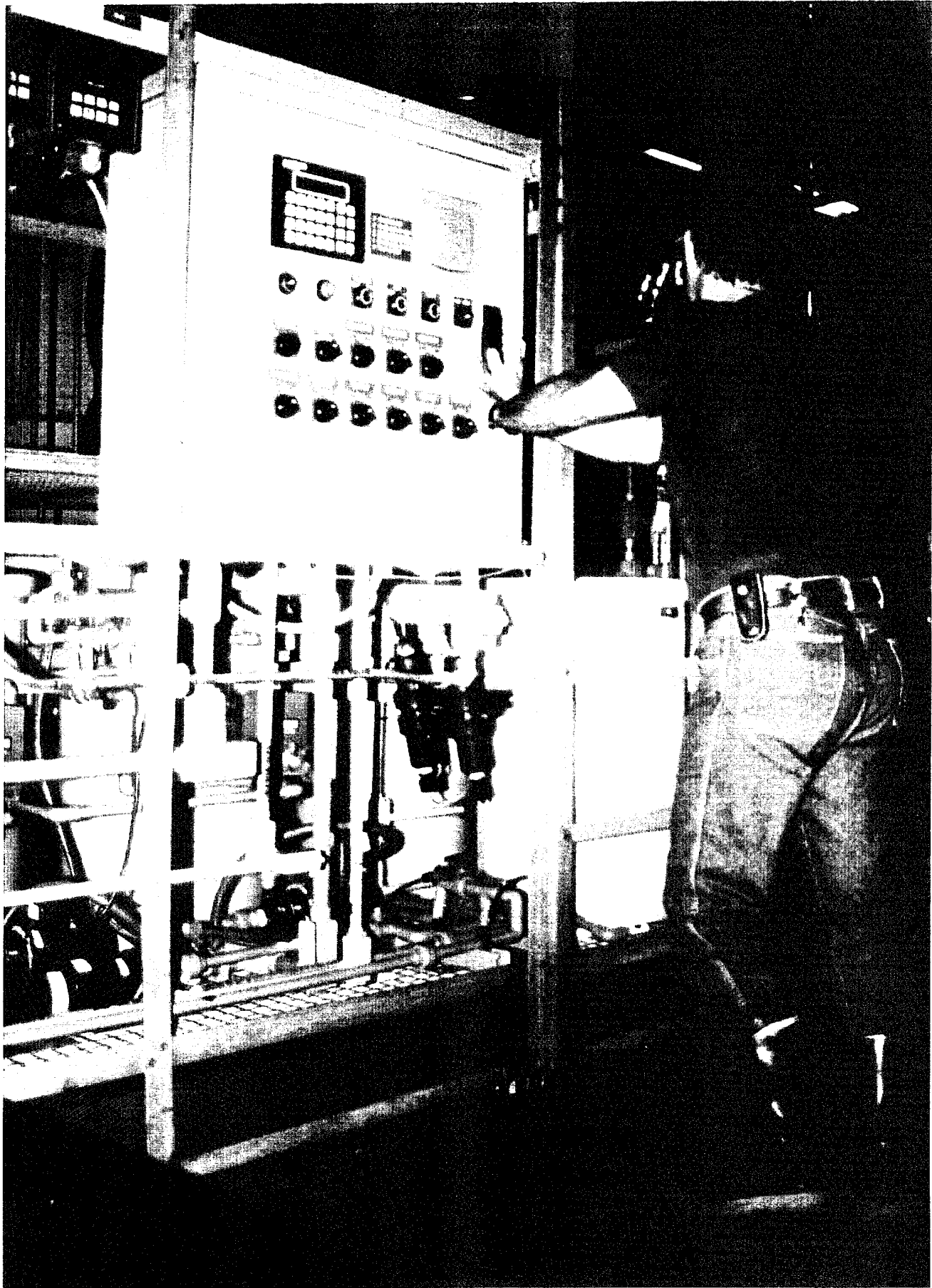
Worker and plating tanks on the cadmium plating line at CCAD



Metal hydroxide storage tank in the plating shop at CCAD

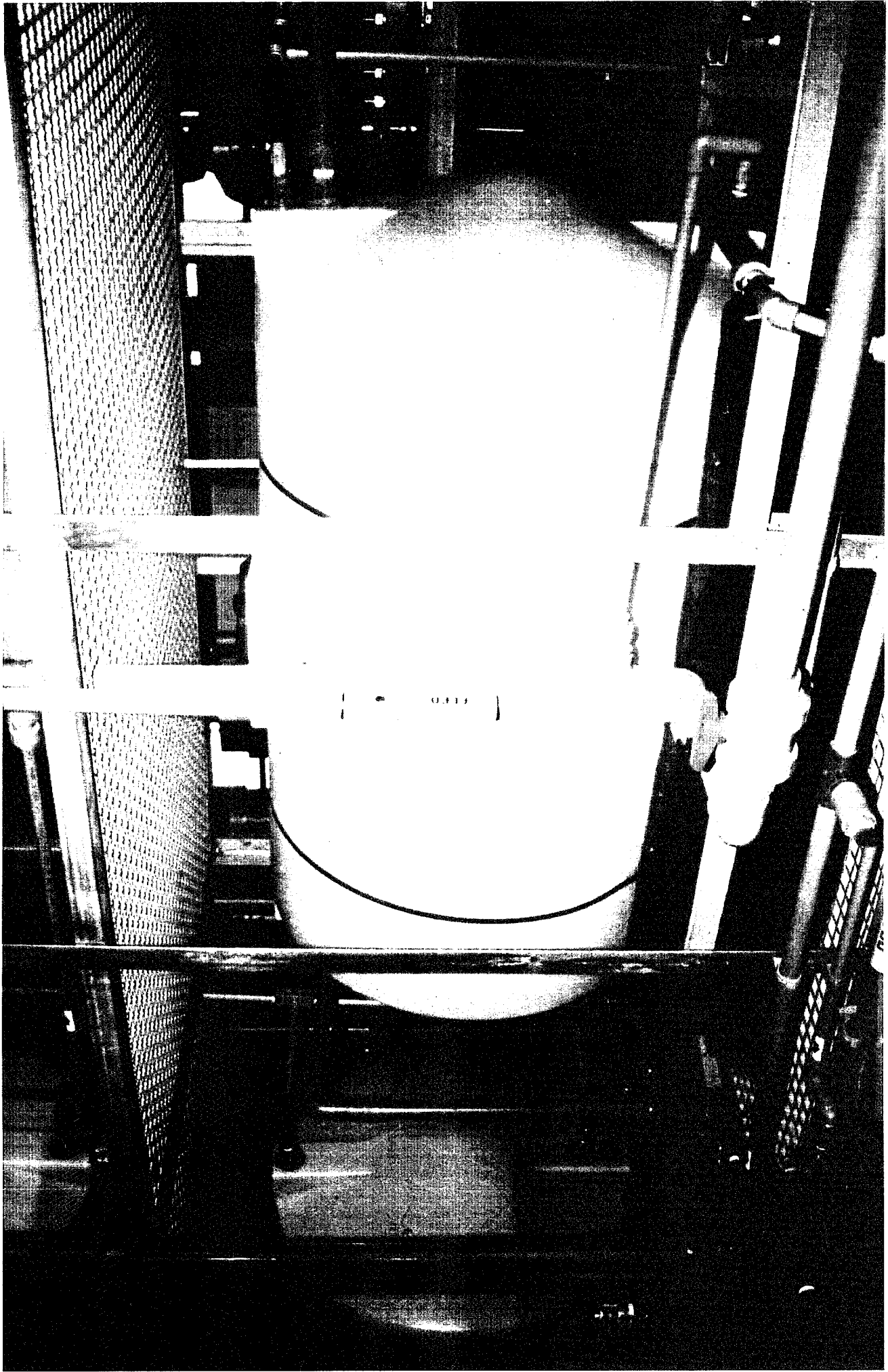


Plating tank with floating heat retention balls in chromium shop at CCAD

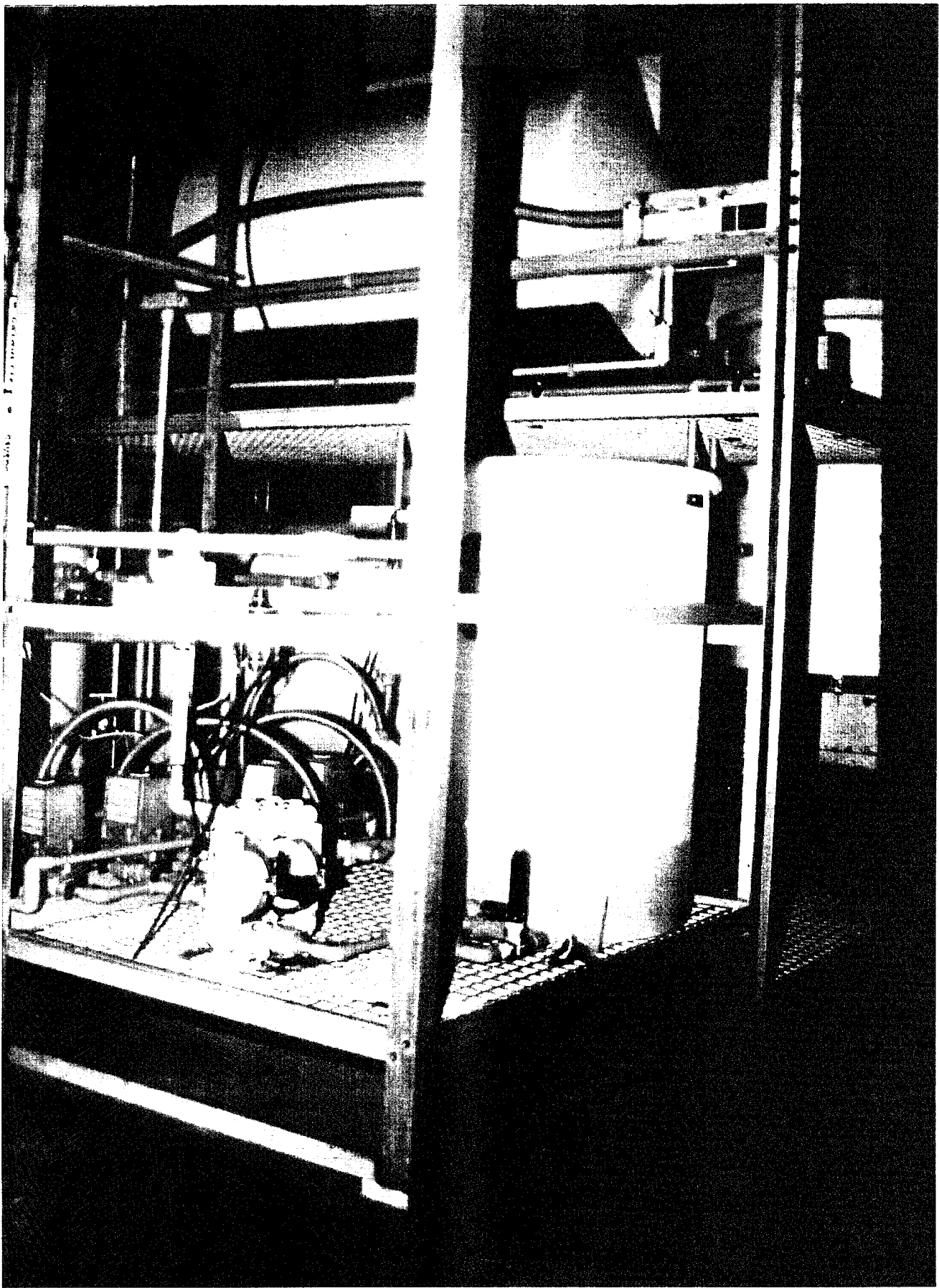


Plating rinsewater experimental reclamation equipment at CCAD



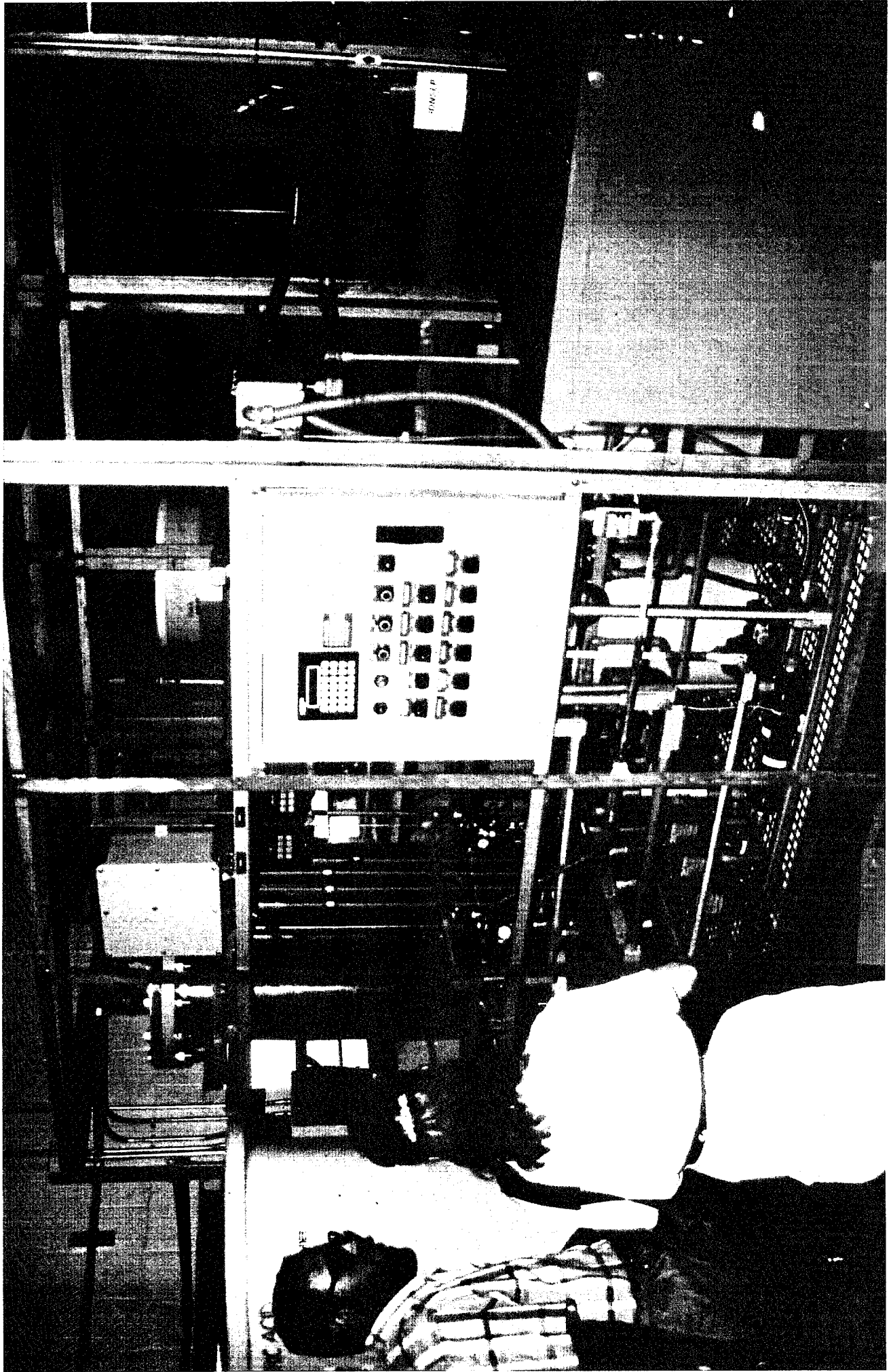


Plating rinsewater experimental reclamation storage tank at CCAD

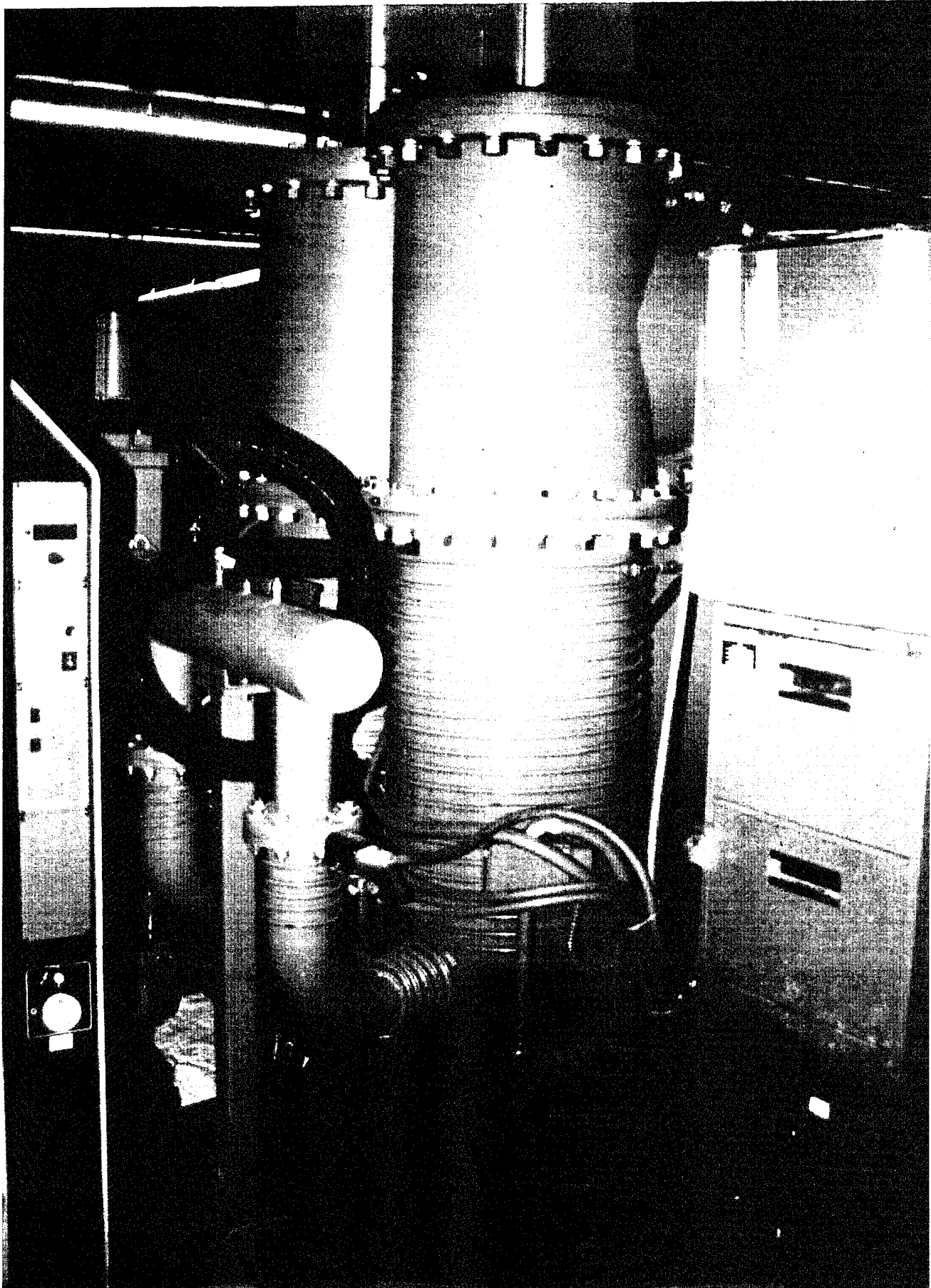


Plating rinsewater experimental reclamation storage tank with diaphragm pump (yellow) at CCAD

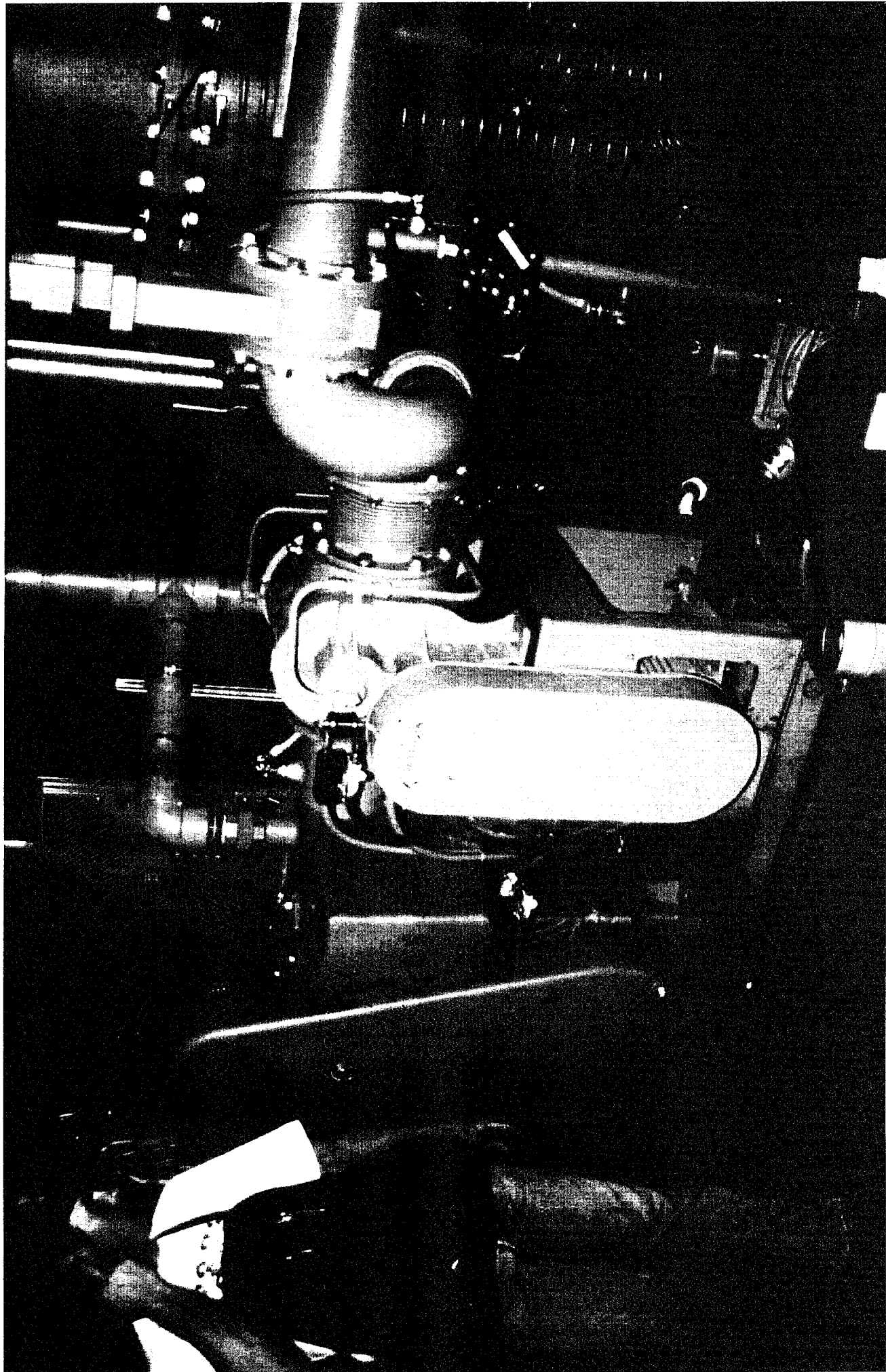




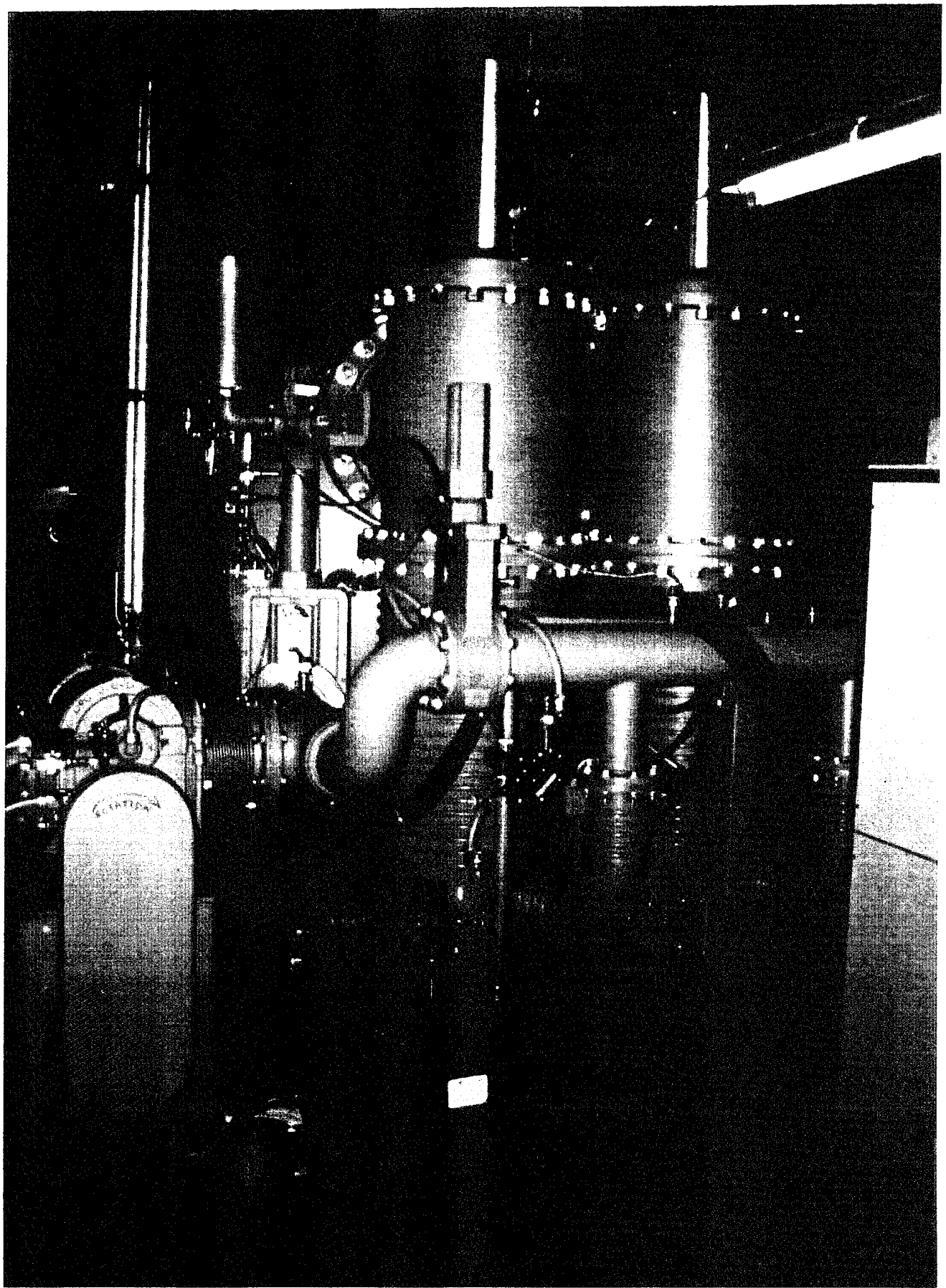
Plating rinsewater experimental reclamation equipment and control panel at  
CCAD



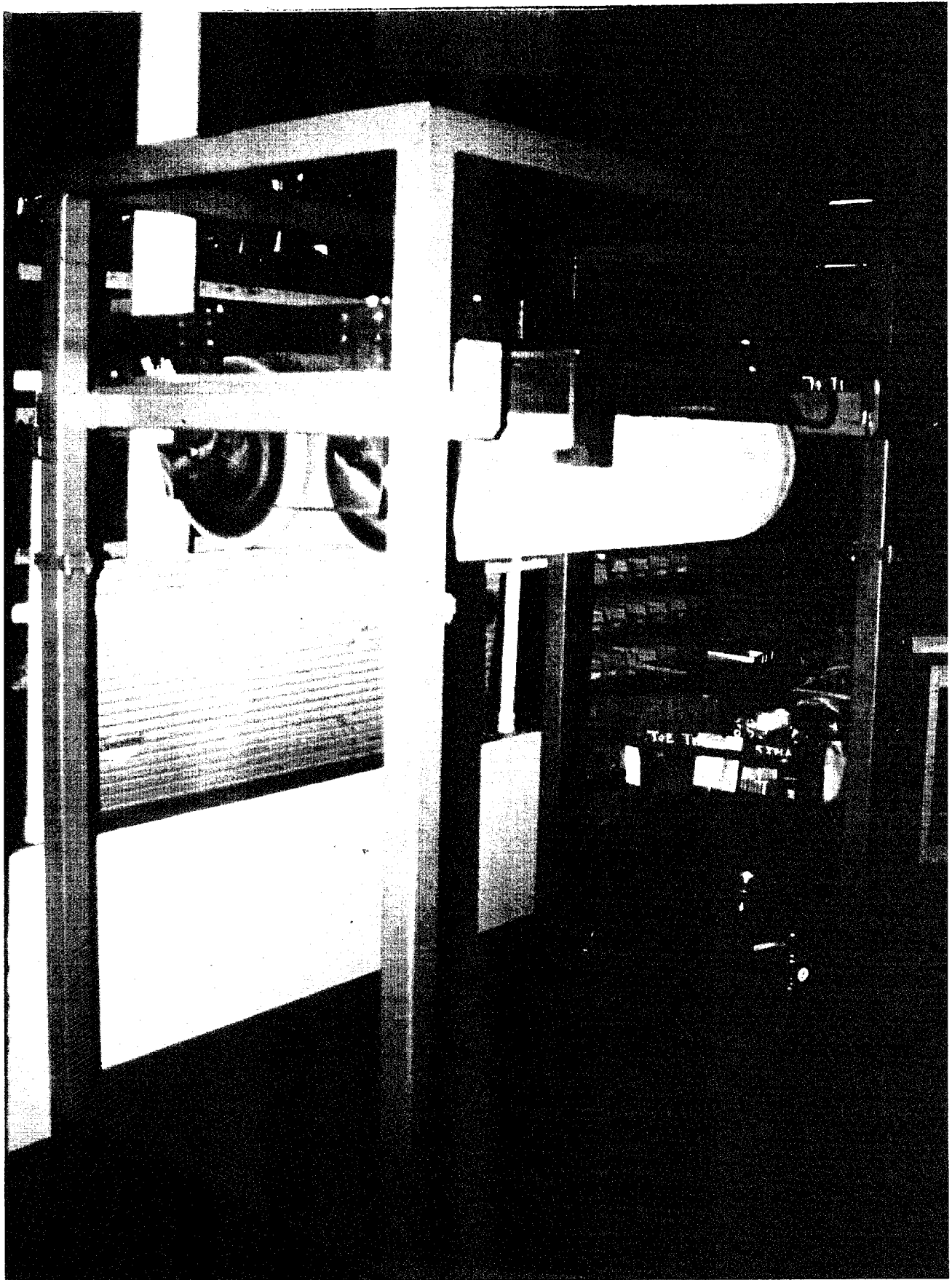
Dual diffusion pumps on back side of Aluminum Ion Vapor Deposition (AIVD) equipment at CCAD



Roughing pumps on back side of (AIVD) equipment at CCAD

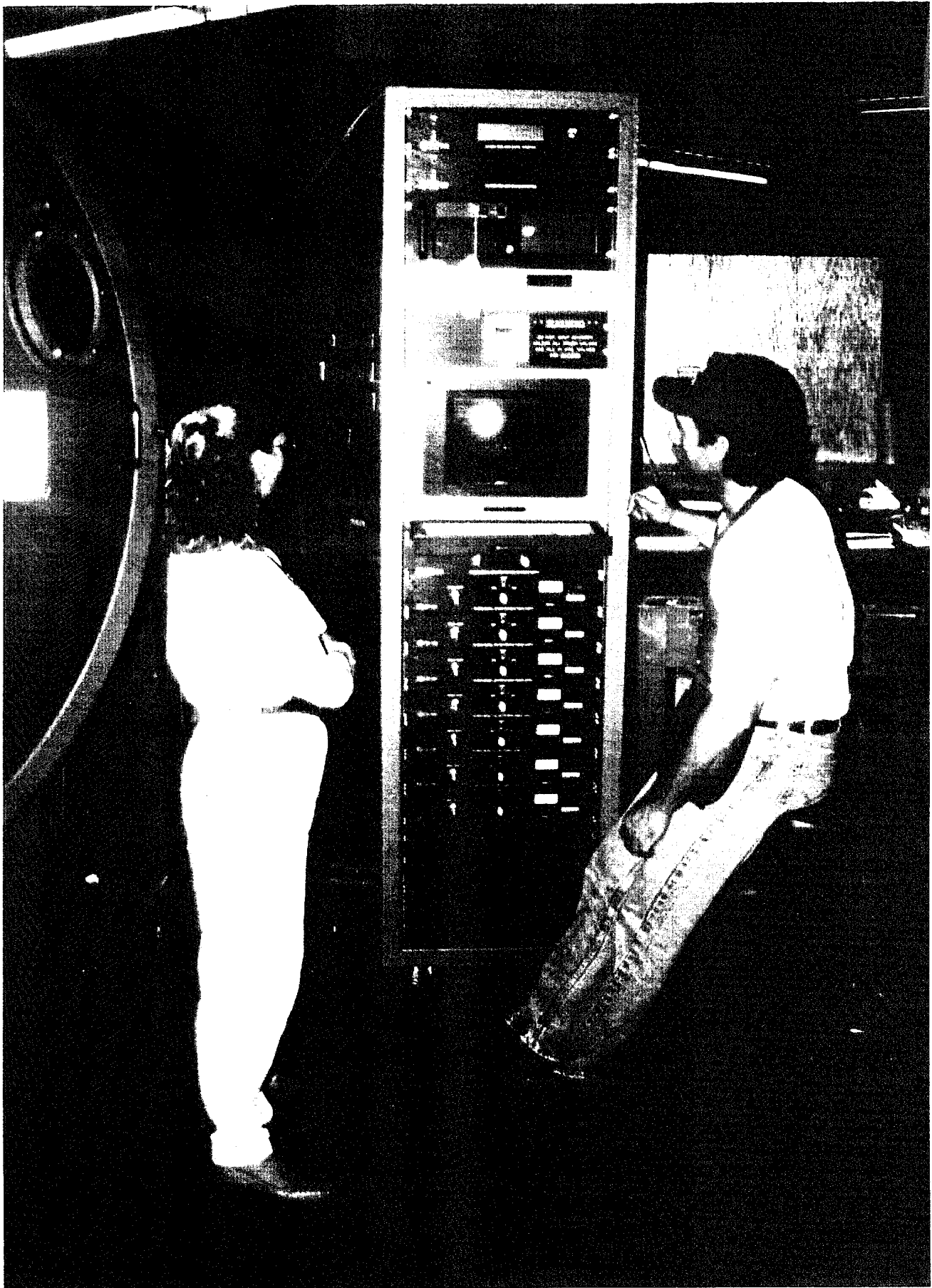


Roughing and diffusion pumps on back side of (AIVD) equipment at CCAD

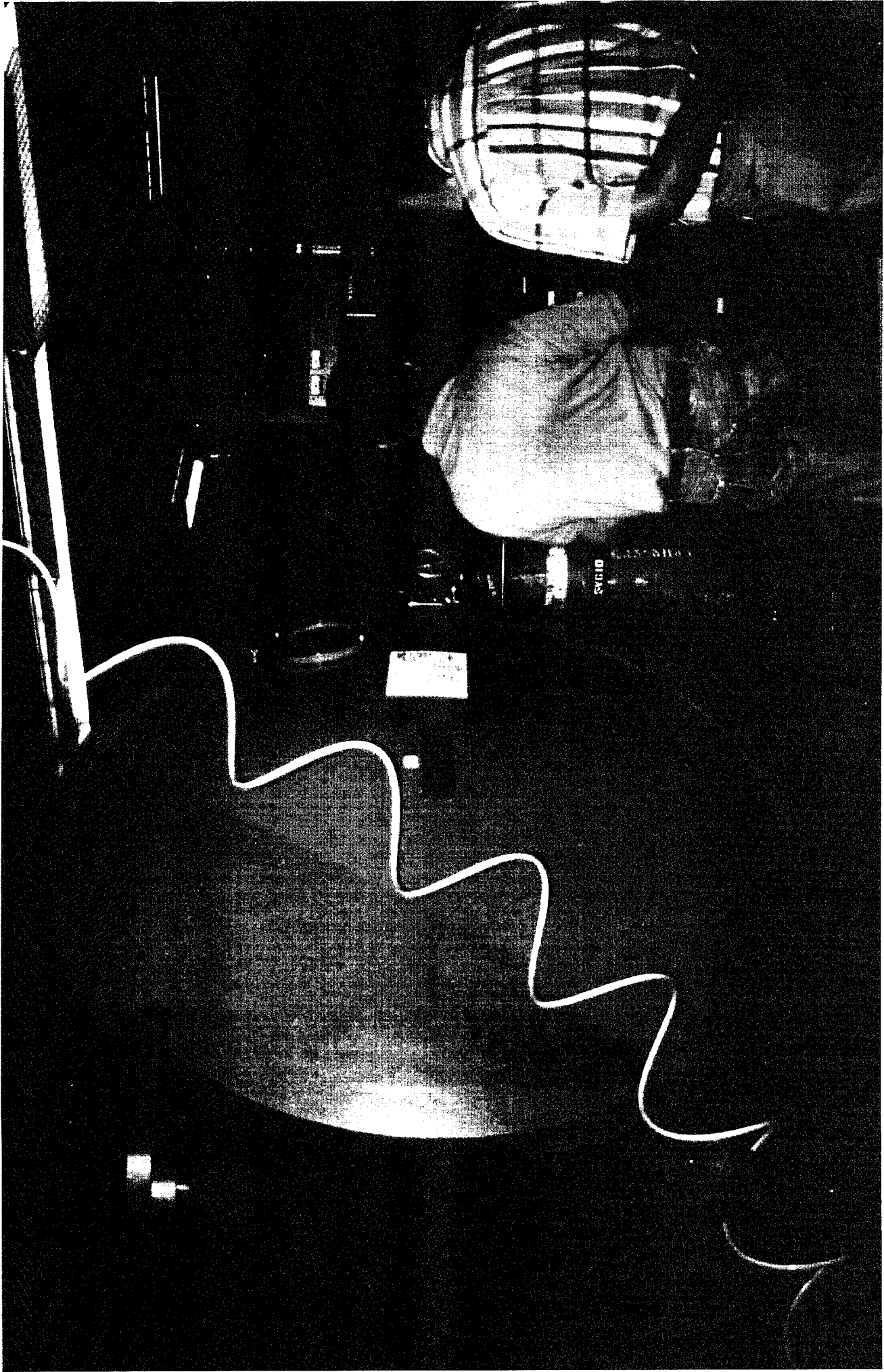


**Pneumatic floating rack with AIVD insertable barrels (2) used for coating small parts at CCAD**

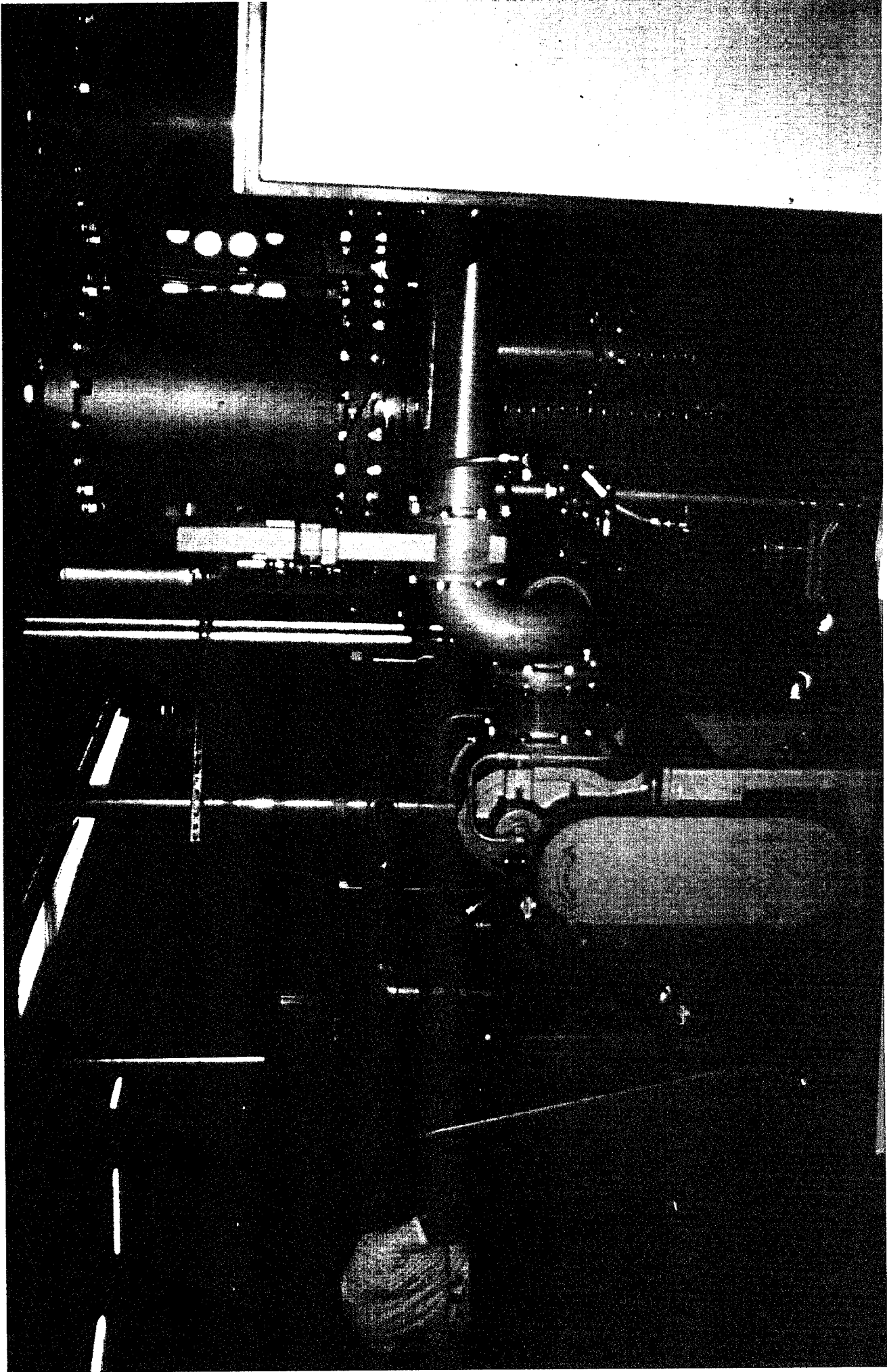




AIVD control rack with microprocessor, keyboard, vacuum gauges, and power supplies at CCAD

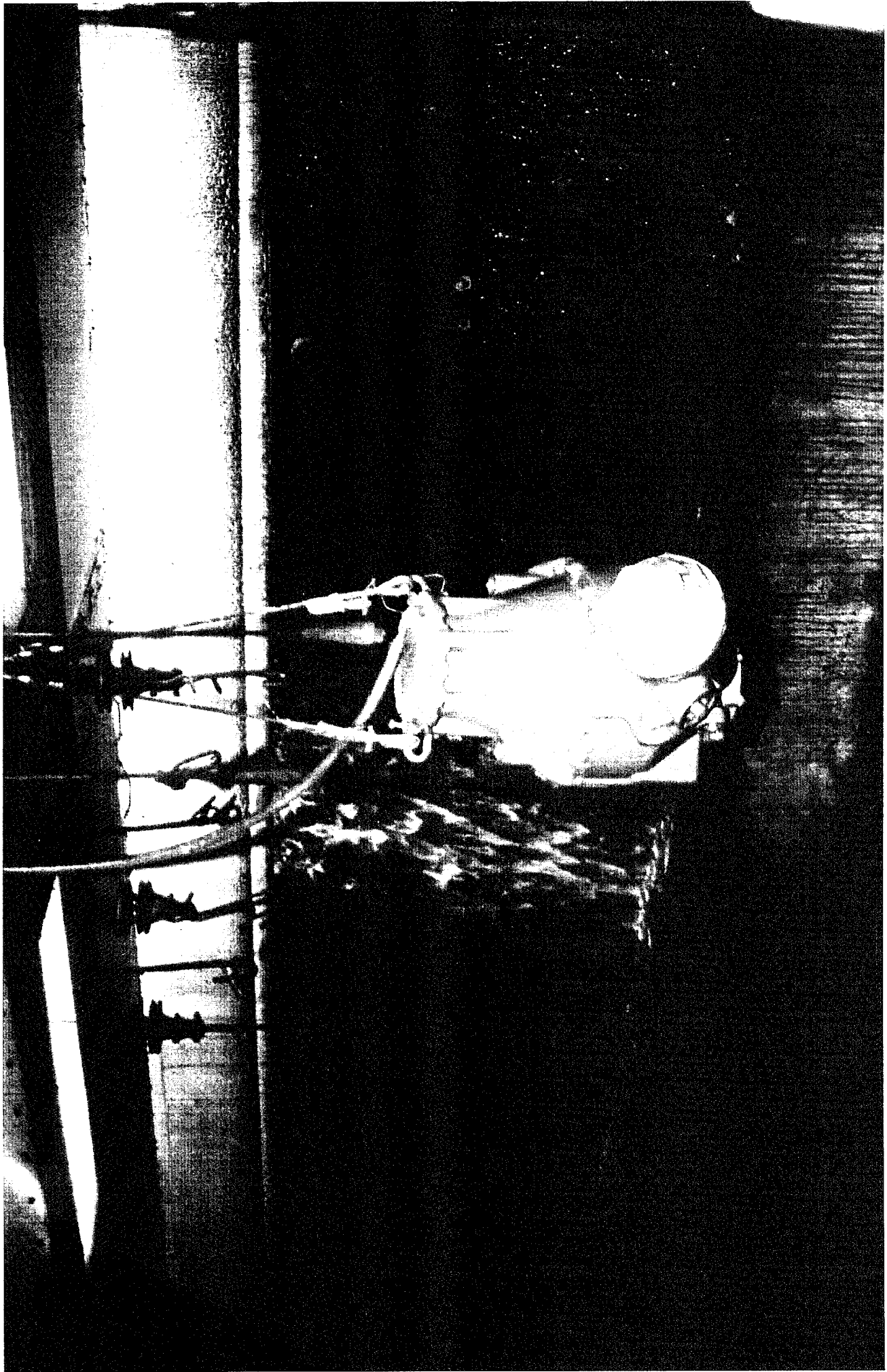


AIVD process chamber front door with argon cylinder visible between chamber and personnel at CCAD



Roughing and diffusion pumps on back side of (AIVD) equipment at CCAD





Cascading water of a wet spray paint booth shown with electric hoist in foreground at CCAD

## **DERA HAZMIN Project Effectiveness**

### **Site Visit: Fort Carson, July 1993**

Arthur D. Little personnel Mike Bryant and Mike Marando participated in meetings and a tour of the facilities at Ft. Carson on July 13, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN-funded project at Ft Carson including: funding request procedures; equipment procurement and installation; day-to-day operation and maintenance of the equipment; operator acceptance; and HAZMIN results and cost implications. Additionally, details were gathered regarding issues including: the timeframe and difficulties involved in initiating and completing a HAZMIN-funded project; the impact MIL-SPECs have on HAZMIN efforts; employee awareness of, and participation in, the HAZMIN program; and the transfer of technology between Army facilities.

Our point of contact (POC) at Ft Carson was Robert Mitchell (Safety/Environmental Officer) with the Department of Logistics (DOL). We were provided with detailed discussions relating to the HAZMIN project as well as a site tour to view the operation of the HAZMIN equipment.

The purpose of this trip report is to document the information obtained during the site visit. The trip report is presented in four sections to clearly identify and address the important issues.

#### **Site Description**

The primary mission for Ft Carson is to train military personnel. Included in this mission is the direction and coordination of installation logistics support, which includes provision of supplies and services, maintenance and management of materiel and equipment, movement of material and personnel, and training assistance. The site occupies over 137,000 acres in Colorado Springs, which is located approximately 50 miles south of Denver.

#### **Discussion of DERA Funded Projects**

The DERA HAZMIN-funded project addressed by this visit was the procurement and installation of jet washers to clean vehicle parts from tanks and trucks used in military exercises. The previous method of cleaning the parts involved vapor degreasers using 1,1,1-trichloroethane (TCA) as a cleaning media. The potential health risk to maintenance personnel was the primary reason for eliminating the vapor degreasers.

In 1990 the point of contact had arranged with a local vendor to have a jet washing unit tested. A pilot-scale unit was tested at the facility and had performed very well. The detergent used in the washer consisted of biodegradable products and did not pose a health threat to maintenance personnel. However, due to government procurement requirements, the \$128,166 purchase order for 12 parts washers was awarded to another vendor who was the low bidder by \$20,000. The vendor who received the equipment contract had experience with cleaning parts from aircraft engines, but had no experience cleaning parts from diesel engines. The POC indicated that the combustion of diesel fuel produces carbon deposits on engine parts which is significantly more difficult to clean than residue left on aircraft parts.

In order to install the jet washers some modifications were necessary. An electrical upgrade to 3 - phase, 480 volt service was extended to the equipment location. A tank which had contained TCA from the previous system had to be removed and an area had

to be excavated since the tank leached about two and a half feet into the ground. The system was able to use a sump already in place from the previous vapor degreasers. The installation cost of the units was \$26,445 and was completed in 1991.

Operation of the equipment has had some success, but there have been numerous difficulties. The initial cleaning solution did not perform as expected. A product by Calgon was then substituted, but this detergent produced severe foaming problems which ruined electrical sensors within the unit. This problem has occurred several times requiring replacement of expensive sensor (\$700 - \$800 each). Since the vendor manufactured their jet washers with parts from numerous sources, procuring new parts for the washers has been cumbersome. An anti-foaming agent is now being used to remedy the problem. The mechanics indicated that the equipment does clean the parts to a sufficient level, but not as thoroughly as the previous degreasers. Even with the jet washers' limited performance, the mechanics would rather use them, instead of the old vapor degreasers with TCA.

No cost savings data were generated, although the savings were believed to be substantial since the disposal cost of TCA contaminated oil was \$1300 - \$1400 per 55 gallon drum. However, the POC did indicate that the savings would be reduced due to the high maintenance inherent to the particular washers purchased.

#### **Other Areas of Interest**

Other HAZMIN efforts at Ft Carson include:

- Recycling of lead batteries. Ft Carson sells the spend lead acid batteries to a recycler who hauls the batteries offsite and reclaims the lead.
- Recycling of used antifreeze. Three recycling units are being tested for effectiveness.
- Eliminating the use of asbestos in brake pads for the vehicles. Asbestos was banned from use in vehicles in 1984, however, brake pads in DOD warehouses still contain asbestos. New shipments from a major U.S. vehicle manufacturer contained asbestos even though the box was labeled "No asbestos" and the packing lists stated that the pads contained asbestos. All brake shoes must then be disposed as hazardous waste.

The overriding problem in managing hazardous waste at Ft Carson is the lack of a cradle-to-grave accounting system of hazardous materials. The amount of hazardous material purchased by a operating unit and what is disposed as hazardous waste is known, but occasionally there is a discrepancy between the two values. An on-line inventory system, which would track the hazardous material on base and would allow an item manager to be the point of control, is being investigated. This measure would prevent excess materials from being purchased. A possible solution to this problem may be in the use of a software program developed by the Navy entitled Hazardous Inventory Control System (HICS). This program uses bar codes on materials to provide on-line tracking of hazardous materials. One site for all hazardous materials is be designated so that control and accounting of such materials would be far easier and would result in substantial savings.

On occasion, personnel order excess material without carefully investigating the contents of a product. After discovering that the product is one that they do not need, the materials are given to the DOL to handle. The DOL usually turns them over to the Depot Reutilization Marketing Office (DRMO), and if that agency cannot find a use for it in 90 days, the material is reclassified as a waste and is disposed. An example of this problem was the purchase of 90% sulfuric acid in place of the 30% concentration used in lead acid batteries. After using the acid and developing corrosion, the acid was turned over to DRMO. The agency was eventually able to find a purchaser for the chemical.

The Directorate of Environmental Compliance and Management (DECAM) is responsible for hazardous waste management at Ft Carson. The agency is also responsible for the annual training in hazardous materials (through a HAZMAT plan developed by a vendor) and hazardous waste management of approximately 250 Satellite Point Managers (SAPMs). Keeping up with the training requirements has been difficult with the personnel shortage, the personnel turnover and the lack of funds.

Discussions relating to technology transfer indicated that the POC was very familiar with HAZMIN technology through talks with environmental coordinators at other installations and attending seminars. He has yet to be informed of an Army-wide technology transfer seminar, at least within FORSCOM, although he has indicated that the need for such a seminar is vital to the success of the Army's HAZMIN program.

Ft Carson disposes of its site-generated hazardous waste through a local hazardous waste vendor. This vehicle allows for the rapid response to disposal requirements and eliminates fines due to violation of the 90 day maximum storage limit imposed by RCRA. Within Ft Carson, DECAM has the authority to issue fines if a discrepancy is noted between the amount of hazardous material that is brought onto the base and the amount of waste generated.

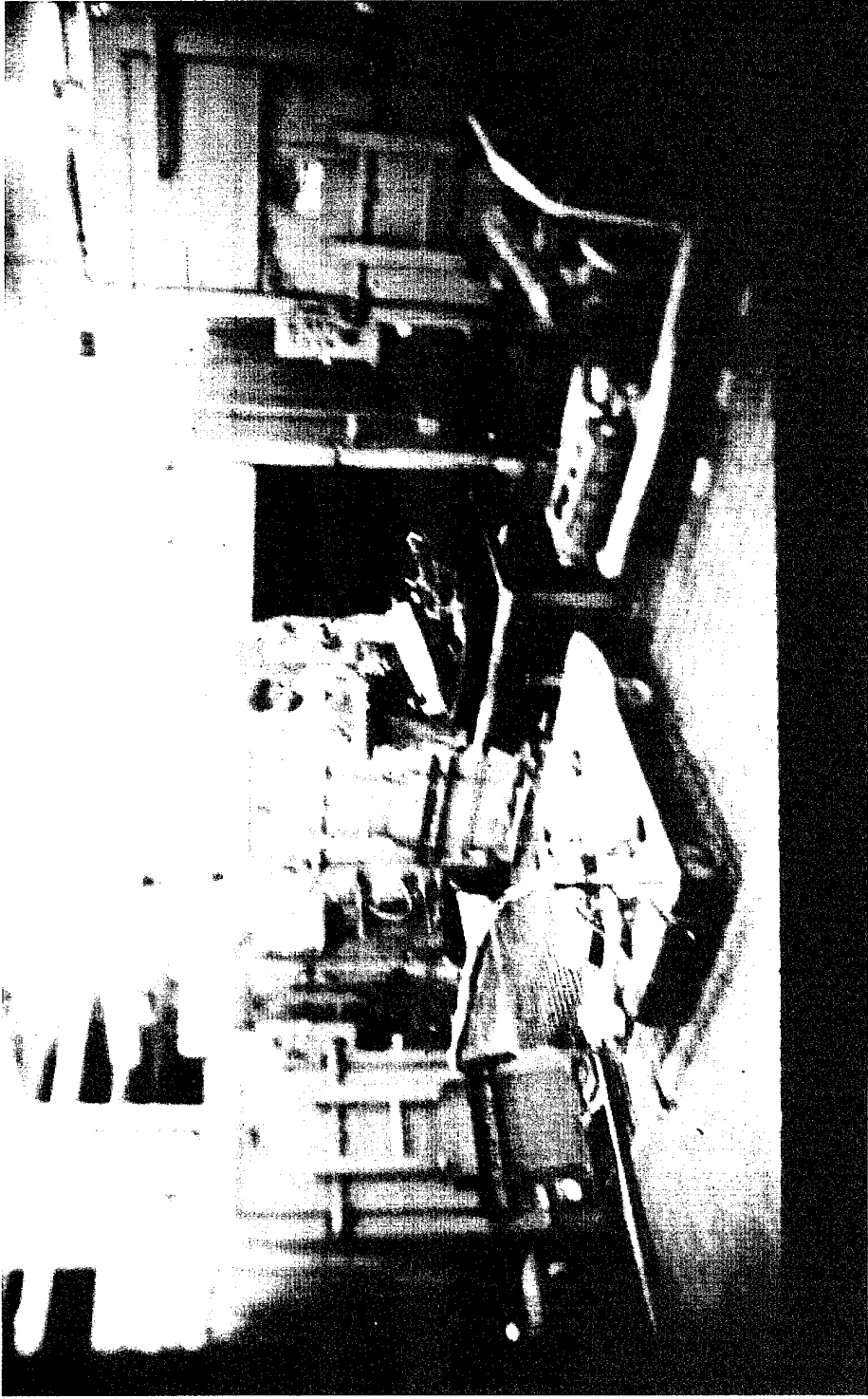
A camera was brought into the Ft Carson facility with prior permission and photographs of jet washing equipment were taken.

## **Conclusions**

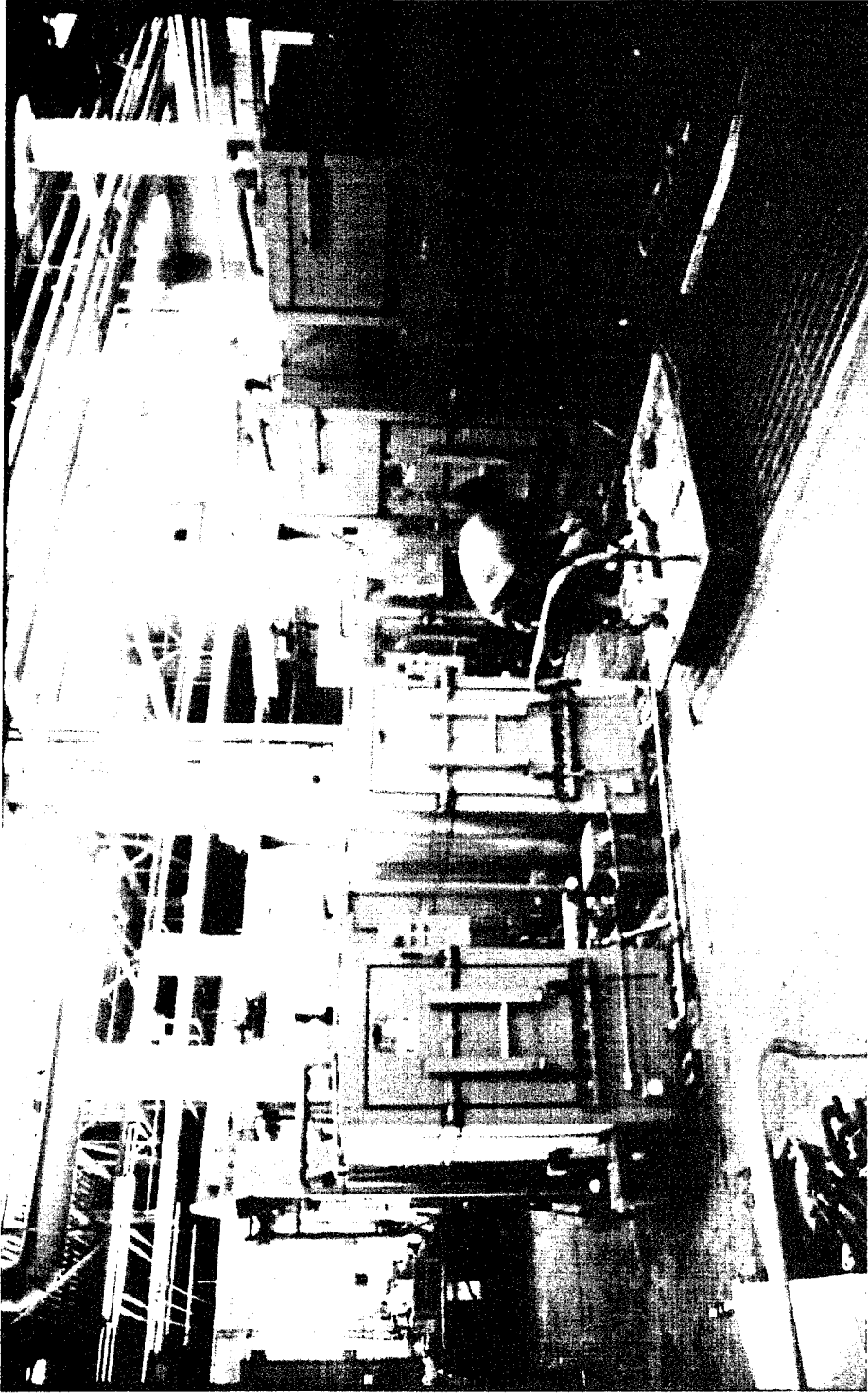
A few issues of concern in the DERA HAZMIN program were noted. The competitive bid process which resulted in the awarding of a bid to a less experienced vendor possibly contributed to the difficulties in proper equipment operation. The time frame with which to obligate the funds also presented a problem. The project manager effectively has three or four months to obligate the project funding. During this time an RFP must be written, vendor quotes reviewed and a bid awarded. Both were seen as a constraint in being able to effectively implement the project.



Sign at main entrance to Fort Carson (Gate 1 on Route 115)



A parts washer being loaded with engine parts at Fort Carson



A parts washer in operation at Fort Carson

## **DERA HAZMIN Project Effectiveness**

### **Site Visit: Milan Army Ammunition Plant, July 1993**

Arthur D. Little personnel Joyce O'Donnell and Colette Lamontagne participated in meetings and a tour of the facilities at the Milan Army Ammunition Plant (Milan AAP) on July 20, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN-funded project at Milan AAP including funding request procedures; equipment procurement and installation; day-to-day operation and maintenance of the equipment; operator acceptance; HAZMIN results; and cost implications. Additionally, details were gathered regarding issues such as: the time frame and difficulties involved in completing a HAZMIN funded project; the impact MIL SPECs have on HAZMIN efforts; employee awareness of and participation in the HAZMIN program; and the transfer of technology between Army facilities. The DERA HAZMIN funded project addressed in this site visit was the purchase of a dry vacuum system to reduce pinkwater generation.

Our primary point of contact (POC) at Milan AAP was Mike Harris (Engineer). We were provided with detailed discussions relating to the HAZMIN projects as well as an extensive site tour to view actual operation of HAZMIN equipment and discuss process and equipment related issues.

The purpose of this trip report is to document the information obtained during the site visit. A camera was brought into the Milan AAP facility with prior permission and was used to take photographs of HAZMIN equipment and in-process depot operations. The trip report is presented in four sections to clearly identify and address the important DERA HAZMIN-related issues.

### **Site Description**

Milan Army Ammunition Plant was constructed in 1941 and is a Government-Owned Contractor-Operated (GOCO) installation run by Martin Marietta with a primary mission to load, assemble, and pack (LAP) ammunition items. Milan AAP is one of AMC's largest generators of hazardous waste and has been designated as a Superfund site. However, over the past five years the hazardous waste generation has been reduced by more than 14,000,000 kg (AMC Progress Report 11/91). Most of the hazardous waste generated at this installation is pinkwater. However, smaller amounts of spent carbon, spent solvents, and painting wastes are also generated.

### **Discussion of DERA Funded Projects**

As a result of ammunition manufacturing operations at Milan AAP, explosive-contaminated waste is generated and collected in remote satellite collection areas. Originally, a dry vacuum system was used to collect the waste, but several explosions deemed this process a safety hazard. In order to reduce the potential hazards associated with the explosives, the Army mandated that a wet system be installed. The wet system vacuumed up the dry waste which would then pass through the primary receiver with a bag, and then through a secondary receiver where water was added in order to reduce the potential detonation. The pinkwater generated in the receiver was then emptied into sumps six to eight feet deep and piped to a facility where it was treated by activated carbon adsorption. Tests were conducted to determine if the carbon could be regenerated on-site, however, the results indicated that the regenerated carbon was too soft, and the granules were too degraded to allow reuse. Therefore, the spent carbon was required to be disposed of as a hazardous waste.



With the rising costs of hazardous waste disposal, potential liabilities, and AMCCOM's goal of 50% reduction of hazardous waste, this HAZMIN project was initiated to replace the wet vacuum systems with dry systems in order to reduce the amount of pinkwater and spent carbon generated. Safety issues previously experienced with dry systems were greatly decreased due to the additional precautions taken. These precautions include the following:

- In the past, steel pipes (which were brittle and could, therefore, act as shrapnel if an explosion occurred) were used. These have been replaced with aluminum pipes which simply burst open if an explosion occurs;
- The floors are made of conductive material that is grounded to prevent any buildup of static electricity which could create a spark and cause an explosion; and
- Additional piping was installed to ensure that each vacuum collection system would serve only two pressing bays instead of six to eight pressing bays. This would prevent any explosive propagation from one process area to another.

This project included the construction of six dry vacuum collection systems serving 12 pressing bays. The dry system follows essentially the same process as the wet system except that the secondary receiver also contains a bag to catch the particles and no water is added thus no pinkwater is generated. It was possible to use the former exhausters and receivers in the new dry system, so the DERA funds were used solely for the following purposes:

- Conversion of 3 wet systems to dry systems which entailed filling in the old sumps;
- Construction of 3 new dry systems and the building in which these systems are housed; and
- Converting the piping system to aluminum from steel as well as adding supplemental piping systems.

Quantitative values of cost savings and waste reduction are difficult to track and calculate for several reasons: the production rates at Milan AAP vary quite frequently; different types of ammunition generate different amounts of explosive waste; and the new dry vacuum systems have only been operating for a short time. However qualitative cost savings and waste reductions are obvious. Milan AAP is in an attainment area and has a permit for open burning. The explosive waste which is mixed with dirt cannot be recycled but can be open burned and used as an initiator of the open burning process, thereby eliminating the hazardous waste stream to be treated. Using the dry system also produces cost savings by reducing the need for purchasing activated carbon, drying the carbon before disposal, and disposing of spent carbon. The only available quantitative values of cost savings and waste reductions are based on the estimates used in the economic analysis performed for the proposal for the project. Pinkwater generation was predicted to be reduced by 38% or 2,380,500 gallons/year. Spent carbon generation was estimated to be reduced by 18%. Current operating costs of the treatment building, carbon disposal costs, and waste explosive drying costs would be reduced by \$17,294/year, \$2,475/year, \$14,108/year respectively.

A schedule of the dry vacuum system project was provided by Milan AAP and is attached to this trip report. The schedule includes site safety approval, RFQ for the new cubicles, award of the contract, construction, and repiping and installation. The installation and repiping time frame was much longer than anticipated. This was due to a conflict on production schedules. A previous construction project (repair of the roofs) required the production lines to be shut down. The production schedule could not tolerate a second shut down for the installation of the vacuum cubicles, therefore, their construction was delayed until the production schedule was brought up to date. Overall, the project took approximately 2.75 years to complete.

Despite the conversion of wet systems to dry systems for the pressing bays, Milan AAP still generates and treats some pinkwater. The largest source of pinkwater is the demilitarization process which is conducted if the ammunition does not pass inspection. Laundering of mops (used to sweep the floors of the production areas), and clothes worn by the production employees also is a source of pinkwater. A separate treatment system was set up for the laundry to prevent explosives from entering the sewer.

Milan AAP is studying the possibility of recycling the treated water back into their manufacturing process. The generation of pinkwater is considered a hazardous waste stream, for which the state of Tennessee collects a tax, even though it is treated prior to discharge. This tax can be lessened if the treated waste water is recycled. In addition, Milan AAP is hoping to be able to reuse the spent carbon as fuel in their boilers, and thus further reducing its hazardous waste generation. Milan AAP sent their interpretation of the regulations regarding this issue to the state for approval but has not yet received a reply.

### **Other Areas of Interest**

Since Milan AAP is a GOCO installation, Martin Marietta is competing with other GOCO installations for Army business and it, therefore, has several unique aspects. Martin Marietta has its own environmental staff which is responsible for maintaining the facility in compliance with all environmental regulations and permits. The Army also has environmental and other staff on site to oversee Martin Marietta. The relationship between the Army and Martin Marietta is very good. There is a HAZMIN plan in place because of the mandate from the DA. There are also quality circles and an employee suggestion program for encouragement of suggestions. Most of the suggestions, however, are regarding production, not HAZMIN issues.

The contract between Martin Marietta and the Army covers a five year period. During that time Martin Marietta produces an annual budget taking into account operating costs such as salaries and utilities. They are reimbursed by the Army for all budgeted items including disposal costs and fees (which are based on the quantity disposed). Martin Marietta also receives a "fee", which adds to their profit base and is based on their compliance with the contract. This arrangement affects the motivation for reducing hazardous waste. By reducing the quantity of hazardous waste, the Army reduces its costs for hazardous waste disposal. This cost savings does not increase Martin Marietta's profits directly because waste disposal is paid by the Army, but it does increase Milan AAP and Martin Marietta's competitiveness overall.

Furthermore, responsibility for fines or violations is unclear. Currently, the permits necessary for the operation of the plant are obtained by the Army and if violations are incurred, Martin Marietta loses some of their "fee" from the Army. However, it is stated in the contract that Martin Marietta will comply with all laws and regulations so there is a disagreement as to who is responsible for paying the fines. As a result there is an increasing trend toward including the contractor in the permitting process for liability reasons.

In general, military specifications have not been a problem or an impediment to hazardous waste minimization. Nonetheless, the technical data packages which describe step by step the procedure for production of each type of ammunition are very strict and are often unreasonable. Any changes in the data package requires the filing of additional paper work to request the change. The funding procedure was also seen as a problem. Martin Marietta is responsible for completing the funding applications and forms. The application process seems to be random because money can be applied for under several different programs. In addition, the GOCO may be asked to produce a proposal/funding package for a project, and then not hear anything regarding the project for several years. This type of response leads to frustration and in some cases the project is no longer relevant or accurate. Once approved, the funds are usually not received at the installation for months after the start of the fiscal year so there is not enough time to complete the project with the allocated funds.

The issue of technical transfer was discussed. Unlike a majority of Army depots that are government-owned government-operated, tech transfer is not widely received at Milan AAP, primarily because they are in competition with contractors operating the other AAP's. Some tech transfer does occur at conferences but it is usually at a very superficial level.

In addition to pinkwater and spent carbon, small amounts of paint waste and spent solvents are generated at Milan AAP. Milan AAP produces one type of ammunition with a combustible case that requires painting. There were some problems with ventilation of the paint booth but this was rectified by the addition of more fans. The use of CARC paint and wet paint booths was eliminated. Currently, all the paint waste is dry and the filters are burned. The spent solvent generated is from a parts cleaning operation that utilizes Varsol (a solvent similar to kerosene). Milan AAP addressed this hazardous waste stream by contracting Safety Kleen to recycle the Varsol.

## **Conclusions**

Milan AAP has addressed their largest hazardous waste stream, and is beginning to address some of the smaller streams. The dry vacuum systems are operating well and have resulted in a reduction in hazardous waste generation and cost savings. Quantifying waste reduction and cost savings has not been accomplished because of the variations in production levels. However, estimates of \$34,147/year total cost savings, 38% reduction in pinkwater generation, and 18% reduction in spent carbon have been made. The application and funding procedures appear to be inefficient, and somewhat frustrating. The technical data packets were found to be very strict and should be reviewed for possible improvements. Lastly, Milan AAP's position as a GOCO impedes technology transfer from one installation to another.

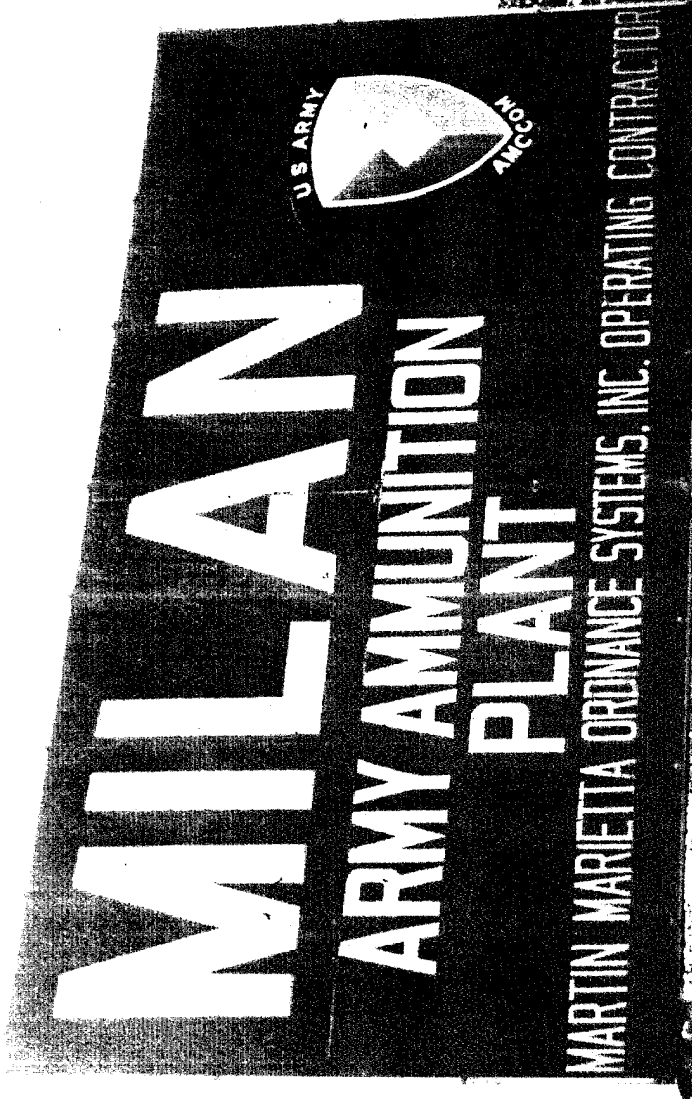
PROJECT 5899993  
 PERFORMANCE AND COST ANALYSIS

[O] Original Milestone  
 [A] Milestone Accomplished  
 [1 - 8] Revised Milestone

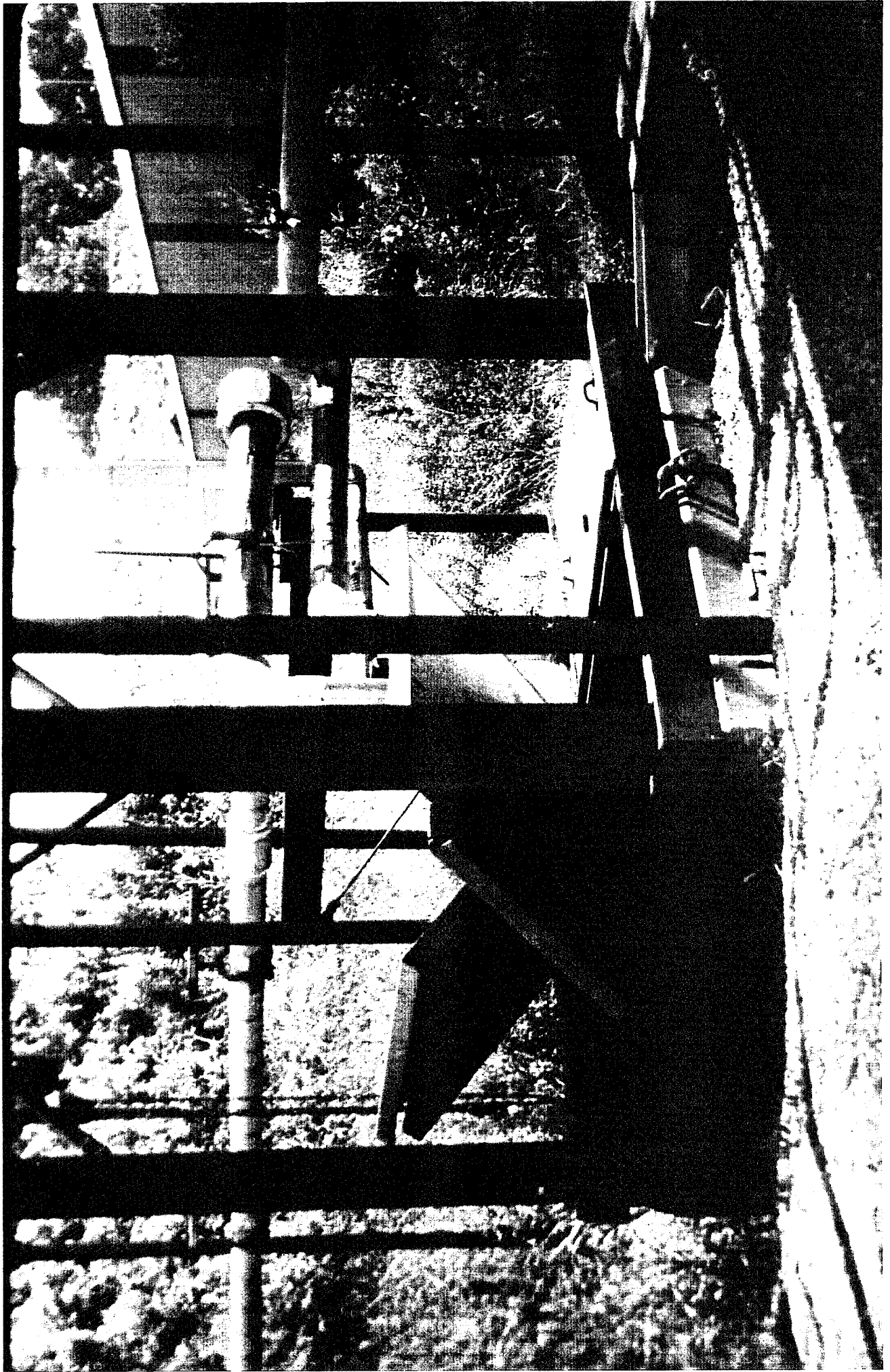
| TASK  | FY 90                                  |         |         |         | FY 91   |         |         |         | FY 92   |         |               |               | Man/Hours |      |
|---|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|---------------|-----------|------|
|   | 2nd Qtr                                | 3rd Qtr | 4th Qtr | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr       | Est           | Exp       |      |
|   | Convert Existing Vacuum Systems to Dry | >>>[O]  | >>>[1]  | >>>>>>  | >>>>>>  | >[2]>>  | >>>>>>  | >>>[3]  | >>>[4]  | >>>[5]  | >[6]>>        | [7][8]<br>[A] | 1874      | 2666 |
| Safety Site Submission  | [A]                                    |         |         |         |         |         |         |         |         |         |               | 60            | 68        |      |
| Safety Site Approval  | >>>>>>                                 | >>>>>>  | >>[A]   |         |         |         |         |         |         |         |               | 0             | 0         |      |
| RFQ for New Cubicles, Lines B and X                                 | >>>>>>                                 | >>>>>>  | >>[A]   |         |         |         |         |         |         |         |               | 0             | 0         |      |
| Award Contract for New Cubicles                                     | >>>>>>                                 | >>>>>>  | >>>[0]  | [1][A]  |         |         |         |         |         |         |               | 0             | 0         |      |
| New Construction Complete   | >>>>>>                                 | >>>>>>  | [0][1]  | >>>[2]  | [A]     | >>>[3]  |         |         |         |         |               | 98            | 98        |      |
| Install Roofs and Sidewall on New Cubicles                          | >>>>>>                                 | >>>>>>  | >>[0]>  | [1]>>>  | >>>>>>  | [2][A]  |         |         |         |         |               | 1460          | 549       |      |
| Repipe Existing Systems; Install Dry Vacuum Systems in New Cubicles | >>>>>>                                 | >>>>>>  | >>[0]>  | >>>[1]  | >>>[2]  | >>>>>>  | >>>[3]  | >>>[4]  | >>>[5]  | >[6]>>  | [7][8]<br>[A] | 1778          | 769       |      |

EXPENDITURES:

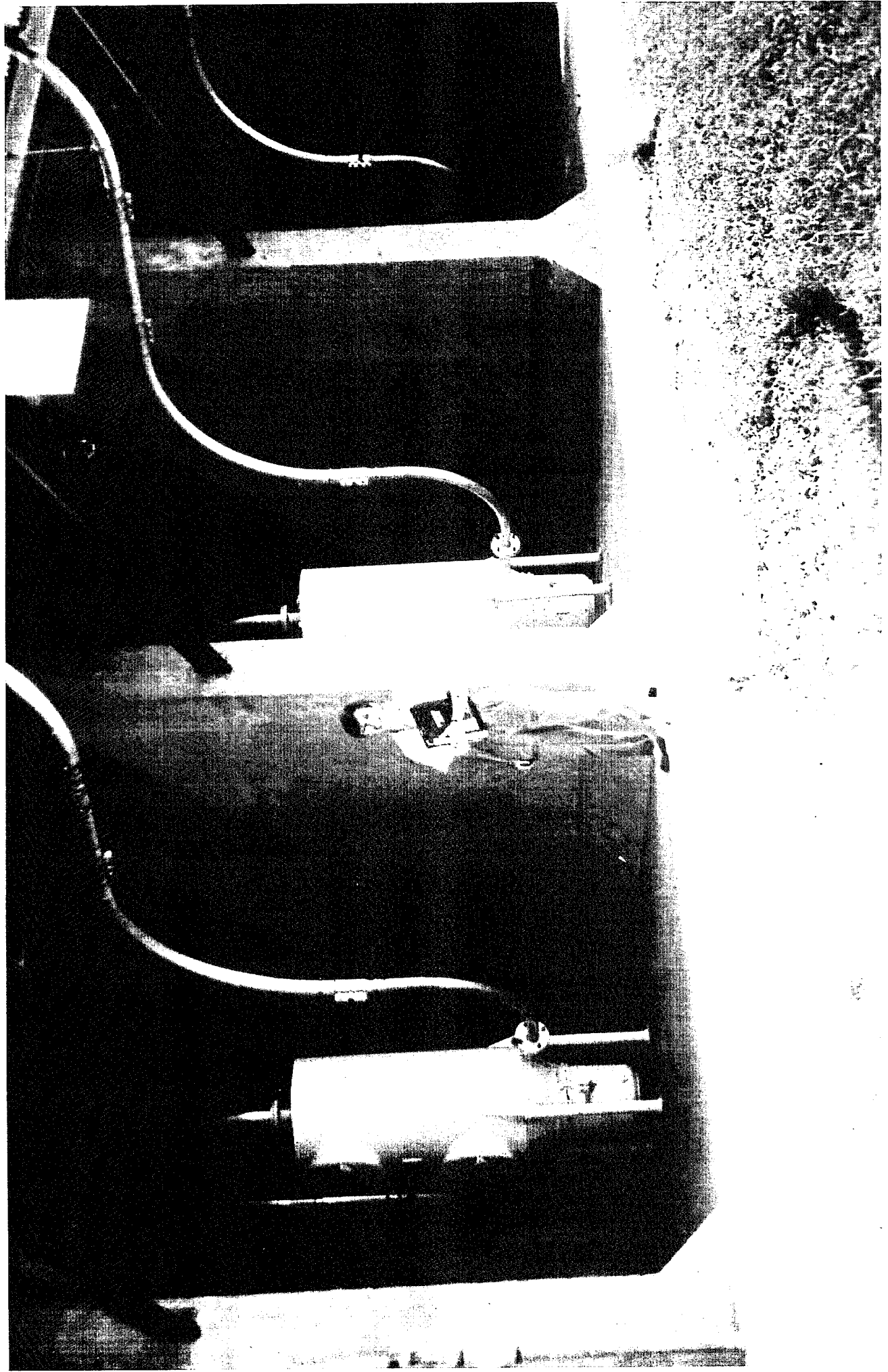
\$289,933.00 Total Funds Received (9/11/89)  
 \$286,003.36 Amount Expended



The sign at the main entrance of Milan Army Ammunition Plant

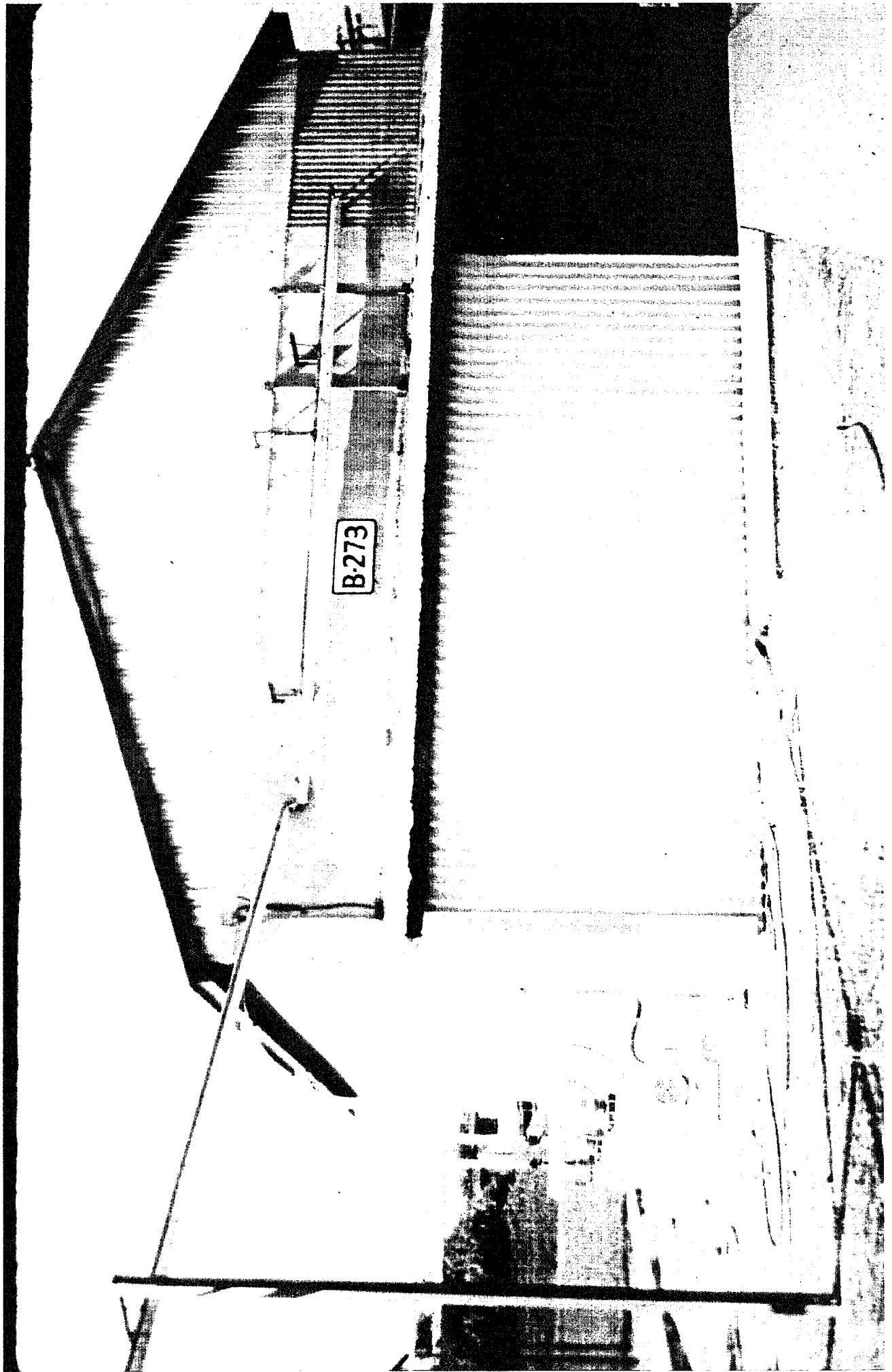


A pinkwater sump outside an LAP facility



A dry vacuum system cubicle showing receivers at MAAP





A dry vacuum system showing exhausters at MAAP



## **DERA HAZMIN Project Effectiveness**

**Site Visit: Pine Bluff Arsenal, July 13, 1993**

Arthur D. Little personnel Joyce O'Donnell and Dr. Raymond Machacek participated in meetings and a tour of the facilities at Pine Bluff Arsenal (PBA) in Pine Bluff, AR on July 13, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN funded projects at the facility including funding request procedures, equipment procurement and installation, day-to-day operation and maintenance of the equipment, operator acceptance, HAZMIN results, and cost implications. Additionally, details were gathered regarding issues such as: the time frame and difficulties involved in completing a HAZMIN funded project; the impact MIL-SPECs have on HAZMIN efforts; employee awareness of and participation in the HAZMIN program; and the transfer of technology between Army facilities.

Our primary point of contact (POC) at PBA was James Hayley, Process Chemical Engineer, who arranged for a joint meeting with Phillip Vick, Chief of Environmental and Natural Resources Management. James Hayley and Phillip Vick provided us with detailed discussions and an extensive site tour to view HAZMIN equipment.

The purpose of this trip report is to document the information obtained during the site visit. The trip report is presented in four sections to clearly identify and address the important DERA HAZMIN related issues. These sections are: Site Description, Description of DERA Funded Projects, Other Areas of Interest and, Conclusions.

### **Site Description**

The primary mission of PBA includes the operation of manufacturing lines and the support of manufacturing by conducting pilot production, pre-production, and limited production operations. The primary products of the Arsenal are smoke grenades, smoke pots, colored smoke signals, and white phosphorus projectiles. PBA also operates a chemical laboratory and a chemical depot -- unique to AMCCOMM installations. PBA is located in Jefferson Count, Arkansas, approximately 30 miles southeast of Little Rock.

PBA has several areas of operation including an Arsenal and a Depot. There are several supporting functions on site such as a hazardous waste incinerator, a hazardous waste landfill, and an industrial wastewater treatment system. The Depot operations include maintenance, storage, and demilitarization of ammunition weapon systems. Specifically, this includes storage bunkers for munitions, a BZ demilitarization facility, and demilitarization of bombs and shells.

### **Discussion of DERA Funded Projects**

Two DERA HAZMIN funded projects were reviewed during the site visit to PBA; a metal shredder, and a semi-tropical bleach (STB) reclamation system. The metal shredder was purchased in late 1990 and installed in early 1991. The equipment was purchased from the lowest bidder at \$87,000. The system was an off-the-shelf metal shredder, therefore, no installation problems were encountered. This shredder is used to shred voluminous materials that are normally landfilled. PBA generates a large volume of metals waste from their operations such as barrels, paint cans, and demilitarized munitions. No hazardous waste is processed in the shredder. The shredder has resulted in a 50% reduction in the volume of waste requiring landfilling (2000 cu yd per year), and a cost savings of approximately \$1,000,000 per year. In addition, PBA processes some metal scrap from the shredder through a box furnace to remove organic

contamination and produce a scrap suitable for recycling through DMRO. No detailed records have been kept to determine the exact waste and cost savings that this project has resulted in, primarily because it is a reduction in solid waste, not hazardous waste.

The second project, the STB reclamation system, was initiated in approximately 1984 due to excess volumes of STB that contained below the required concentration of chlorine. This required the material to be disposed of as a hazardous waste, and also required the purchase of fresh STB. STB is used to generate decontamination solution for chemical agent. DLA and other Army installations have large stores of STB that do not meet the military specifications for Cl content. Batelle Memorial Institute piloted a wet rejuvenation system involving the dissolution of the solid form of STB in water, and introducing Chlorine gas to react and increase the chlorine content to within specification. After some initial tests, the pilot plant was turned over to the Army, however, it was not properly rinsed and severely corroded by chlorine to the point where it was unusable. DERA funds were used to purchase full-scale equipment, and additional funds have been received for a contract to build, install, test, and train operators on the system. The equipment includes, glass-lined reactor tanks, a carpenter-alloy centrifuge to separate the rejuvenated bleach from the liquor, a toroidal drier to dry the product and a baghouse to recover the product and to clean the offgases.

The total spending for this project is approximately \$1.5 million since 1984, however, the DERA funded portion is approximately \$345,000. Initially, funding for this project was resisted by AMCCOM because it was felt that it was in support of DLA which does not fall under the responsibility of AMCCOM. However, PBA was able to justify the project. The economic analysis for this project shows a return on investment of 26%, or \$435,200 per year over a ten year period. Details of this economic analysis are provided below:

Present Alternative: - continue buying STB from a foreign, overseas supplier and buying hazardous waste landfill space to hold out of spec STB.

|       |   |             |
|-------|---|-------------|
| Cost: | Purchase of 765,025 lbs At \$1.78/lb -      | \$1,361,746 |
|       | Landfill space for 502,000lbs at \$.18/lb - | 90,360      |
|       | Salvage of 263,026 lbs/yr at \$.027/lb -    | (7,085)     |
|       |   | -----       |
|       |   | \$1,445,021 |

Proposed Alternative - install an STB rejuvenation system.

Cost: Rejuvenation of 765,026 lbs at \$1.32/lb - \$1,009,800

The cost savings per year is: \$435,200

PBA projects that this system will be operating by the end of 1994. PBA also projects that if the system were operated for 24 hours per day, it would take six months to process all of the STB that the DLA has presently stored.

Additional DERA funds have been used to conduct groundwater monitoring of areas that were remediated over the last 20 years. Approximately \$250,000 of additional DERA

funds has been requested to conduct remedial investigation/feasibility studies (RI/FS) at the site as are required under the Resource Conservation and Recovery Act (RCRA).

### **Other Areas of Interest**

PBA has several other wastes that are difficult to dispose of. These wastes are generated from the colored signal material used to create colored smoke for the signalling grenades. The colored signal materials are a mixture of ingredients including food coloring, corn starch, sodium carbonate and sodium perchlorate, and are thus not considered a hazardous waste. However, because they are classified as a Class C explosive, they are not accepted by DRMO to find a potential alternative use. Thus, the colored signal materials are being stockpiled and the environmental personnel are seeking a buyer, such as the plastic or textile industry. If the dye was sold at market price, a revenue or savings of \$1.5 million dollars could be realized. Another problem with this is the way that the Federal Acquisition Regulations (FARS) are written. These regulations govern how material and equipment is purchased, and make it difficult for equipment or raw materials to be sold.

Another area in which PBA is requesting funding is to develop a tighter process control conditions for preparing the batches of smoke mixtures. Currently, the largest source of off-spec smoke mix is from mixtures that were not formulated correctly, however, there is no set procedure for formulation or any instrumentation used to provide guidelines for the formulation. An economic analysis was prepared and funding requested to conduct this type of process control procedures for the white smoke manufacturing line which utilized hexachloroethane (HC), zinc oxide, and aluminum. Specifically, the objective of the project is to determine what qualities of the raw materials are most important to obtain a burn time within specification limits. A relationship between the raw material factors and burn time would be developed so that if the characteristics of each raw material are known, the formulation of the mix can be adjusted based on a statistical burn time model. The economic analysis indicated that the project would cost approximately \$298,000 and would provide a payback of \$68,000 per year. The resulting saving/investment ratio is 1.56 and the rate of return on investment is estimated to be 26%.

The HC waste that is generated is currently on the land ban list, and is difficult to incinerate. Therefore, PBA is forced to stock pile the material until a waste disposal method is determined. Additional research is on-going for a sublimation process to treat the HC.

In addition to the stock piling of HC, PBA is also stockpiling waste phosphorous. There is a proposal which has been submitted to conduct pilot tests for burning phosphorous containing wastes in the existing hazardous waste incinerator.

As in other site visits, the issue of the time frame of funds availability, and the penalties associated if funds cannot be appropriated within the given time frame, were discussed. This is particularly difficult for projects such as the STB rejuvenation facility because of the need to develop specifications or an RFP, request bids from competitive companies, review the bids, and deal with any protest letters. Many times, this takes up to six months, and the funds are no longer available. This may also cause money to be spent unwisely just because of the tight time constraints and the penalty induced if the money is not spent. In addition, PBA is considered a Defense Base Operating Facility (DEBOF). A DEBOF facility is restricted in the type of funding it can receive, and primarily can only

spend what their earnings are from the products they manufacture. The DEBOF status requires that they operate as private industry in that if another facility can conduct or produce the required task for less money, it can be awarded to the lowest bidder. This further restricts funds which could be applied to HAZMIN projects.

Discussions regarding MIL-SPECS revealed that many documents dealing with chemical munitions are very outdated, and create conflicts with EPA requirements i.e., requiring the use of di-octyl phthalate smoke (a hazardous material) for filter testing filter, and the use of Freon in other tests. This same problem is also encountered by the Depot operations on the base. The Depot conducts rework, storage, and demilitarization of ammunition weapon systems such as tanks, bombs, and shells. The Depot Maintenance Work Requirements (DMWR's) required to conduct product and operational requirements are outdated and make some HAZMIN efforts difficult. The POC's felt that part of the problem comes from the development sources, and that the organizations which develop the processes and products should be very conscience of HAZMIN efforts and safety considerations. If this were accomplished, much of the hazardous waste generated and Mil Spec conflicts could be avoided.

Discussions relating to technology transfer revealed that because the operations at PBA are so unique, useful technology transfer does not occur. When conferences and seminars are scheduled with applicable subject matter, they are attended.

A hazardous waste minimization plan does exist at the Arsenal as is required by the DA. No prioritization or procedure is currently being used to coordinate projects. This is primarily because the Arsenal operates as a job shop processing requested primarily from Aberdeen to produce products according to their specifications. This type of climate makes it difficult to categorize any specific waste or project. No formal procedure exists to follow up on any HAZMIN project, except in the asset capitalization group which requires a follow-up. In general, it is dependent upon the type of project and the amount of funding that was required for any formal follow-up to occur.

One area in which the Arsenal reflected upon was the creation of waste quantities that were generated per unit process. This kind of base line development would have been useful because production information is variable, but readily available. Waste generation information is available, but difficult to sort and tabulate.

Employees are encouraged to participate in quality circles, however, employee buy-in and participation has been limited. The production line nature and the education and age of the employees has made it difficult to implement such programs. The old style of manufacturing and management is not questioned, and any change or suggestion of the use of TQM procedures is difficult to implement. The management stresses the use of SOP's for manufacturing and discourages any deviation. The incinerator employees, however, are generally more educated and are willing to accept TQM procedures and offer suggestions.

The environmental staff indicated that the state regulatory agencies have been reasonable and favorable to deal with. This is partially due to the fact that the environmental staff at PBA is very well educated because of the various issues they are required to deal with including their hazardous waste incinerator (TSD status), air emissions from the chemical processing, hazardous waste landfill, wastewater treatment plant, and others.

A camera was brought into the PBA facility with prior permission and was used to take photographs of HAZMIN equipment and in-process Depot operations.

### **Conclusions**

Operations at PBA are fairly unique and independent within the Army, and thus create a unique set of problems. Actions are being taken on various HAZMIN projects, however, their status as a DEBOF facility limit the funding amounts and mechanisms for funding. Mil Specs and funding time frames are also an obstacle. The personnel felt that it needed some support from further "up the ladder" in the development stages of the processes which are performed at the facility in order to enhance HAZMIN efforts. In addition, it was felt that TQM techniques should continually be pushed on employees even if some employees resist.

**U.S. ARMY**  
 **WELCOME**   
**PINE BLUFF ARSENAL**

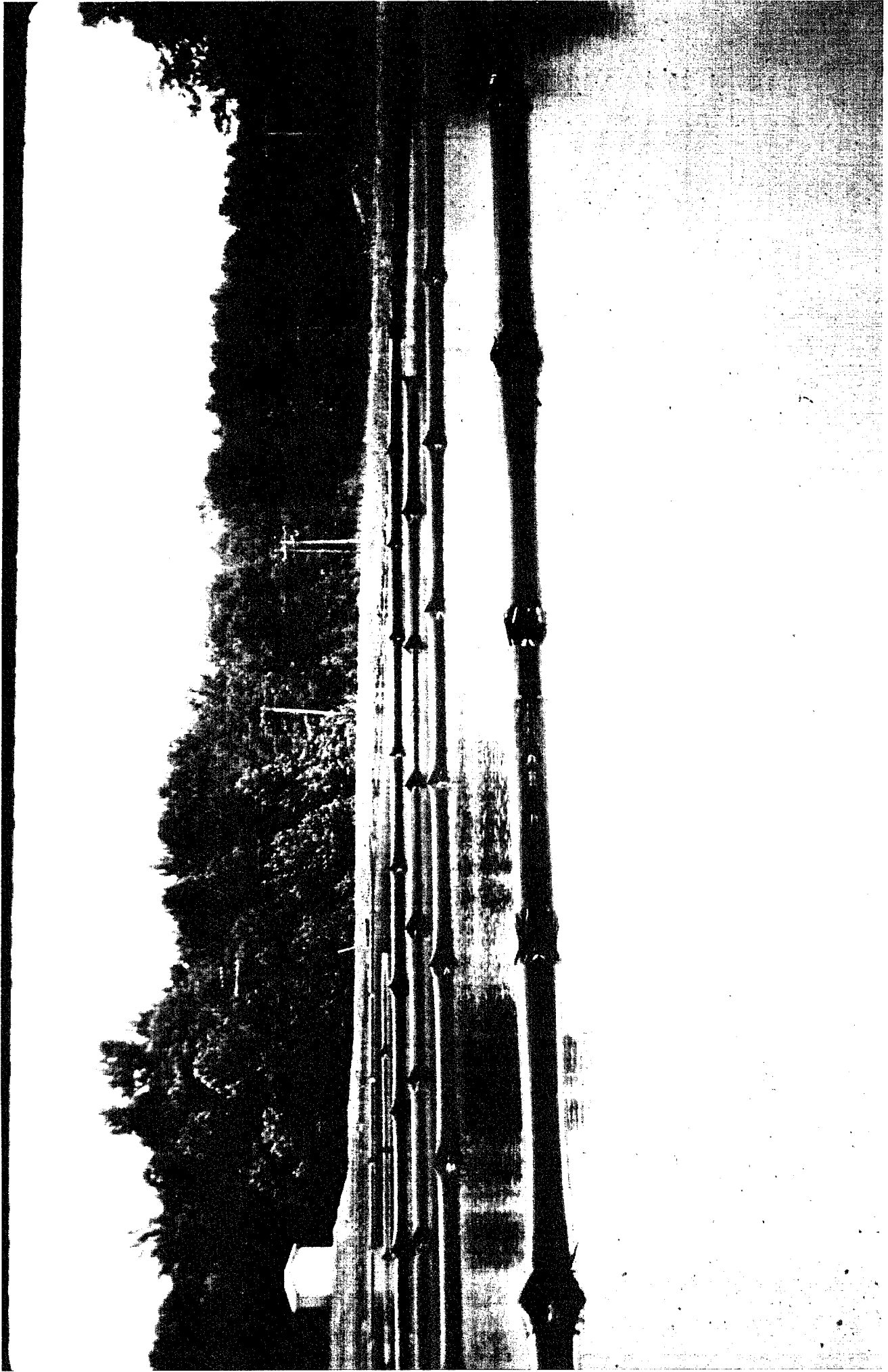
**DRAGON COUNTRY** 

The sign at the main entrance of PBA



PBA Facility Map



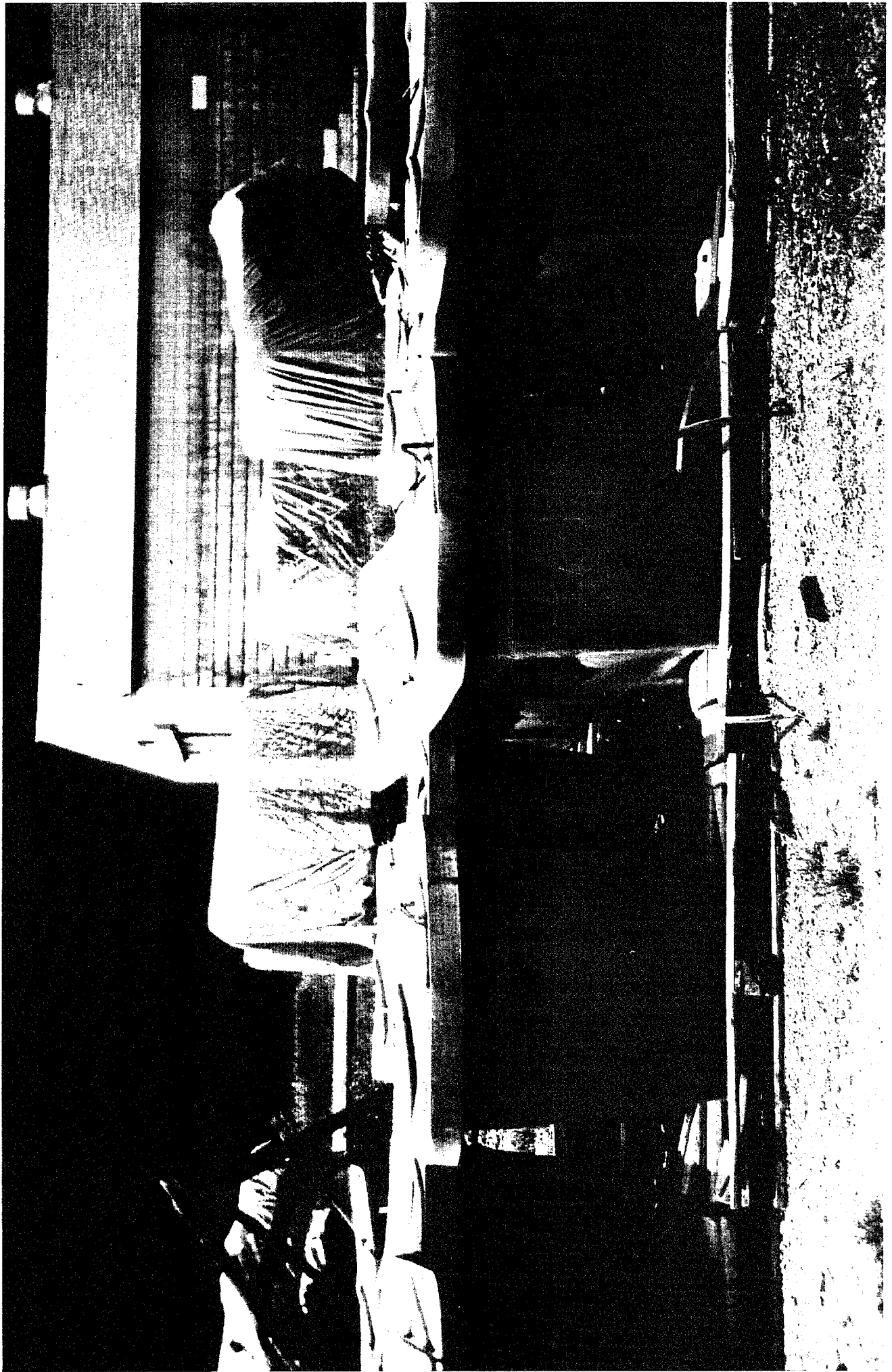


PBA's settling ponds for activated carbon

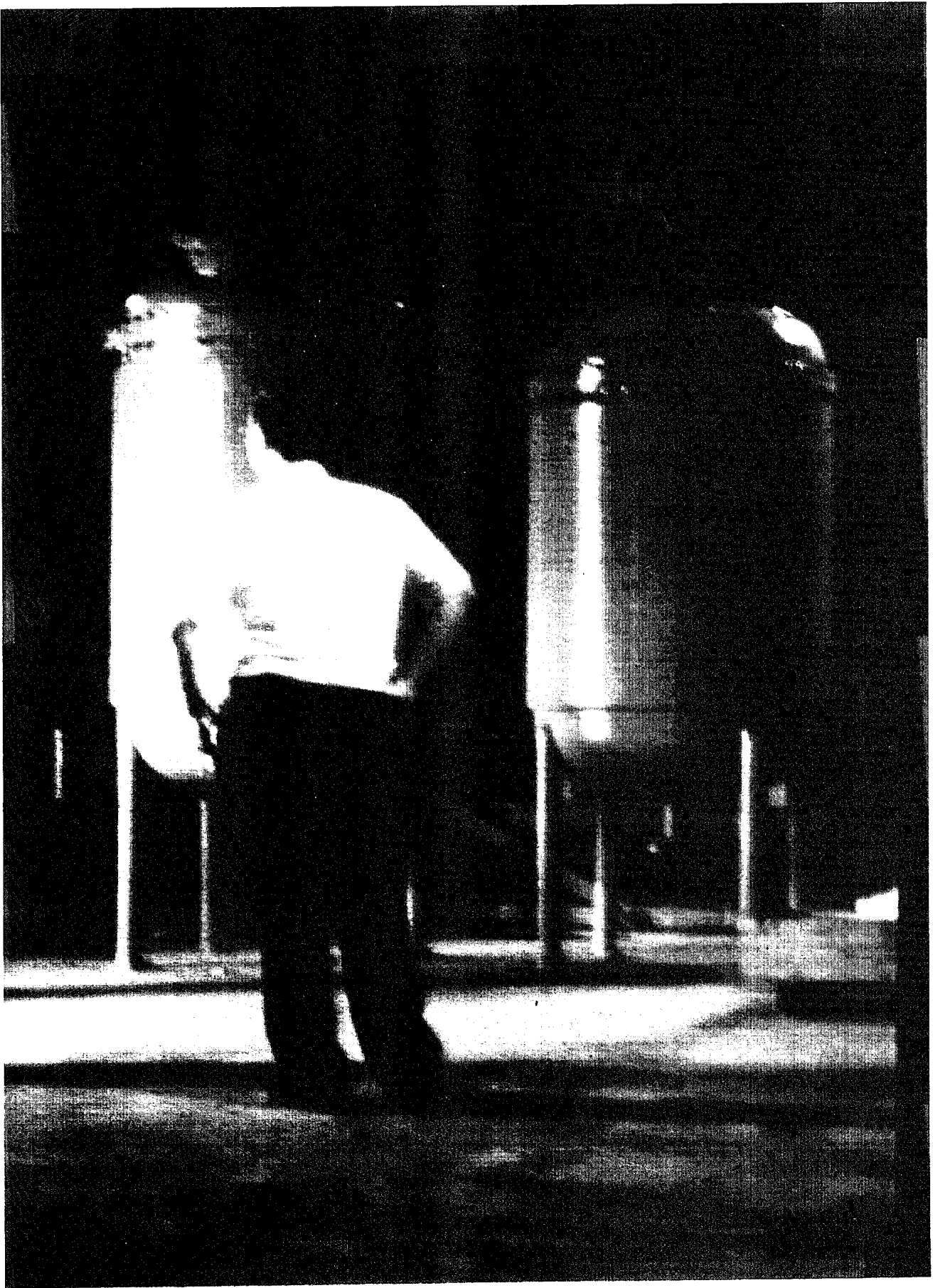




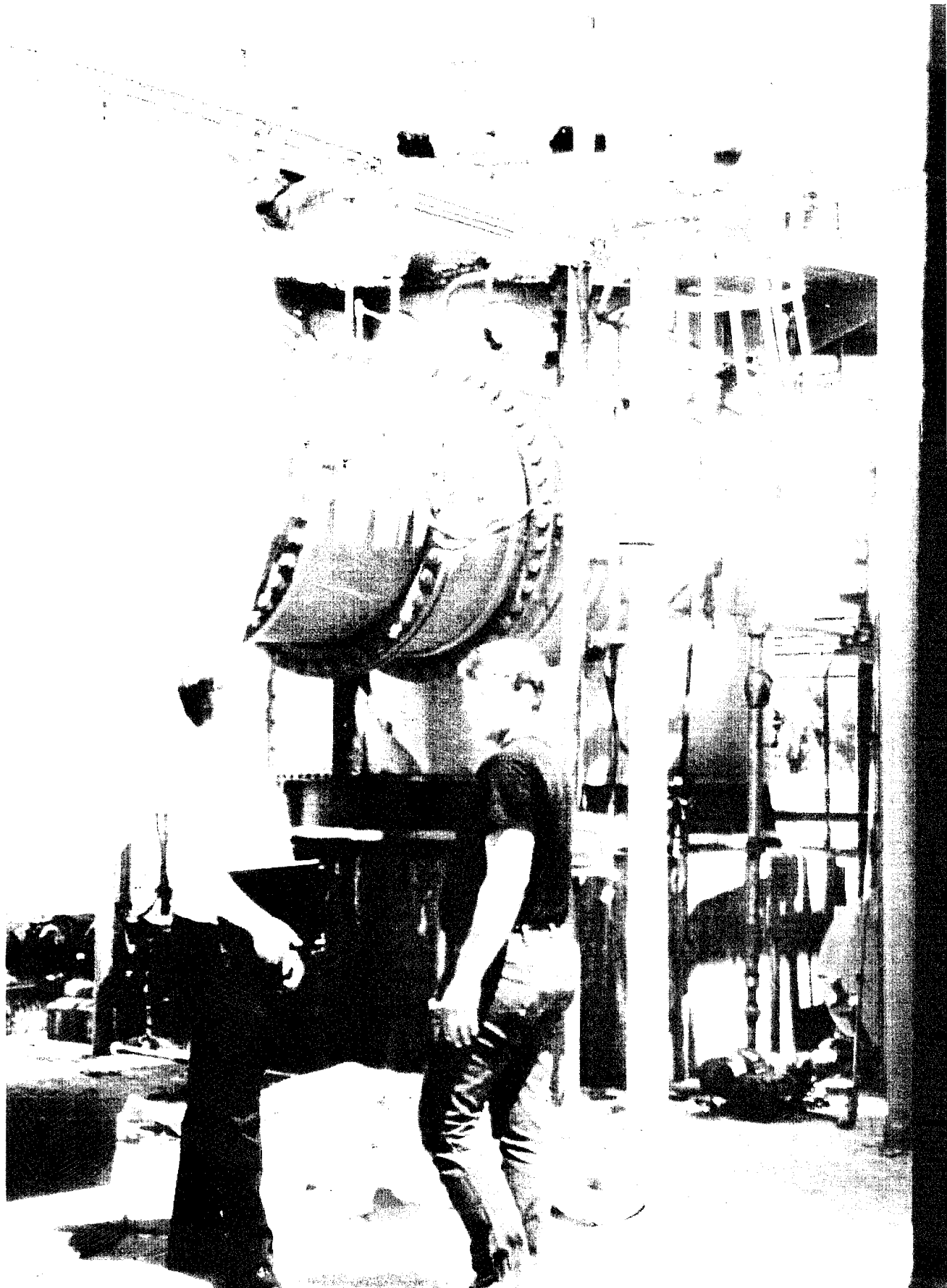
PBA's settling ponds with their hazardous waste incinerator in the background



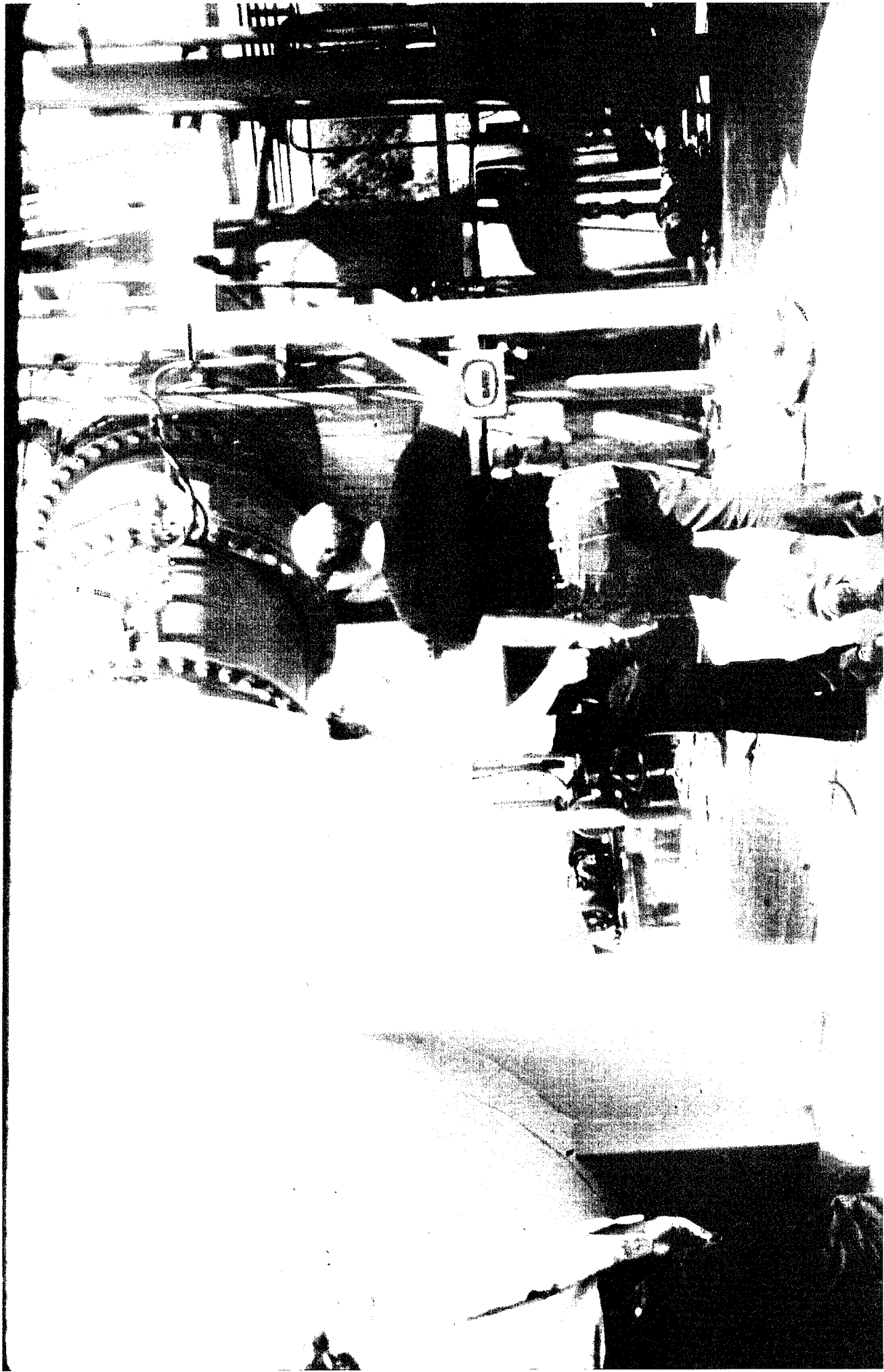
Storage of spent semi-tropical bleach (STB) at PBA



**Glass-lined tanks for the semi-tropical bleach (STB) regeneration system at PBA**

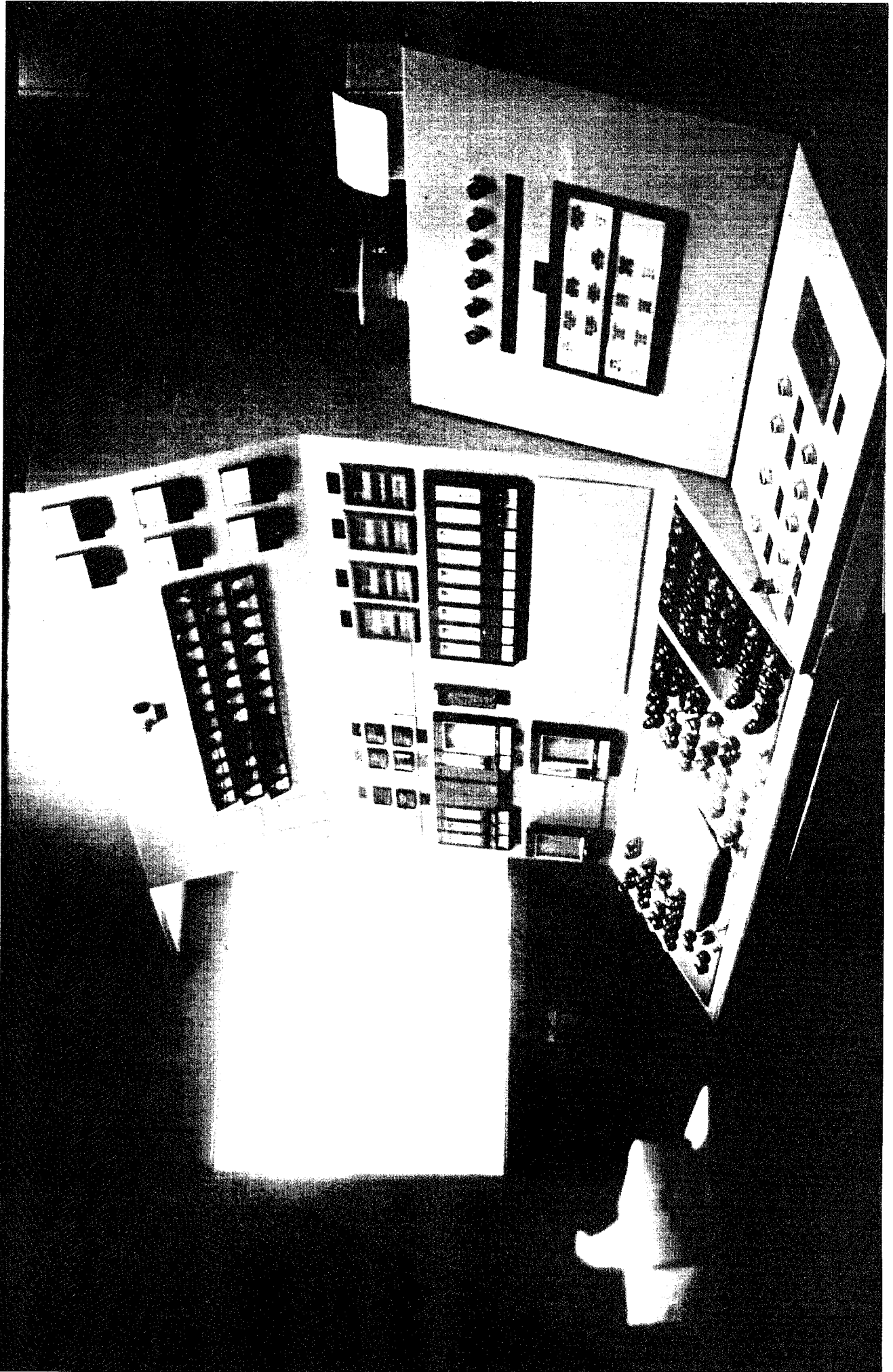


The incinerator afterburner at PBA

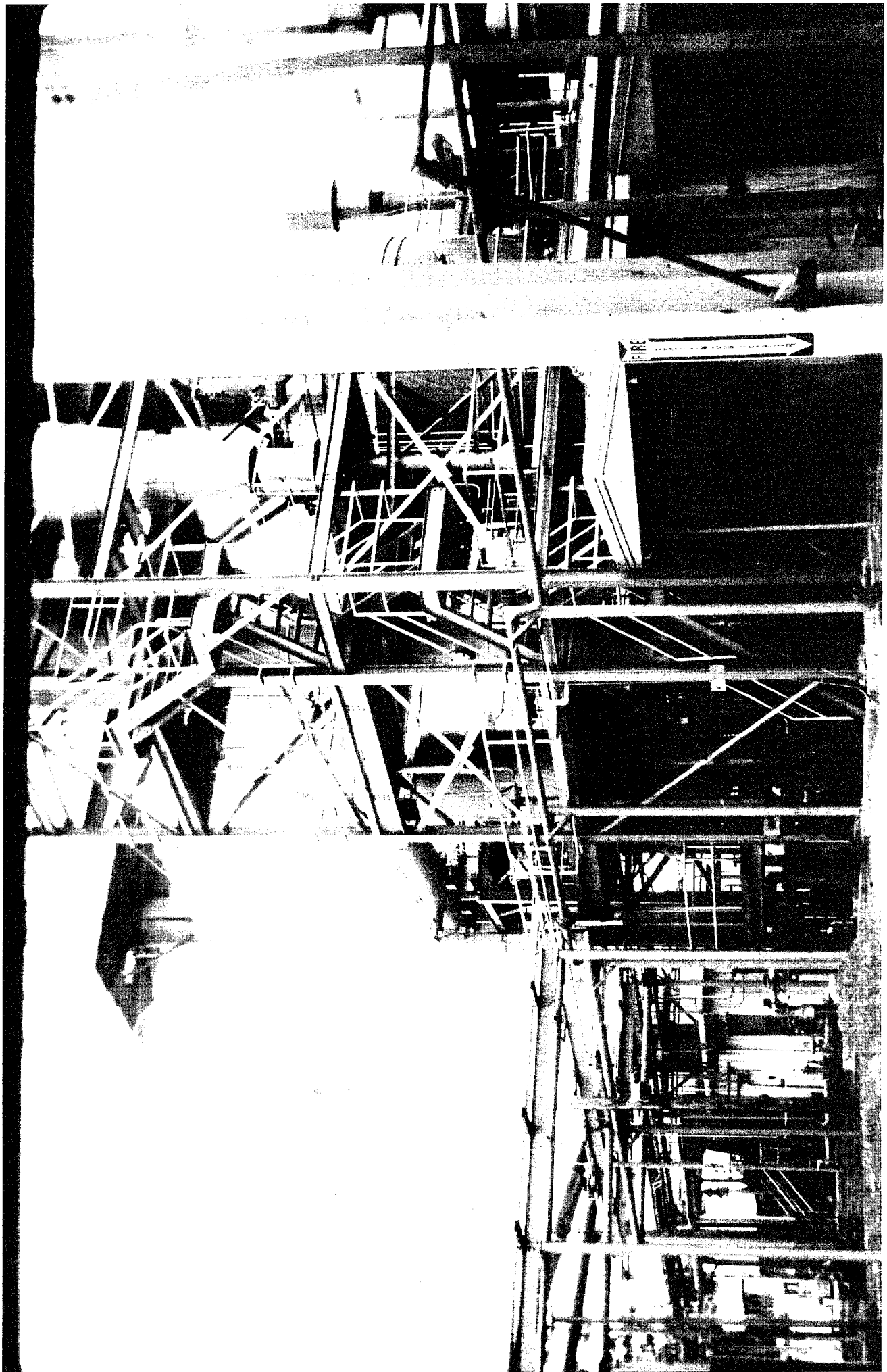


The incinerator afterburner at PBA

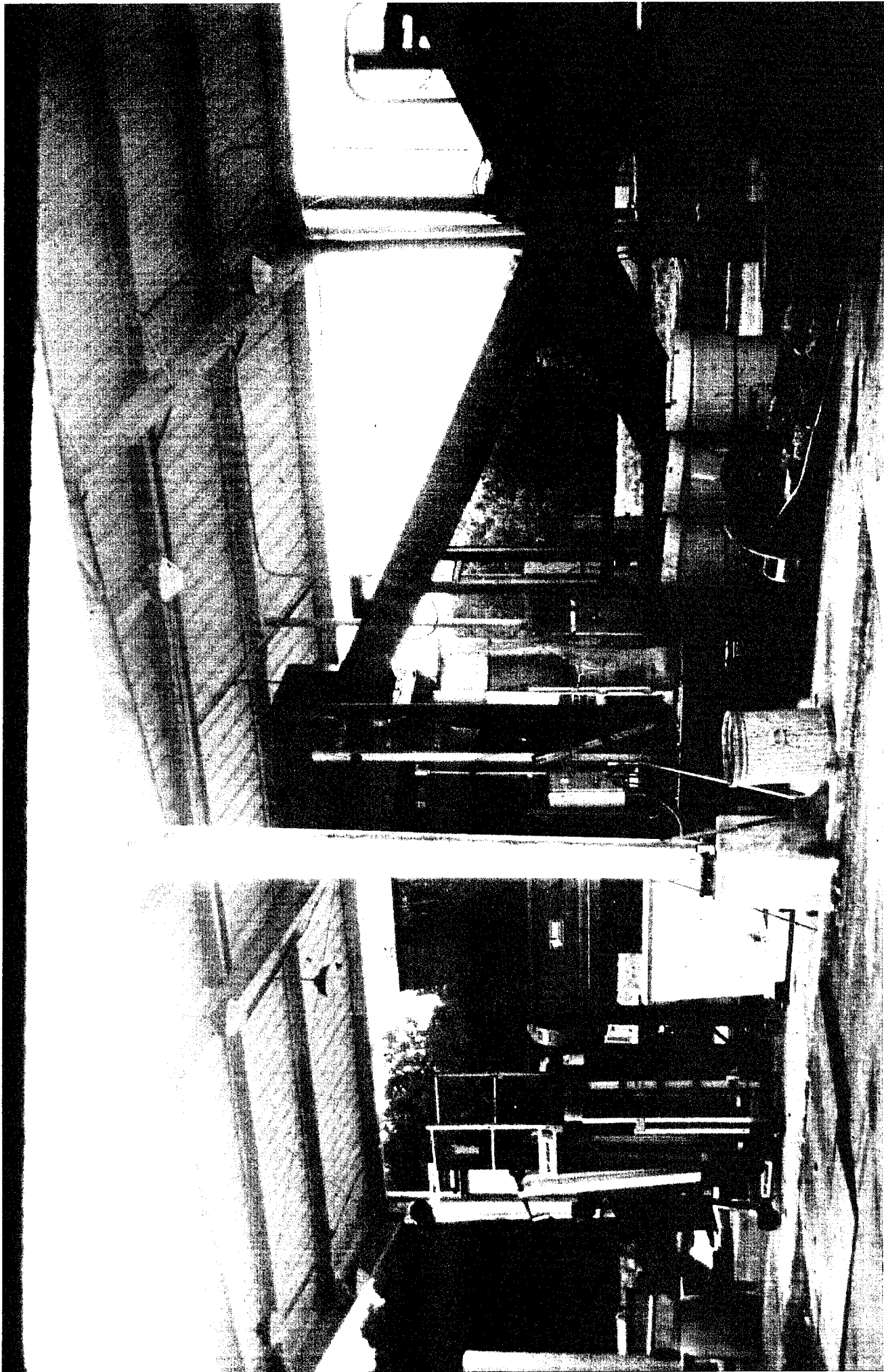




The incinerator control room at PBA



The incinerator at PBA



The metal shredder at PBA



## **DERA HAZMIN Project Effectiveness**

**Site Visit: Red River Army Depot, July 15, 1993**

Arthur D. Little personnel Joyce O'Donnell and Dr. Raymond Machacek participated in meetings and a tour of the facilities at Red River Army Depot (RRAD) in Texarkana, TX on July 15, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN funded projects at the facility including funding request procedures, equipment procurement and installation, day-to-day operation and maintenance of the equipment, operator acceptance, HAZMIN results, and cost implications. Additionally, details were gathered regarding issues such as: the time frame and difficulties involved in completing a HAZMIN funded project; the impact MIL-SPECs have on HAZMIN efforts; employee awareness of and participation in the HAZMIN program; and the transfer of technology between Army facilities.

Our primary point of contact (POC) at RRAD was Mike Lockard, Environmental Engineer, who arranged for us to meet with several RRAD personnel. These personnel included the following: Terry Funderburg, Supervisor Hazardous & Solid Waste Management Branch; Renita Foster, Environmental Protection Specialist; Mark Crawford, Environmental Engineer; and Ed Hanna, Process Engineer. In addition, the operators of the two DERA HAZMIN funded projects were interviewed. The discussions with these personnel and the tour of the facility provided us with detailed information on HAZMIN equipment, and other process and equipment related issues.

The purpose of this trip report is to document the information obtained during the site visit. The trip report is presented in four sections to clearly identify and address the important DERA HAZMIN related issues. These sections are: Site Description, Description of DERA Funded Projects, Other Areas of Interest and, Conclusions.

### **Site Description**

The primary mission of RRAD is to rebuild and maintain light track vehicles including the M113, and the M2 and M3 Bradley Fighting Vehicle System. In addition, Red River has a General Supply mission as part of the Defense Logistics Agency. Seven of the eleven CONUS divisions and an eighteen-state area are supported by the Depot supply operation. The third mission is ammunition storage and renovation for the HAWK missile and the PATRIOT.

The operations conducted at RRAD which support the above missions include paint stripping and reapplication, metal surface refinishing such as coating and plating, degreasing, denuding of rubber, and other vehicle maintenance activities.

### **Discussion of DERA Funded Projects**

Two DERA HAZMIN funded projects were reviewed during the site visit to RRAD; a solvent recovery system for 1,1,1 trichloroethane and an oil reclamation system. These projects are discussed in detail below

**Trichloroethane Reclamation System.** The solvent recovery system was purchased in late 1990 and installed in early 1991. The project cost totaled approximately \$190,000 and included the construction of a central reclamation site to which all waste trichloroethane (TCA) was brought. The manufacturer of the unit is PRI, from Columbia, IL, and the model is SCR. The equipment is a distillation system which

purifies the solvent while leaving sludge and dirt in the bottoms. The only problem encountered in the installation was insufficient power to the building. This caused some minor project delays until the correct power leads were installed.

The distillation system worked very well and resulted in considerable savings. A QA/QC program was developed to ensure that hydrochloric acid was not formed which would severely corrode any equipment to which it was exposed. The original estimates for cost savings assumed that 100% of the TCA could be reused, however, the military specifications require that only 25% of solvent can be reused, the remaining 75% must be virgin. This is likely because the inhibitor which is included to the virgin material is not reclaimed in the distillation process. This significantly reduced the potential waste reduction and savings. The following is an estimate of the cost savings for the TCA reclamation system.

|                               |           |
|-------------------------------|-----------|
| Assume 100% recycle:          |           |
| Disposal of 64,700 kg of TCA: | \$114,000 |
| Purchase of Virgin TCA:       | 77,000    |
|                               | -----     |
| Total cost savings:           | \$192,000 |

A more realistic estimate would be approximately 50% of the above numbers because of the restriction on recycle of reclaimed material. The savings is more than 25% because of the rising cost of purchasing virgin material since it is being phased out of use. This would result in a total cost savings of approximately \$100,000 per year.

The Army has since mandated that TCA no longer be used. RRAD has investigated the use of the still to reclaim other solvents. Currently, the still is operating to reclaim MEK which is used to wash out paint cans and paint guns. This reclaimed MEK is reused for cleaning operations. RRAD was able to do this because of the flexibility in the still that was purchased. The still has adjustable controls which allow it to be used for a variety of solvents just by changing the temperature (boiling point) of operation. The other factor in the ability to reclaim paint solvent is the segregation that is conducted at the source. Unused portions of paint in the paint cans are poured into a segregated drum while dilute cleaning solutions (those which have more solvent) are collected in a separate container. It is the dilute solution which can be reclaimed in the still.

Operation of the still to reclaim methyl ethyl ketone (MEK) has only recently begun, therefore, actual cost savings and waste reduction can only be estimated. RRAD personnel provided the following figures which enable the estimate of savings.

|   |             |
|---|-------------|
| Estimated paint solvent generation in 1993: | 163,000 lbs |
| Disposal Costs at \$.64/lb:                 | \$105,000   |

Additional savings can be realized in the reclaim of the MEK because of the avoided purchase costs of virgin material.

**Oil Reclamation System.** The oil reclamation system was purchased in 1990 and installed in 1991, however the project was initiated in approximately 1986. RRAD conducts maintenance operations on several vehicles and engines which require the draining of the engine and lubricating oil. This oil can be contaminated with trace heavy metals which classifies it as a hazardous waste, or it can be non-hazardous but no longer

able to meet the Mil Spec for reuse. The cost of the equipment was approximately \$160,000 and was purchased from Baron Systems.

The oil reclamation system includes a vacuum filtration system which heats the oil under vacuum to pull off the lighter fraction and then filtration to remove any particulates. A total of six units were purchased. Three mobile units were purchased and are housed in the same building as the solvent distillation still discussed above. The mobile units were intended to be used at various locations as needed. The other three units are permanent and are permanently installed in the dynamometer shop. This shop tests rebuilt engines and generates a large quantity of slightly contaminated 10W, 30W, and 50W oils.

RRAD has conducted several tests with these units, with limited success. The equipment does not remove the particulate metals, and in some cases appears to actually increase the metals concentration. In addition, the permanently installed equipment has an automatic shut off when the pressure drop across the filters becomes too great. However, upon start-up of the systems, with clean filters, the pressure drop is already too great and immediately causes the system to shut down. Several attempts have been made to change filter sizes and system operation methods. RRAD is also investigating the analytical method used to test for metals concentration. RRAD has been unable to require the manufacturer to meet the original specifications because the manufacturer was inadvertently released of its contractual duties before the systems were tested. RRAD intends to have the manufacturer revisit the site to trouble shoot the system as a separate project.

Disposal of reclaimed oil and unreclaimed oil was also discussed. The non hazardous oil, as generated in the dynamometer shop, is currently being offered to a university who increases the BTU value and resells the oil as heating fuel. If the reclamation system were brought on line and the metals concentration further reduced, approval will be sought to enable the reuse of this oil in the dynamometer shop. The high use oil, after reclaim may be able to be used as a boiler fuel supplement.

Cost savings for this project have not been realized due to the problems encountered in their operation. A previous economic estimate indicated that approximately one third of the waste oil could be reclaimed which would result in a savings of \$200,000.

### **Other Areas of Interest**

**Other HAZMIN Projects.** RRAD has several other HAZMIN efforts in progress to reduce other waste. One of the largest wastes generated on the site is bag house/blasting media. Media operations which contribute to this waste include paint removal utilizing steel shot, plastic media, and walnut hulls. In addition, a fluidized bed utilizing sand is used on site to remove rubber and adds to the blasting media waste. The waste is classified into three classes; non hazardous, special, and hazardous. The classes reflect the level of heavy metals and total petroleum hydrocarbons (TPH) contained in the media. High levels of heavy metals classify the waste as hazardous, high levels of TPH classify it as special, and low levels classify it as non hazardous.

RRAD has investigated the use of an on-site stabilization system to treat the hazardous blast media. Additional tests are being conducted now to determine if the special waste can also be treated. Once stabilized, the media can be landfilled in the on-site solid waste landfill along with the other non hazardous media. RRAD conducted pilot tests utilizing

HAZ-TECH Waste Management technology for stabilization. The results of the testing were extremely good, resulting in non hazardous characteristics for all stabilized waste. RRAD is moving forward in negotiating a contract and awaiting approval from the state regulatory agency to bring a full-scale mobile system to the site. The waste reduction and cost savings are estimated as follows:

|  |                       |
|--|-----------------------|
| Quantity of waste generated:           | 936,968 lbs           |
| Off-site stabilization at \$.42-.60/lb | \$393,426 - \$562,181 |
| Off-site landfill costs at \$40/cu yd  | 15,000                |
|  | -----                 |
| Total Off-site Costs                   | \$408,426 - \$577,180 |
| On-site stabilization at \$.16/lb      | \$159,915             |
| On-site land fill costs                | 68,305                |
|  | -----                 |
| Total On-site Costs                    | \$218,220             |
| Total Cost Savings                     | \$190,206 - \$358,960 |

Another ongoing effort is the reduction of solvent waste generated. RRAD currently utilizes Safety Kleen to reclaim all of the cleaning solvent used on site. RRAD recently switched from a hazardous solvent, 105, to a non hazardous solvent, 150. Approximately 656,863 lbs of waste 105 solvent was generated in 1992, thus the switch to 150 will result in a comparable reduction in hazardous waste. Safety Kleen has continued to consider the 150 a hazardous waste, however, and RRAD is challenging this action. Samples have been taken to determine whether the solvent contains any material which would classify it as hazardous and expects the results within the next month. If hazardous materials are found, an investigation will be launched to determine their source.

RRAD has replaced nearly all of their TCA degreasers with high pressure water cleaners. These washers utilize an alkaline detergent to clean parts using high pressure hot water. The parts are placed on a turn-table, or smaller parts are put in a tumbler. The units are performing very well, however, since they are designed to remove oil and grease, the bearings must be greased at least twice during the day to prevent them from burning out. The units are self-contained and utilize a grease and oil separator. The water and detergent is reused. The operators appear to like it because they are not exposed to TCA vapors, however, it does take longer than a vapor degreaser. In addition, the operator must load and unload the part in and out of the washer.

RRAD has a large facility for denuding rubber from its tracked vehicles. Several technologies were investigated such as mechanical removal of rubber and solvent dissolution. The technology chosen is a fluidized bed containing sand which operates at a temperature of approximately 950F. The fluidized bed was installed in Building 493, the Rubber Shop. The parts are loaded into the bed in a large basket. The high operating temperature heats the sand which provides a good heat transfer media and results in the

burning of the rubber. Cycle times vary from 30 to 50 minutes. Once completed, the parts are removed and placed in a quench tank to maintain their heat treating characteristics. The volatiles that are generated are further combusted in an afterburner. Additional air pollution control equipment includes an air cooling system and baghouses for removal of residual sand and particulates. This system has resulted in significant reduction in both the use of solvents as well as VOC emissions.

RRAD personnel have developed their own waste tracking system is extremely versatile. The system tracks individual hazardous waste containers from the point of origin, facilitates compliance with waste management laws by assisting in the preparation of required reports, and meets the 3-year data holding legal requirements. A demonstration of the system was provided to us. The system has separate menus for different points of use which include the generator, the Fire Department, and the Environmental Management Office. For the waste generator, the system has been programmed to allow only limited choices for types of waste which can be generated at specific locations. This minimizes any potential errors in classifying the waste. The system is used to notify the Environmental Office when waste is ready to be picked up, it tracks the dates at which the waste is generated and picked up, the quantity, and the type. For the Environmental Management Office, the menu includes several reports, including when and where any waste should be collected. This system is being used as the cornerstone for an Army-wide standardized program.

RRAD has conducted tests to prove that the chromate conversion coating required as a CARC paint primer is not necessary since the primary metal base processed at the facility is aluminum. Tests have shown that the paint has good adhesion and corrosion resistance without the primer coating. The elimination of this conversion coating would result in a large reduction in chromium contaminated waste. Approval is pending.

RRAD has developed a process utilizing baking soda as a blasting media to remove paint without removing the corrosion resistant coating. This has significantly reduced the unit operations required to repaint a part because of the reduction in stripping steps and reapplication of the coating.

When questioned about the status of the recommendations that resulted from the HAZMIN Audit and Report (dated April 1991), the POC said that most of the items on the list of recommendations developed in the report were provided by RRAD to the auditing team in the form of items that the installation hoped to address in the coming years. Therefore, it was felt that the overall value of the audit effort was minimal and rather time consuming.

**HAZMIN Program.** Red River has a formal program as is required by the Department of the Army. The program includes a reduction goal of hazardous waste generated 50% by 1992 and a 50% reduction in hazardous disposed by 1992 utilizing 1985 as a base year.

RRAD is designated as a Center for Technical Excellence (CTX) for chlorinated solvents and stabilization. When asked what the motivation behind their continuing HAZMIN efforts, it was indicated that the proactive attitude has been established for many years. In addition, the personnel believe that to successfully operate a DEPOT and to maintain a competitive edge, it must have a good environmental program, and it must have the

capability of being flexible. The combined engineering and environmental talent at RRAD has accomplished both.

Technical transfer between facilities was viewed positively. This is especially advantageous when trying to develop a specification or an economic analysis. A lot of time can be saved if a facility has already prepared documentation which can be reused. The CTX groups are also a very good source of tech transfer and the group meets once a year at a conference.

Employee involvement is always encouraged through the suggestion program and quality circles. The acceptance of the employees to new processes is generally good, however, it can depend upon how it affects their day to day routines. New processes which require less work and exposure to hazardous materials are generally accepted more readily than those projects which require more work.

The environmental staff indicated that the state regulatory agencies have been reasonable and favorable to deal with. Relationships were further improved since the implementation of the Defense State Memorandum of Agreement (DESMOA) program. This program partially funds a position at the state which serves as the primary point of contact for the facility with the regulatory agency. This designated point of contact expedites requests and communication.

**Funding Issues.** The issue of the time frame of funds availability, and the penalties associated if funds cannot be appropriated within the given time frame, were discussed. This is particularly difficult for projects such which the require the development of specifications or an RFP, request bids from competitive companies, review the bids, and deal with any protest letters.

Funding documentation is prepared by the engineering group and the environmental group, depending upon the type of equipment. Process equipment is generally handled by the engineering group, while environmental control equipment is handled by the environmental group. Funding is sent to DESCOM for approval. In addition to DERA funds WEMCA funds are also used to fund HAZMIN projects.

Follow up on HAZMIN projects is not conducted consistently. It is dependent upon the project and the amount of funding that was spent. However, the hazardous materials tracking system that was developed provides good data on waste reduction and cost savings.

**Military Specifications.** Discussions regarding MIL-SPECs revealed that many documents dealing with chemical munitions are very outdated. Many of the mil specs are written very specifically, i.e. requiring that a part be vapor degreased, yet vapor degreasing is no longer allowed. If the spec were written as a performance requirement, it would allow some flexibility for the Depot as to how they would remove the grease. Many times a waiver must be applied for to allow the use of a process that is not specifically called out in the spec.

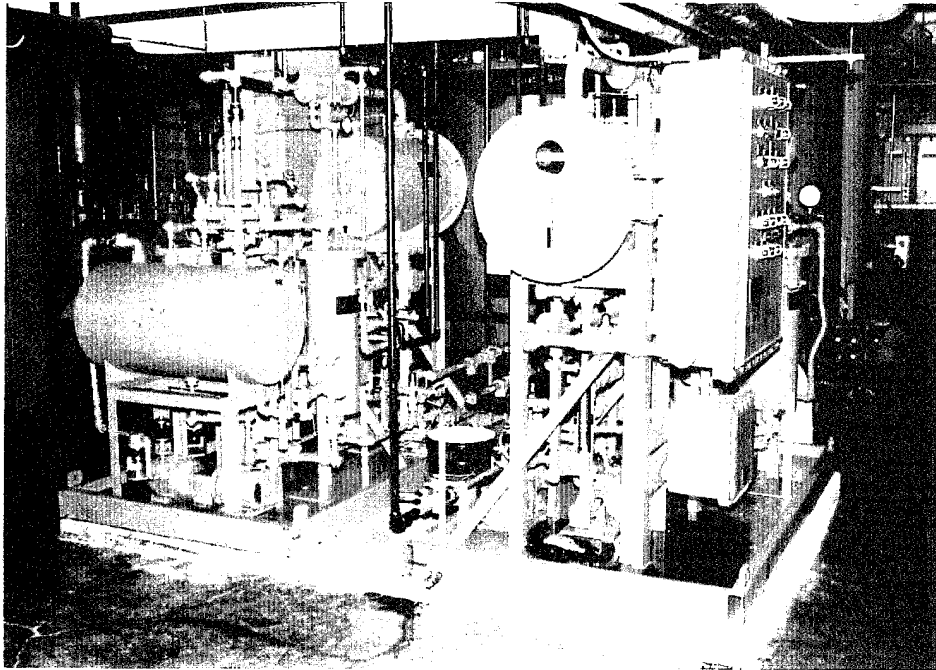
## **Conclusions**

RRAD operates a proactive facility which is constantly looking for ways to improve their processes and reduce their waste generation. Highlights of their program include the fluidized bed rubber denuding system, the development of their own hazardous waste tracking system, their efforts to eliminate chlorinated solvents, and their stabilization effort. Their purchase of a flexible distillation system for solvent recovery has also enabled them to find an alternative use for a piece of equipment which might have been obsolete because of the phase out of TCA. Difficulties have been encountered in the funding process primarily due to the time frame of funds to be obligated. Approval of alternative processes have also been held up because of issues with meeting military specifications and DMWRs.

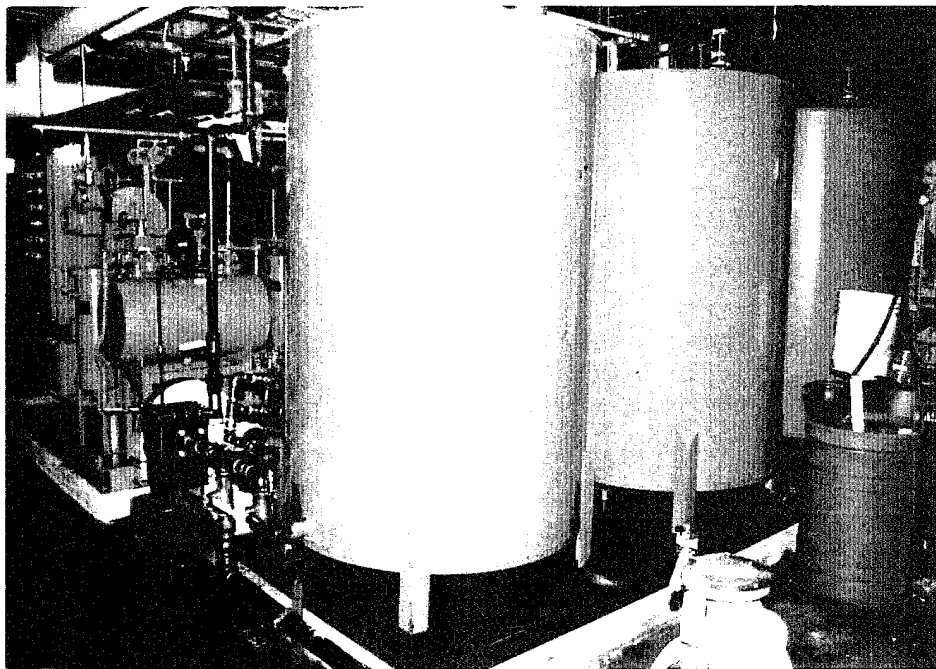


A sign at the main entrance of Red River Army Depot

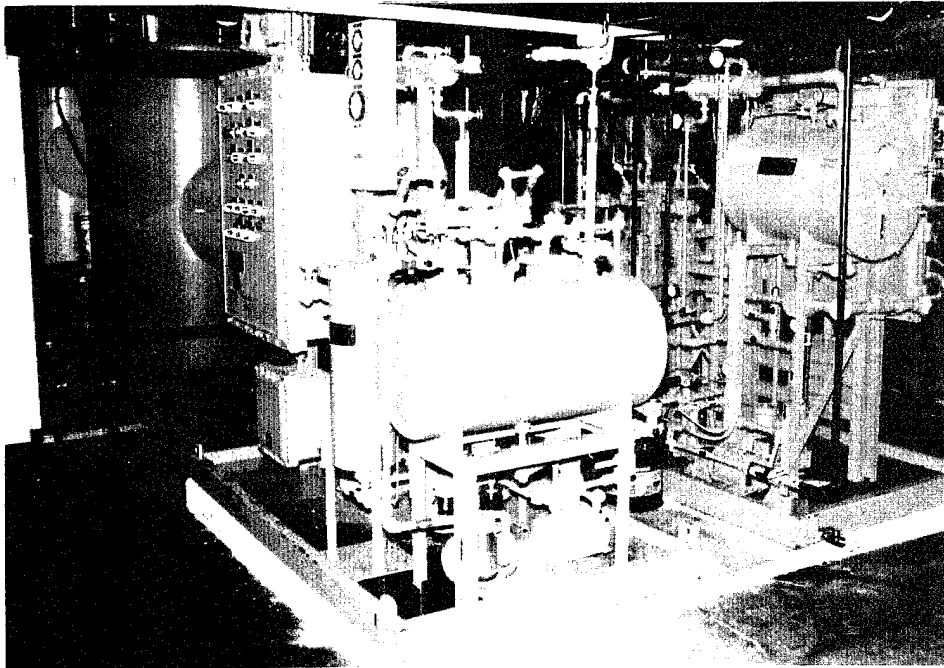
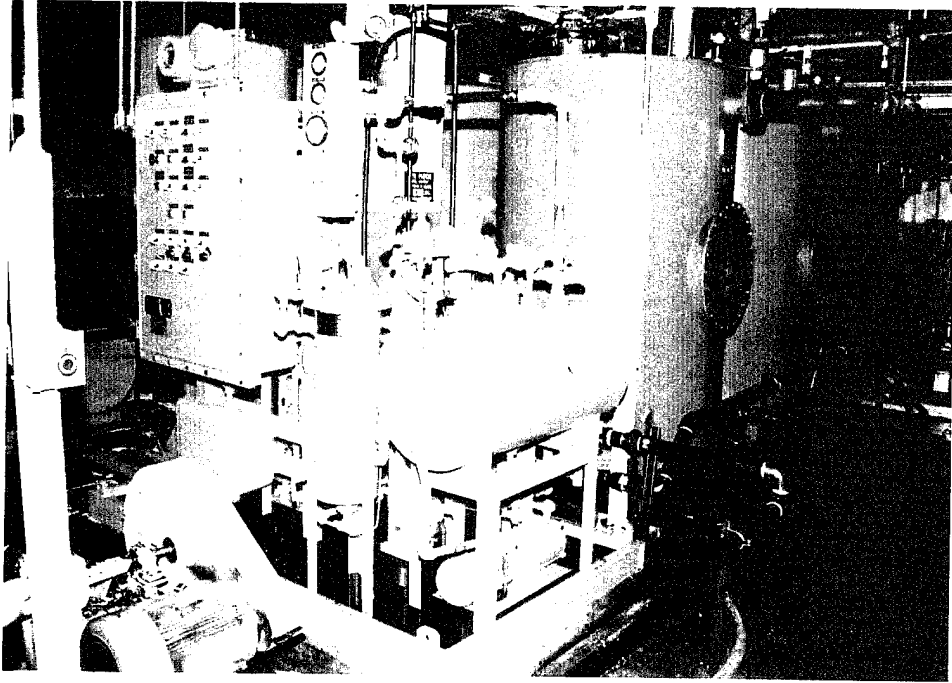




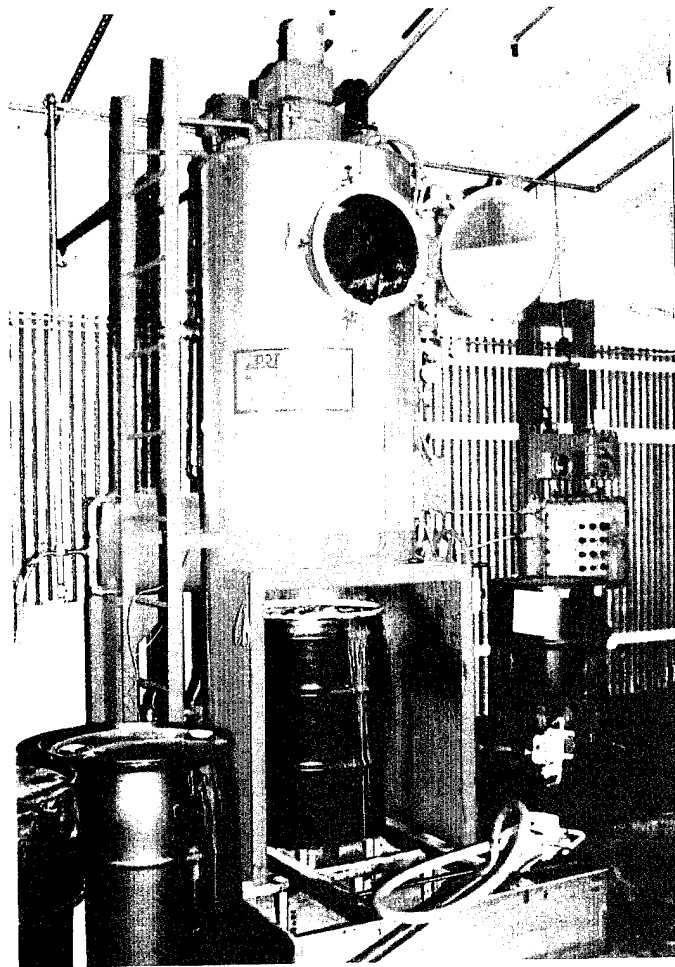
Oil Recovery Units at RRAD



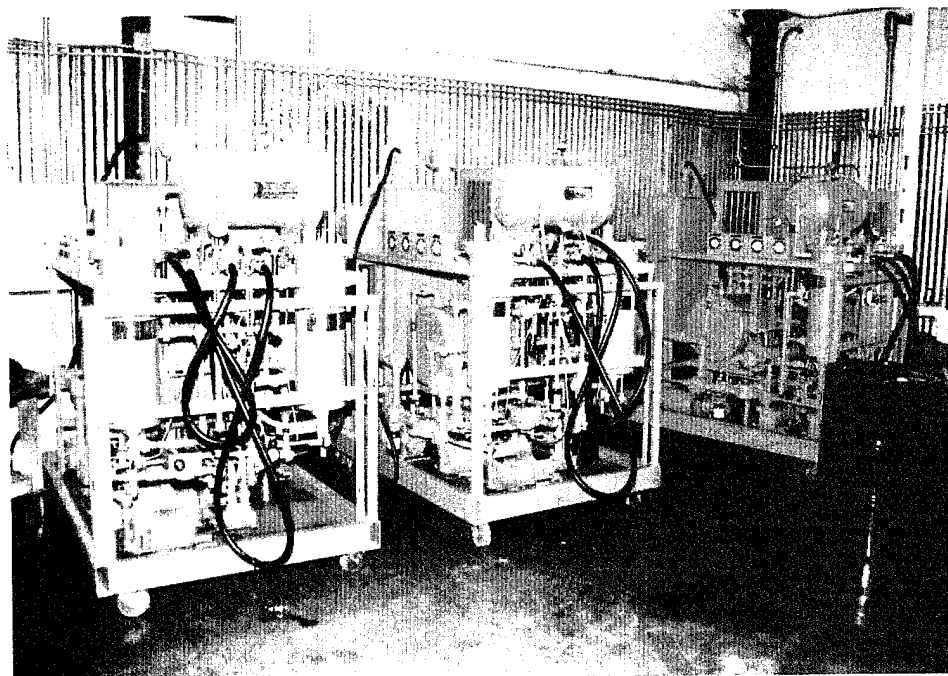
Back of Oil Recovery Units showing the large oil storage tanks



Permanently installed Oil Recovery Units at RRAD



Solvent Recovery Unit at RRAD



Portable Oil Recovery Units at RRAD

## **DERA HAZMIN Project Effectiveness**

### **Site Visit: Stratford Army Engine Plant, July 1993**

Arthur D. Little personnel Mike Bryant and Mike Marando participated in meetings and a tour of the facilities at the Stratford Army Engine Plant (SAEP) in Stratford, Connecticut on July 27, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN funded project at the facility including funding request procedures, equipment procurement and installation, day-to-day operation and maintenance of the equipment, operator acceptance, HAZMIN results, and cost implications. Additionally, details were gathered regarding issues such as: the time frame and difficulties involved in completing a HAZMIN-funded project; the impact MIL-SPECs have on HAZMIN efforts; employee awareness of and participation in the HAZMIN program; and the transfer of technology between Army facilities.

Our primary point of contact (POC) at SAEP was John Fleming (Supervisor of Environmental Engineering) who arranged for us to meet with Jim Morrell (Environmental Engineer). We were provided with detailed discussions and a site tour to view actual operation of HAZMIN equipment and discuss process and equipment related issues with equipment operators.

The purpose of this trip report is to document the information obtained during the site visit. The trip report is presented in four sections to clearly identify and address the important DERA HAZMIN-related issues.

#### **Site Description**

SAEP's primary mission is the manufacture and testing of turbine engines for Army tanks and helicopters. The facility also receives, stores and issues raw materials for production of engine components. SAEP is a Government-Owned, Contractor-Operated (GOCO) installation and is located in Stratford, Connecticut.

#### **Discussion of DERA Funded Project**

The DERA HAZMIN-funded project addressed by this visit was the procurement and installation of spray wash cabinets to clean turbine engine parts for use in tanks and helicopters. The cabinets are the first step in a three part washing process which also includes an immersion of the part in an agitation or ultrasonic bath followed by a final drying step. The previous method of cleaning the parts involved vapor degreasers using 1,1,1-trichloroethane (TCA) as a cleaning media. The primary reason for eliminating the vapor degreasers was to minimize the fugitive emissions on site. A 1992 survey indicated that 30,578 gallons of TCA was used in vapor degreasing operations. 9,120 gallons of TCA was disposed, leaving 21,458 gallons of TCA lost to fugitive emissions.

The four spray wash cabinets were purchased in October 1992 for \$207,600 and were installed during spring 1993 for approximately \$40,000. The spray wash cabinets have stainless steel parts to avoid corrosion which occurred during a pilot test with steel lined parts. The detergent presently used in the process is Blue Gold, which consists of NaOH and a surfactant. Flexible cords or flexlink tubing is available to allow the operators to direct the detergent spray to clean parts with more difficult geometries. In order to prevent rusting of some parts, a rust inhibitor is added to the second stage wash. The wash water is recycled and oil skimmers are used on the sumps. Not only does the effluent contain oil and grease from the parts, but also lead, zinc and other metals. Engineers are investigating ways to treat the effluent including biological

degradation as well as oil/water separation. Presently, the sumpwater is handled and disposed.

Testing has been completed on the first set of parts which are primarily stainless steel turbine housings used in tank engines. Results of these tests has been very favorable. Testing on a second set of parts from plating operations will begin shortly and will have more stringent cleanliness requirements. Operators expressed their willingness to use the equipment and are happy to avoid using TCA in the cleaning process. The personnel were aware of the health risks associated with TCA and were glad not to be inhaling the TCA vapors. This enthusiasm should ensure proper maintenance and operation of the spray washers. Consideration is being given to purchasing two more units.

### **Other Areas of Interest**

A HAZMIN plan is in operation at SAEP and its primary goal is to work toward the elimination of 1,1,1-trichloroethane in plant processes. Other aspects of the plan are:

- Solvent replacement or process change for the cleaning of metal parts by immersion.
- Low-level radioactive chips consisting of magnesium or nickel are generated from machining operations. The turnings containing magnesium are remelted to a specification that allows for the scrap to be classified as neither a hazardous waste nor a low-level radioactive waste.
- A change in a process in the plating shop may be able to reduce the quantity of metal hydroxide sludge by 50%.
- The use of ammoniacal solution in the stripping process may eliminate the need for chromic acid.

The POC indicated that he works with ATCOM in St. Louis and uses Form 1383 to obtain project funding. He usually is able to deal directly with HQAMC to obtain funding, which is beneficial, since most efforts at the installation run two to three years, which is longer than the DERA funding timeframe would allow.

In general or other process specifications MILSPECS have not been a significant problem in completing HAZMIN projects. As opposed to a majority of installations surveyed, SAEP has been able to implement projects successfully without this barrier.

The primary barrier to further HAZMIN efforts at SAEP has been imposed by unions and personnel practices. Many operators at the facility have worked at the facility for an extended period (over 20 years) and are reluctant to change their methods of operation.

In order to facilitate the disposal of hazardous waste, SAEP uses a local hazardous waste vendor to ensure compliance with the RCRA 90 day storage limit. SAEP has also developed their own software to accurately monitor hazardous material.

Discussions relating to technical transfer revealed that the POC attends a lessons learned conference with other Army environmental personnel once per year. The POC at the facility also has contact with other DOD environmental staff.

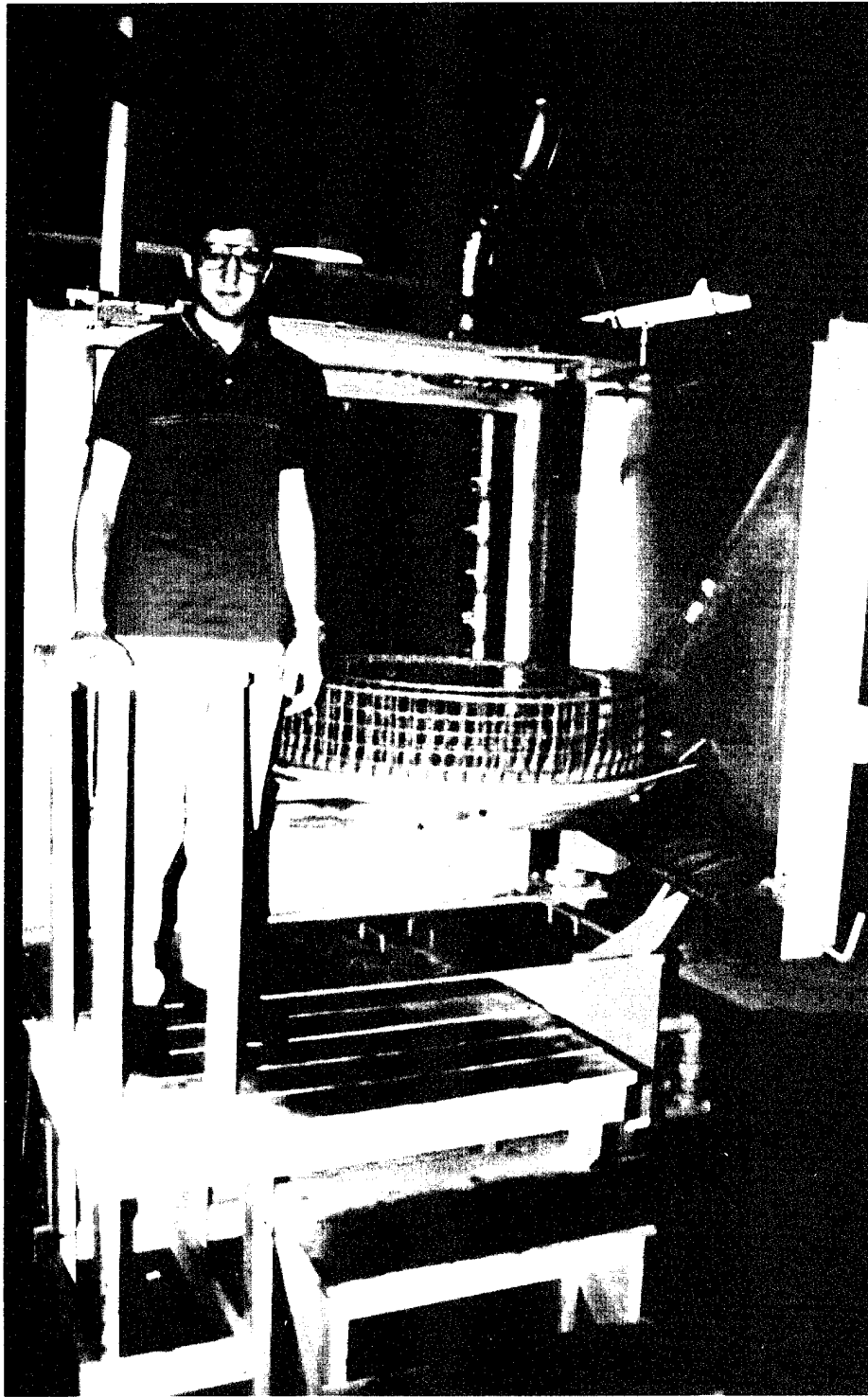
Discussions pertaining to the INEL audit (December 1991) revealed that most of the resulting recommendations were implemented before the audit occurred. Two were implemented as a result of the audit.

A \$5,000,000 funding request in 1993 to redesign and reconstruct the plating room was not appropriated, since the facility's contract terminates in 1994 and is not expected to be renewed. As a result of the expiration of the contract, further HAZMIN initiatives have been diminished.

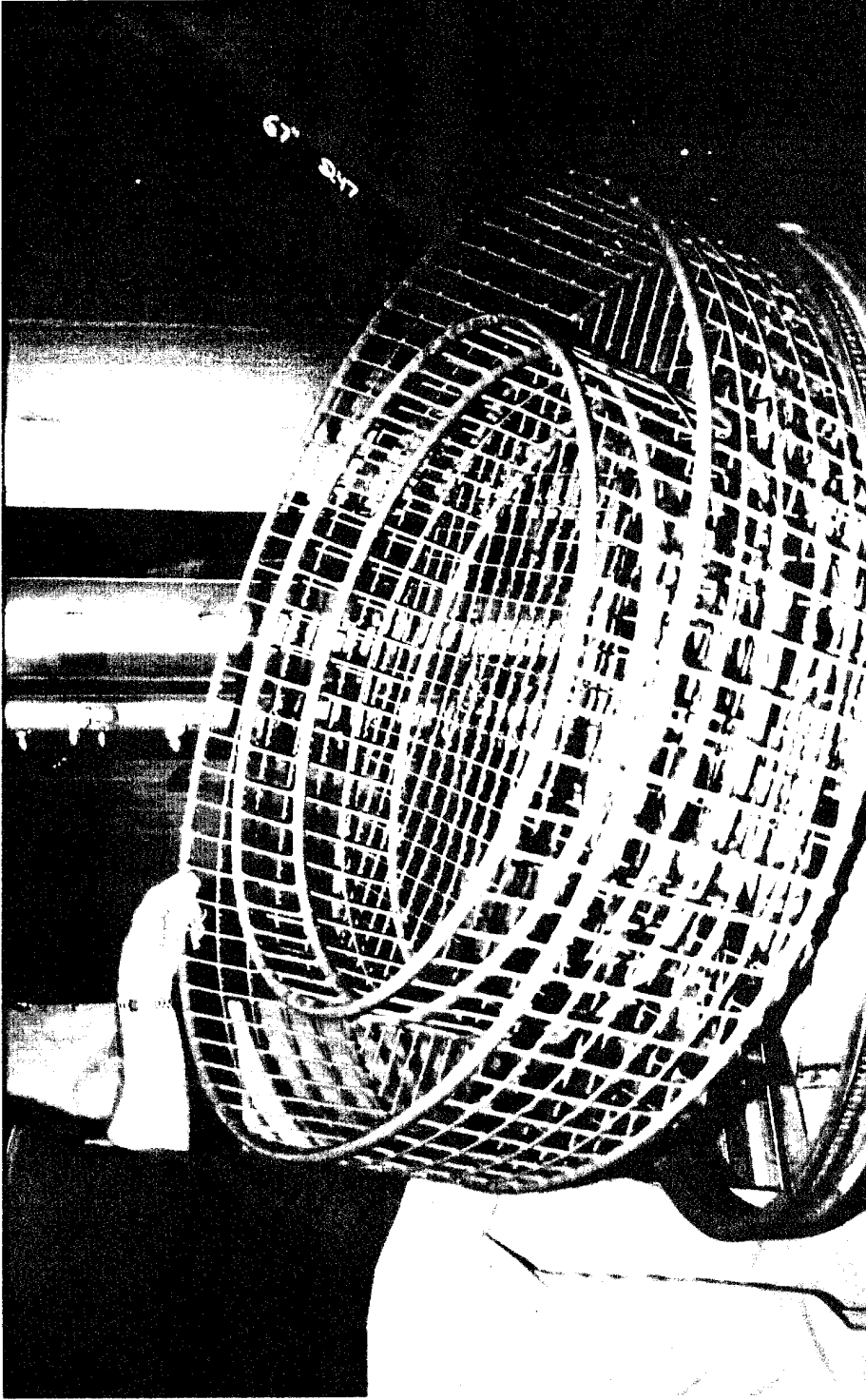
A camera was brought into the SAEP facility with prior permission and was used to take photographs of the HAZMIN equipment and in-process operations.

### **Conclusions**

SAEP successfully implemented spray wash cabinets which helped reduce the amount of TCA emissions and hazardous waste generated. As a GOCO facility, SAEP presents a more profit-motivated approach to HAZMIN than does the typical Government-Owned, Government-Operated industrial depot. Although MILSPECS have not been a substantial barrier to HAZMIN progress, labor related issues have presented a problem to pursuing HAZMIN initiatives.

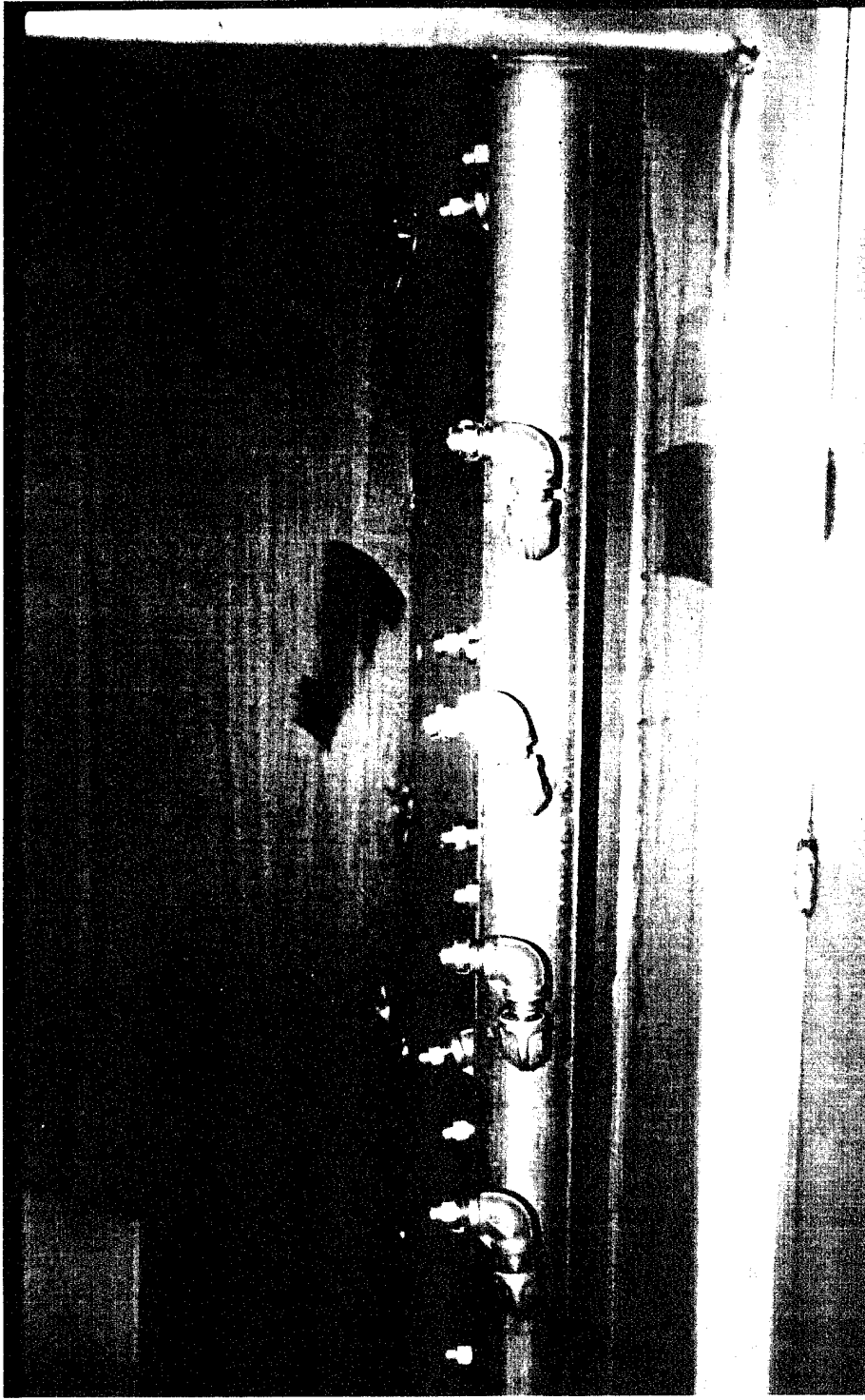


A spray washer with small parts retainer basket at SAEP

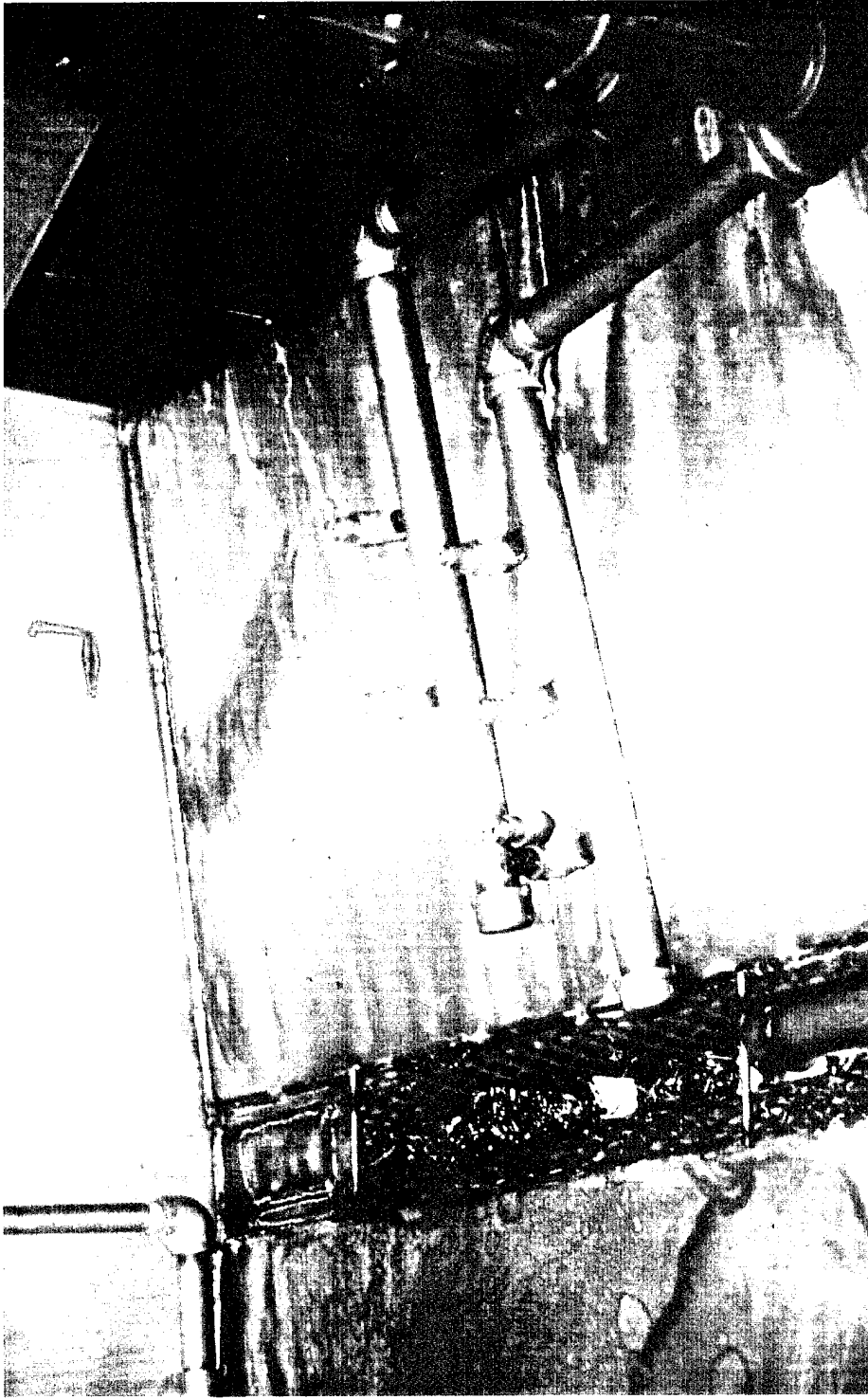


A small parts basket without cover for a spray washer at SAEP

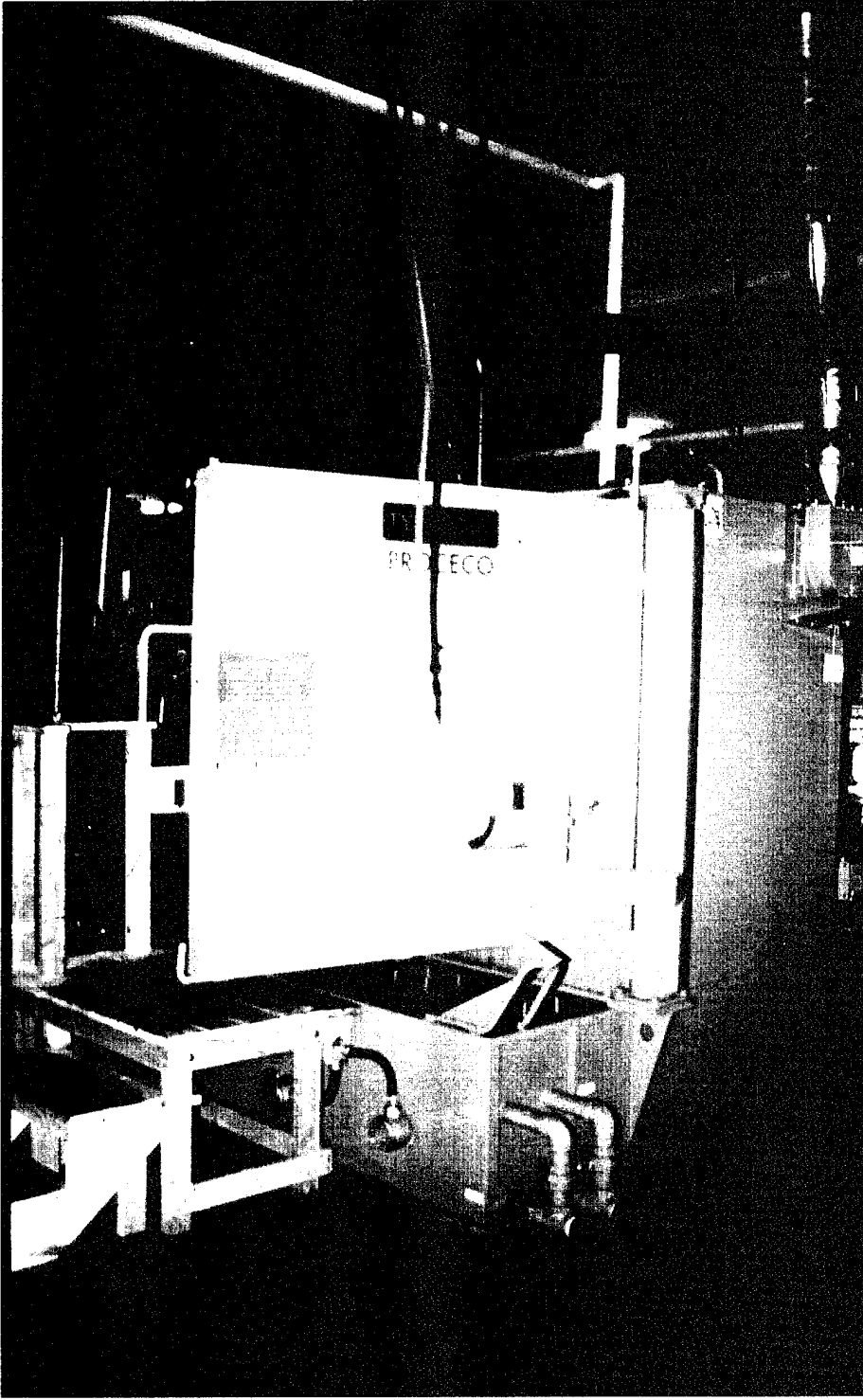




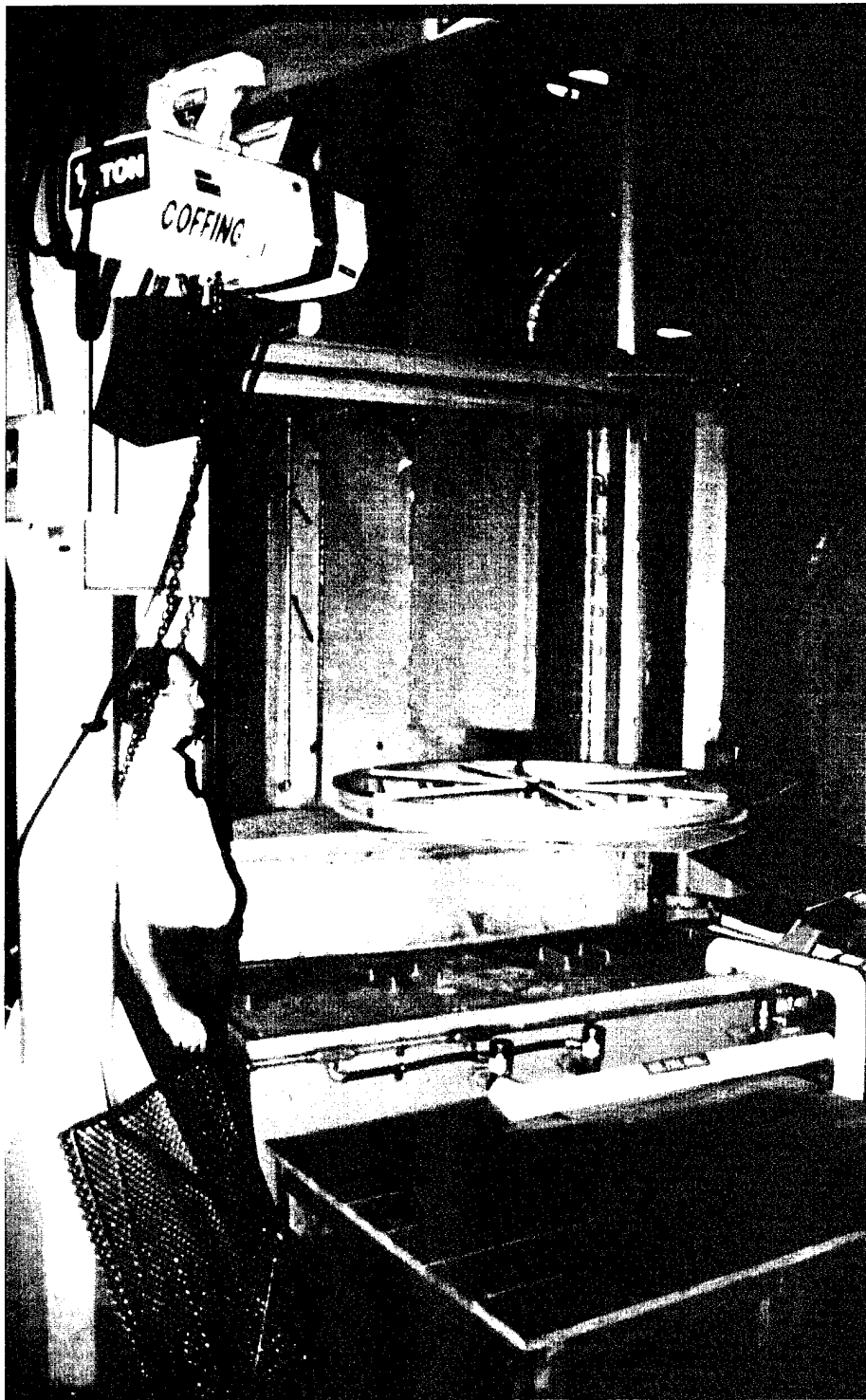
Spray nozzles mounted on the right interior of a spray washer at SAEP



Spray nozzles mounted on the bottom interior of a spray washer at SAEF



The right exterior side of a spray washer at SAEP



The interior of a spray washer with rotating circular table and an overhead hoist at SAEP

7300, TELLIER  
MONTREAL, QUEBEC  
CANADA H1N 3T7

☎ : (514) 264-0494  
FAX : (514) 264-0184

MACHINERIE INDUSTRIELLE LTÉE  
**PROCECO**  
INDUSTRIAL MACHINERY LTD

MODEL NO.

SERIAL NO.

VOLTS

AMPS

PHASE

CYCLE

1<sup>st</sup> STAGE

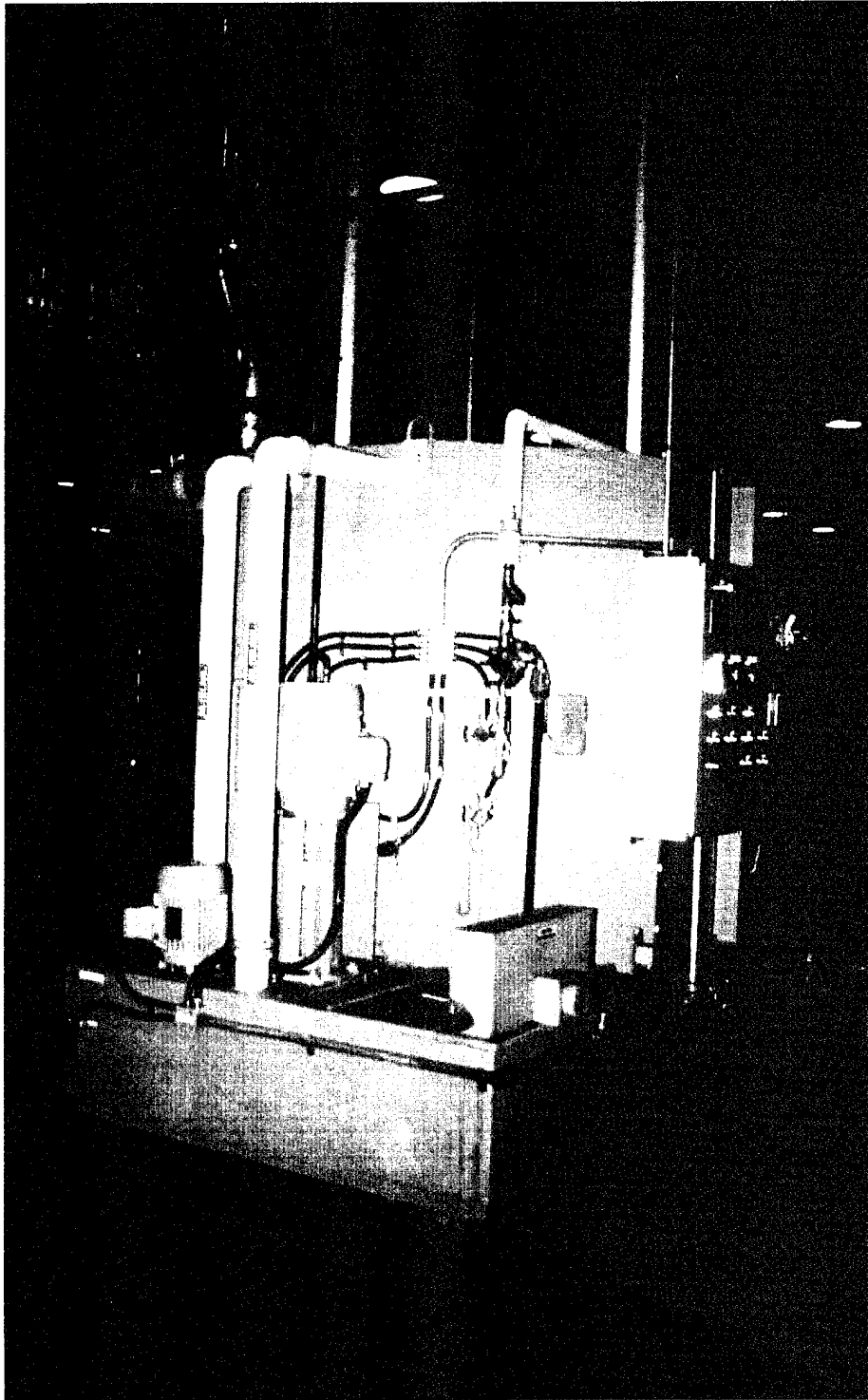
2<sup>nd</sup> STAGE

HEATING CAPACITY

TURNTABLE CAPACITY

LARGEST MOTOR

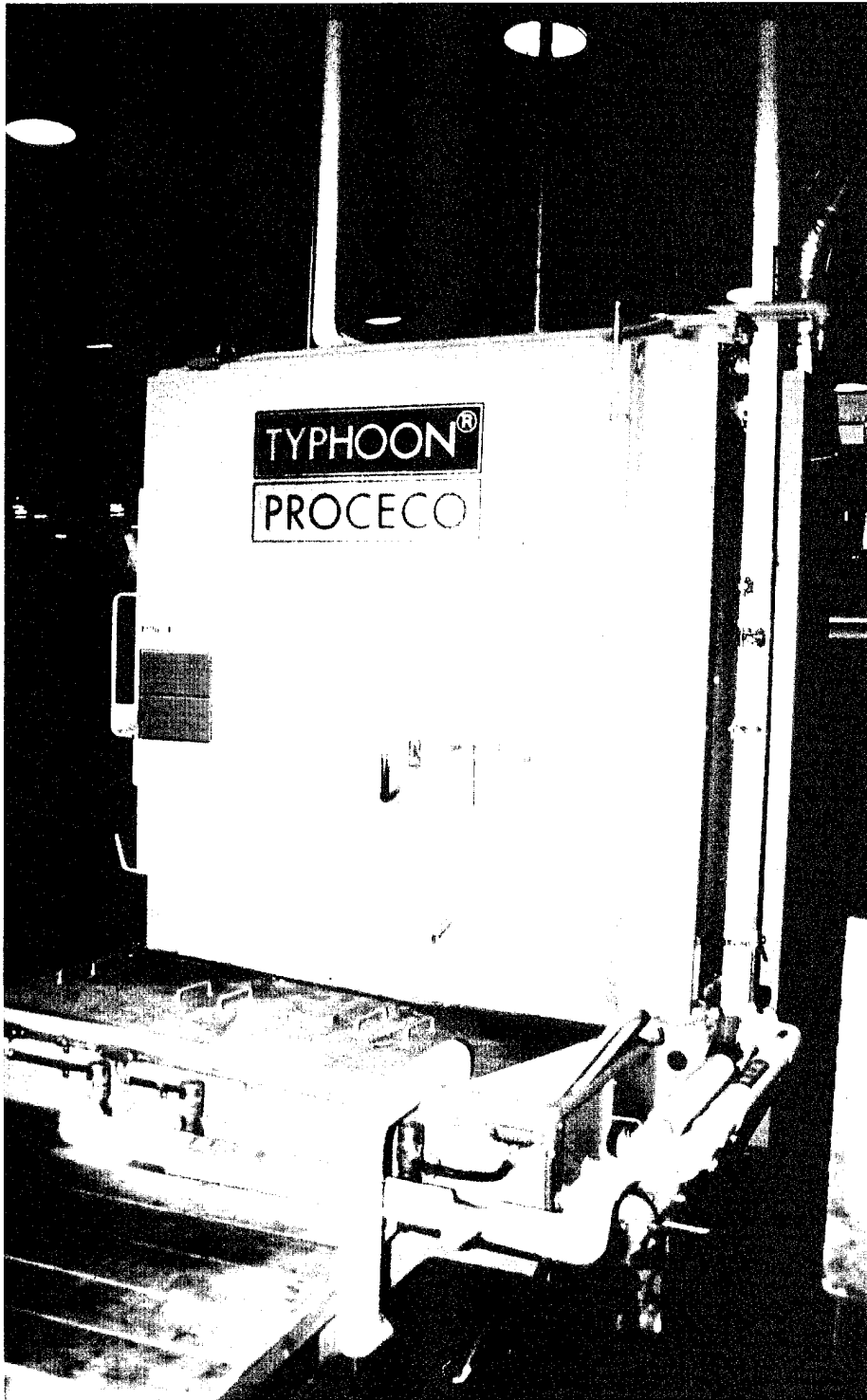
Manufacturer's label on a spray washer at SAEF



The back left side of a spray washer at SAEP

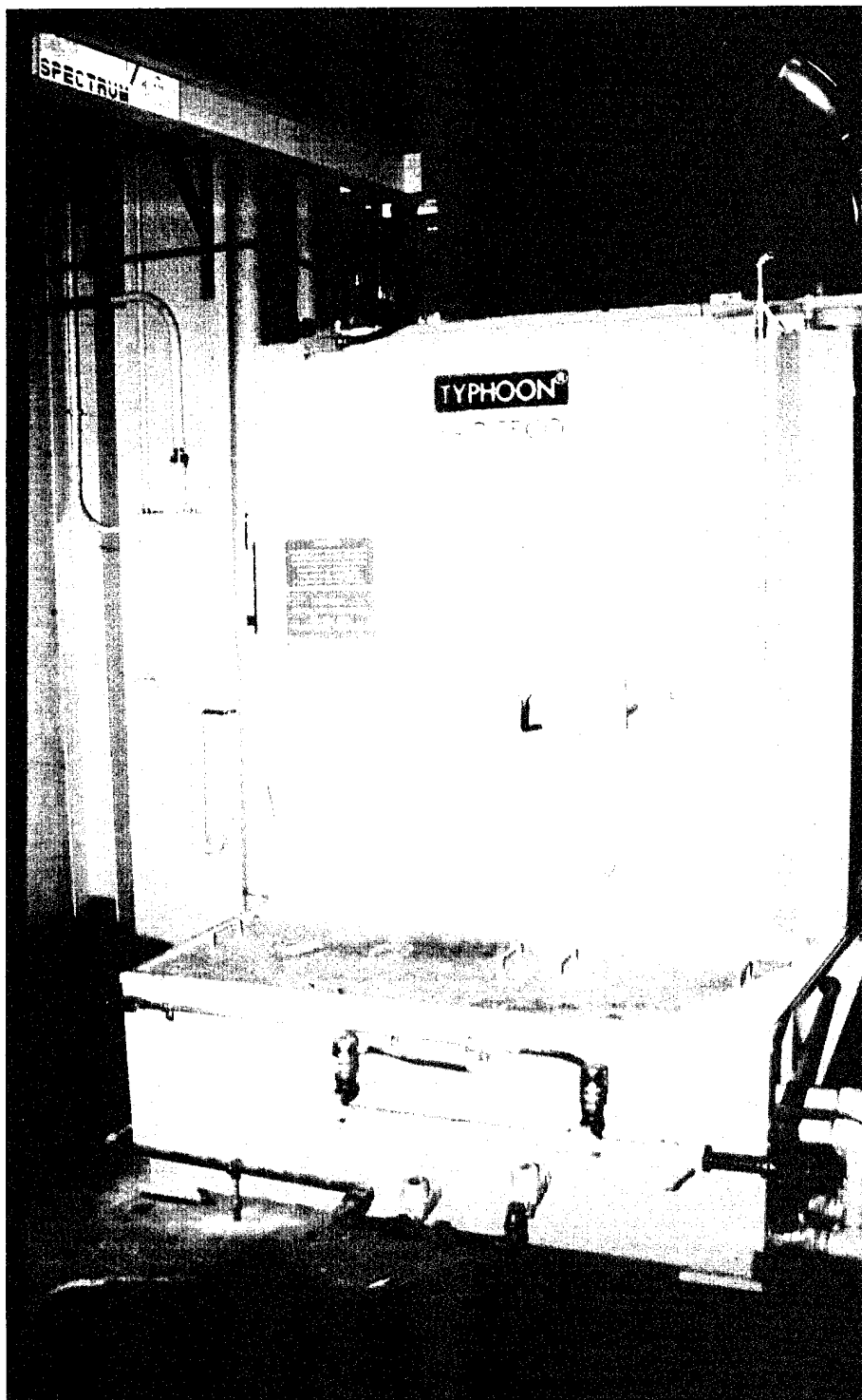


The control panel on the left side of a spay washer at SAEP

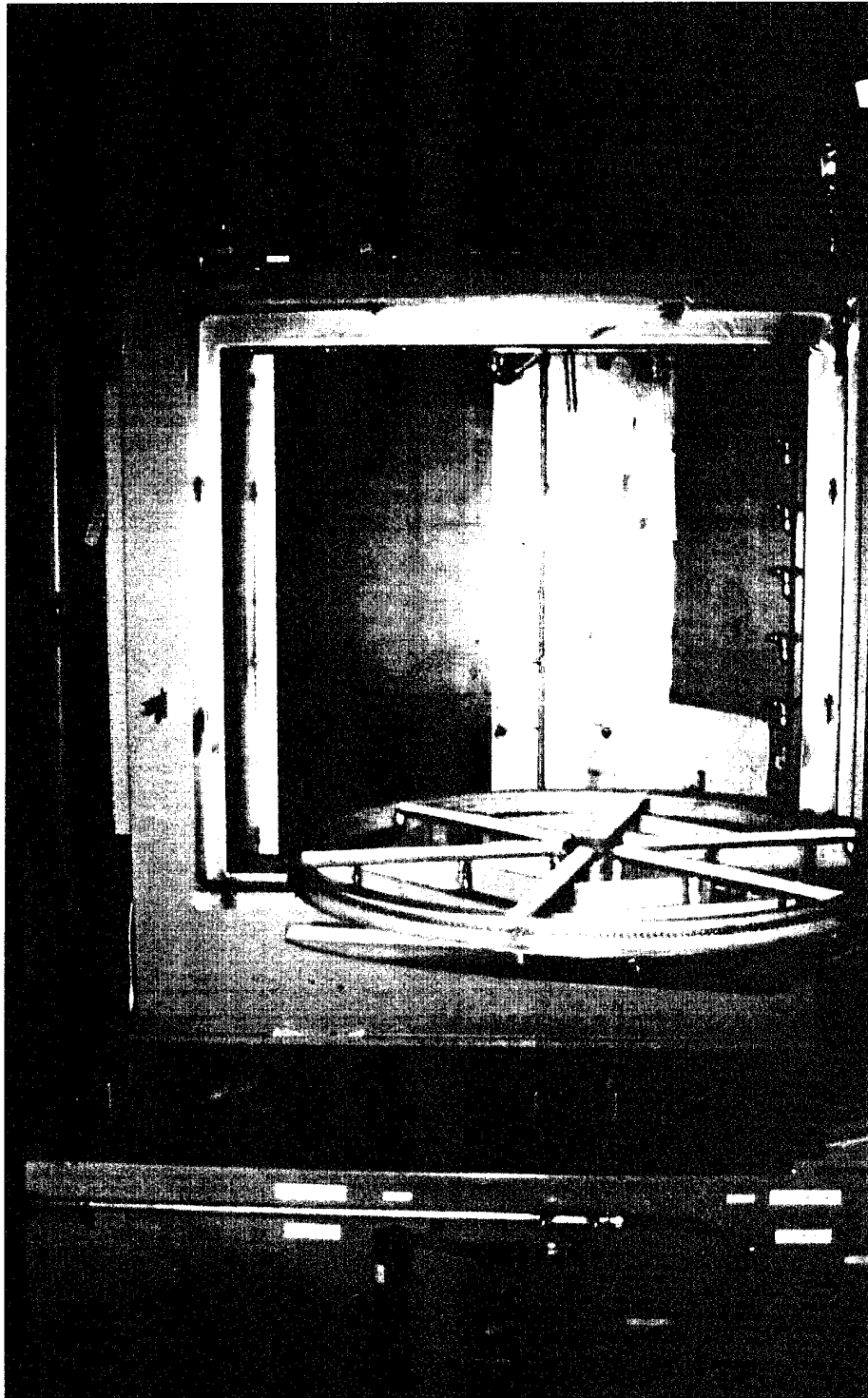


The front door view of a spray washer at SAEP

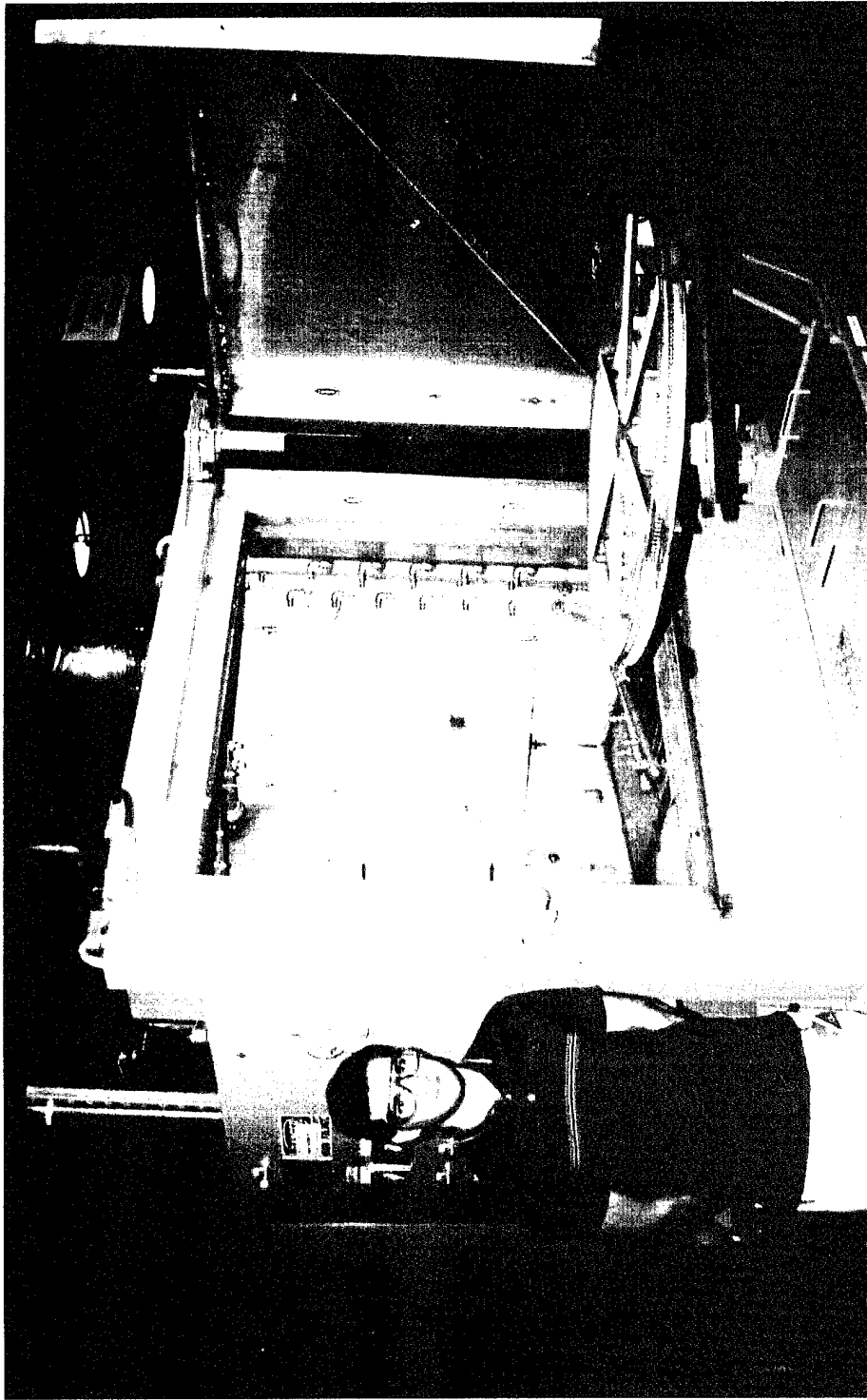




The back side view of a SAEP spray washer showing the water sump at the bottom



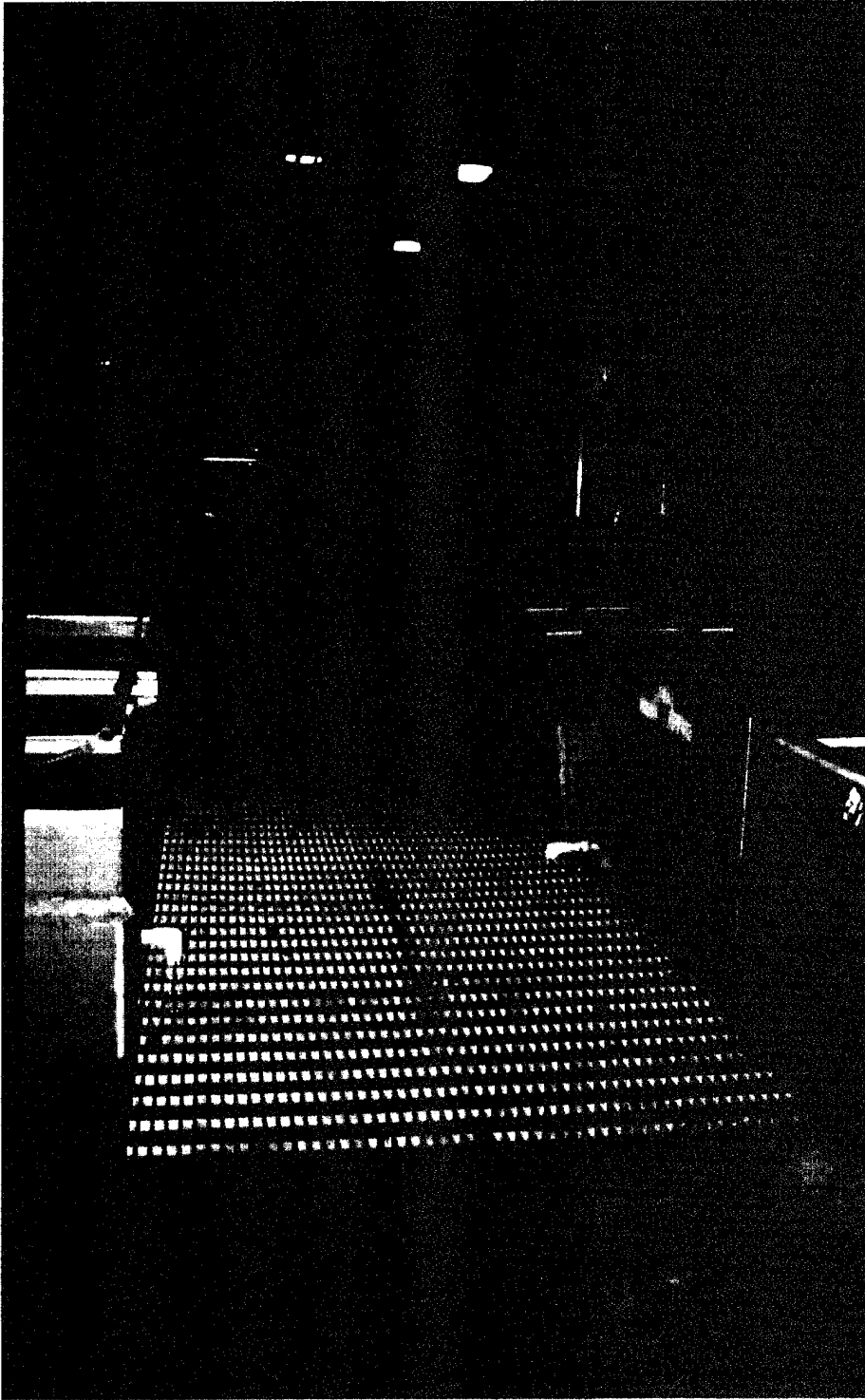
A view of the interior of a spray washer at SAEP



A view of the interior of a spray washer at SAEP



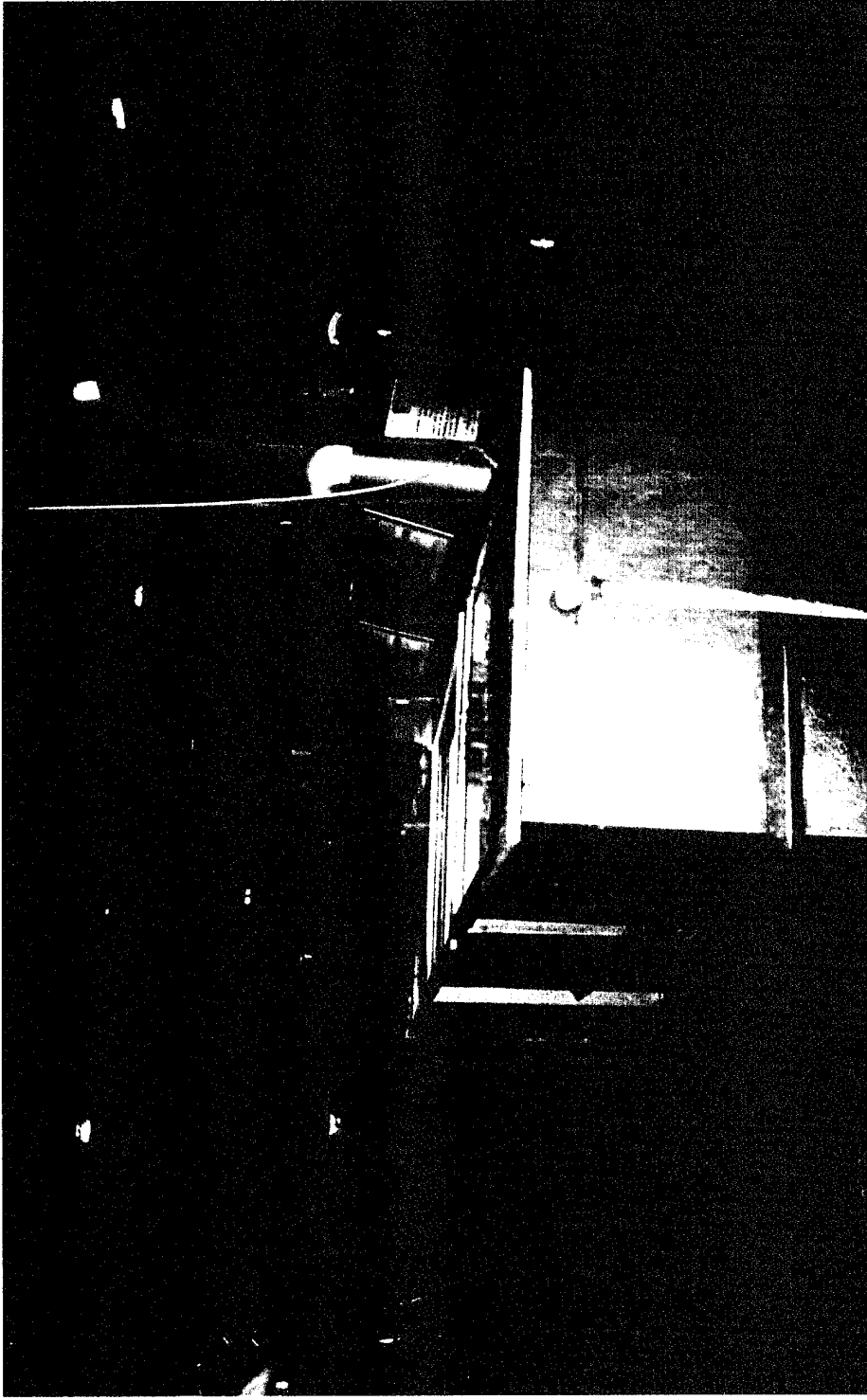
The control panel on the left side of a spay washer at SAEP



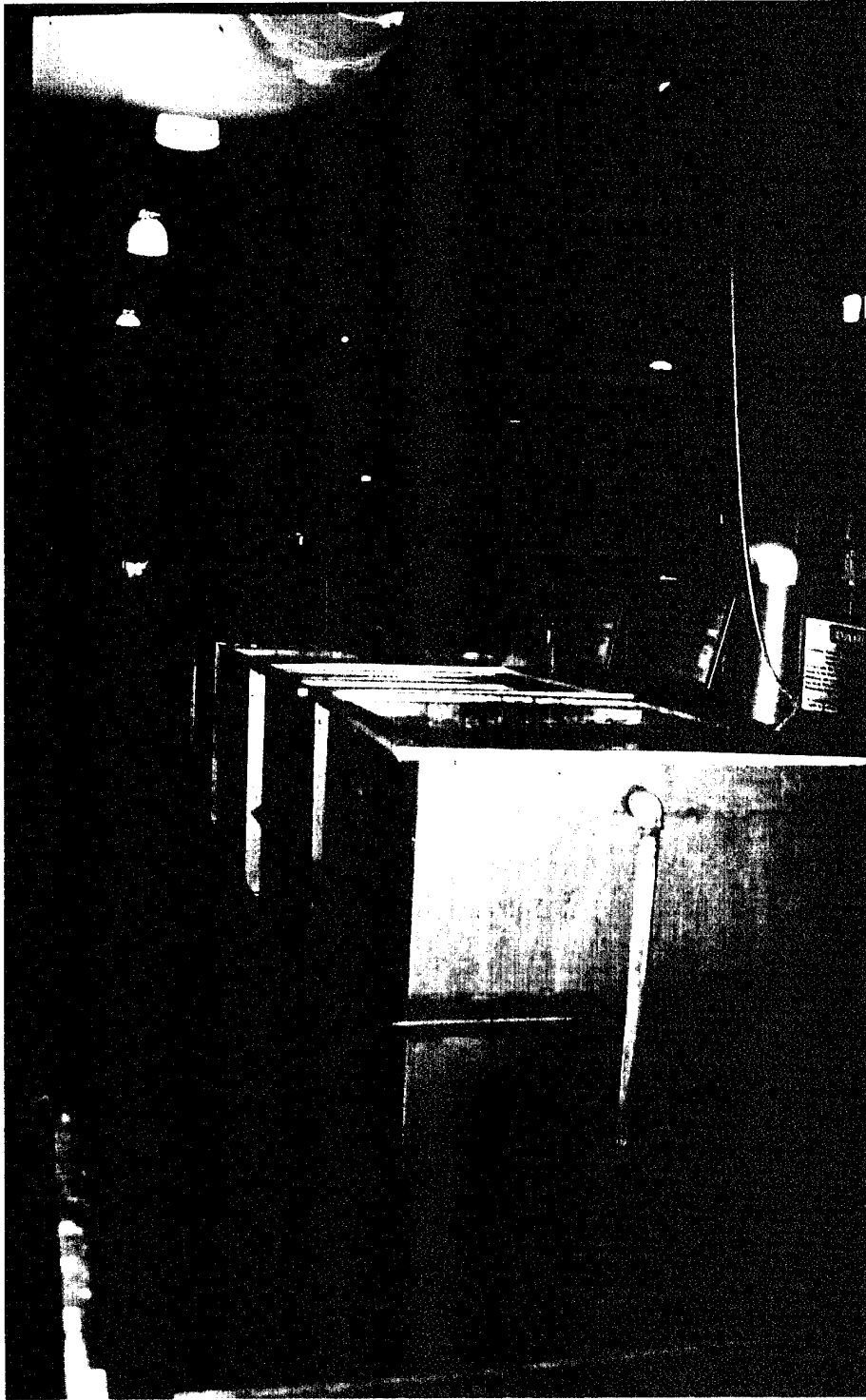
Plating shop tanks at SAEP



Plating shop tanks at SAEP

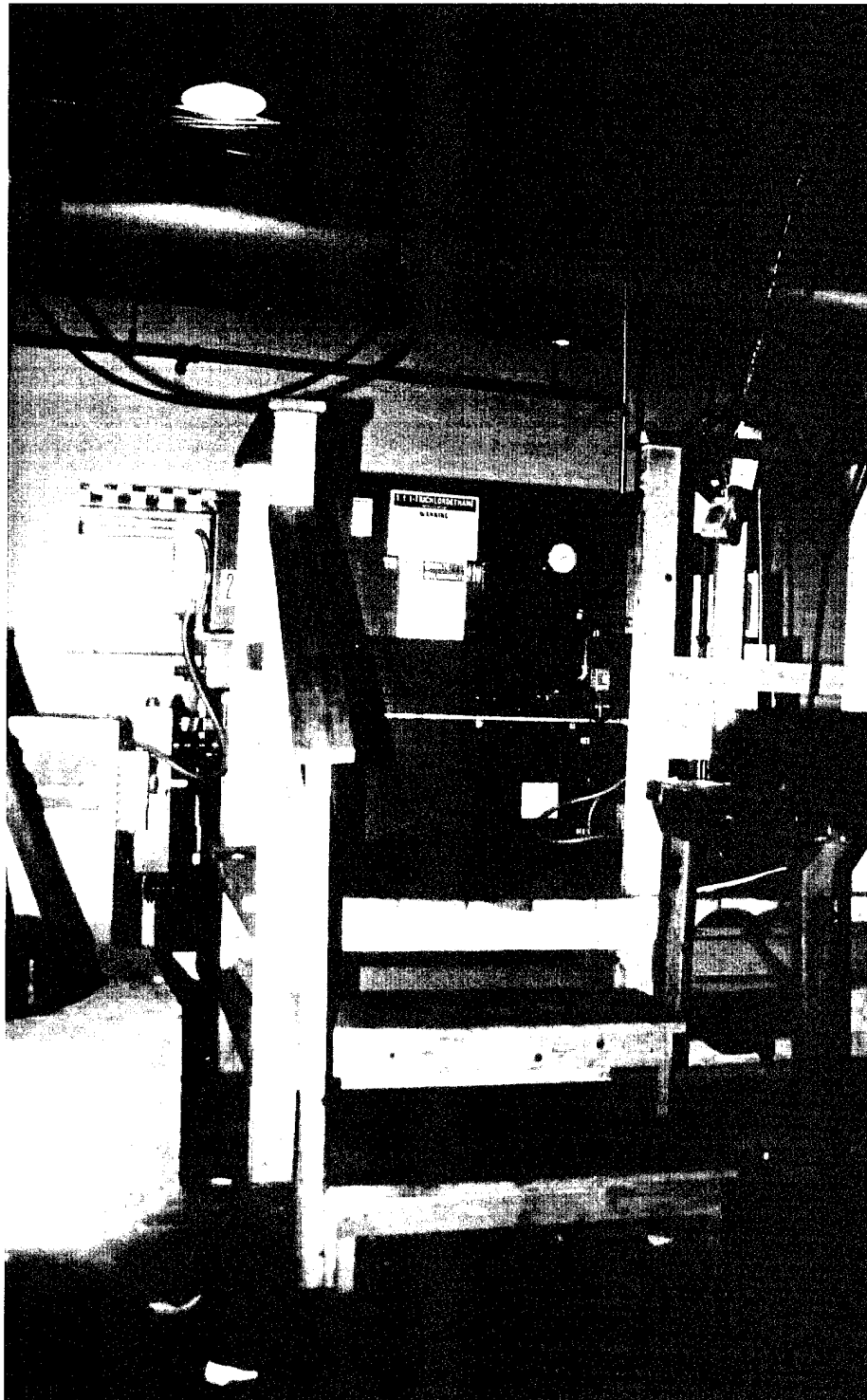


Plating shop tanks at SAEP

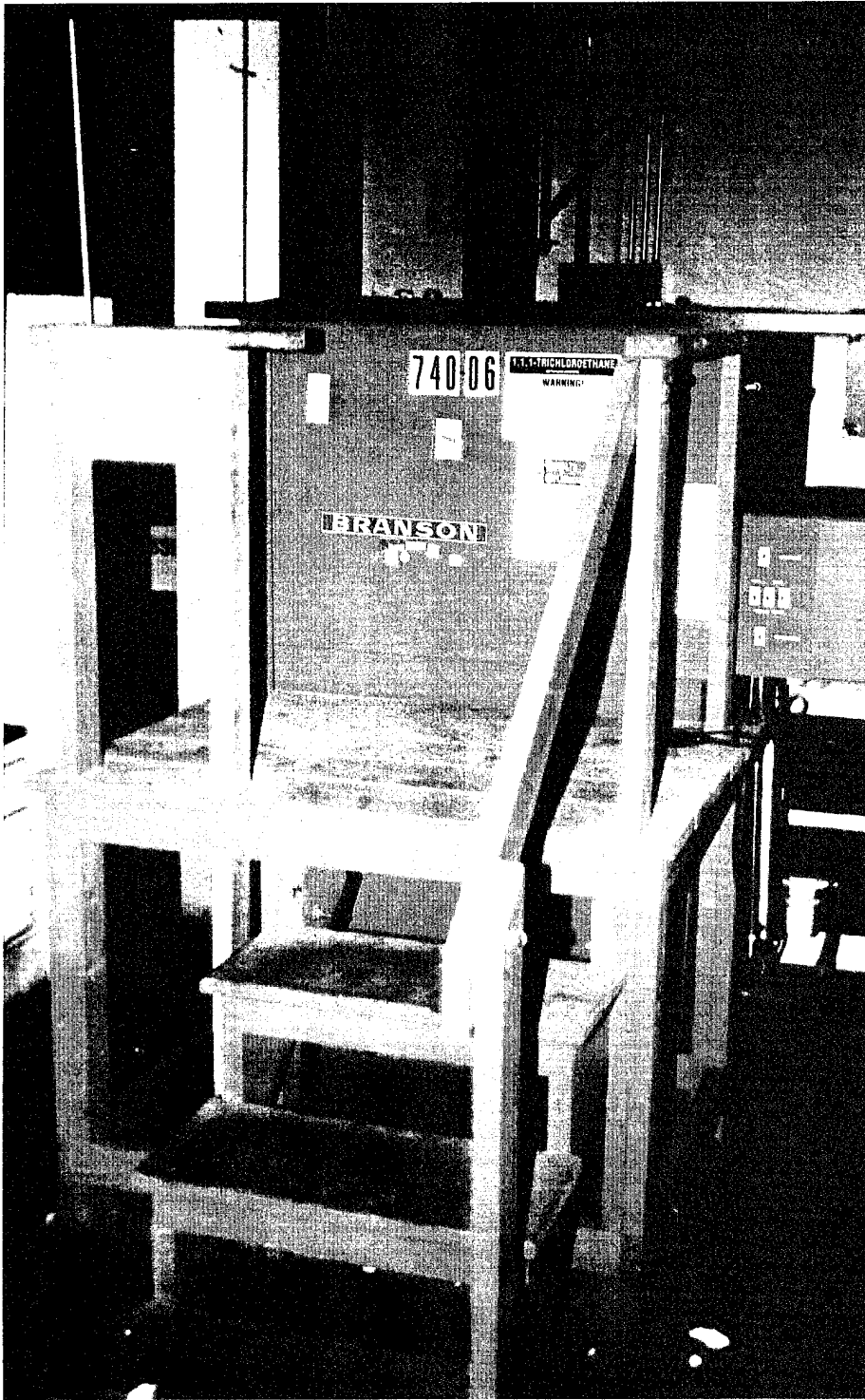


Plating shop tanks at SAEP





A vapor degreaser at SAEP



A vapor degreaser at SAEP

## **DERA HAZMIN Project Effectiveness**

### **Site Visit: Yuma Proving Ground, August 1993**

Arthur D. Little personnel Mike Bryant and Mike Marando participated in meetings and a tour of the facilities at the Yuma Proving Ground (YPG) in Yuma, Arizona on August 3, 1993. The objective of the visit was to obtain additional information on all phases of the DERA HAZMIN funded project at the facility including funding request procedures, HAZMIN results, and cost implications. Additionally, details were gathered regarding issues such as: the time frame and difficulties involved in completing a HAZMIN-funded project; employee awareness of and participation in the HAZMIN program; and the transfer of technology between Army facilities.

Our primary point of contact (POC) at YPG was Charles Botdorf (Physical Scientist) who arranged for us to meet with Chuck Harper (Environmental Protection Specialist) and Patricia Chappell (Environmental Protection Specialist). We were provided with detailed discussions and a site tour.

The purpose of this trip report is to document the information obtained during the site visit. The trip report is presented in four sections to clearly identify and address the important DERA HAZMIN-related issues.

#### **Site Description**

The primary mission of YPG is to test and evaluate a wide variety of tactical systems including: tube artillery systems; aircraft armament systems; air delivery systems; tank automotive equipment; and air-movable equipment. The facility occupies 838,000 acres of land approximately 23 miles north of the city of Yuma, Arizona. YPG has particular value to the Army since it provides an environment for desert testing.

#### **Discussion of the DERA HAZMIN Project**

The DERA HAZMIN project discussed during the visit was a hazardous waste stream analysis. The project was conducted in 1989 by Camp, Dresser and McKee at a cost of \$144,000. A baseline understanding of the site-generated waste was provided through the study.

As part of the analysis, each process which dealt with hazardous material was examined. Mass balances were performed to analyze the waste streams generated by each process and to determine any discrepancy between the material brought into the process and the waste generated. Process flow diagrams were drawn and the final destination of the wastes was determined. Samples were taken to determine the types of wastes generated within each process. For each scenario, hazardous waste minimization proposals were developed.

The resulting project document provided motivation to improve process hazardous materials and waste management. Wastes generated from vehicle maintenance, analytical labs and gun cleaning were analyzed. From the suggestions in the stream analysis, good operating practices were reinforced and improved practices were established where needed.

Due to the changing nature of the operation at YPG, the facility would like to be able to update the survey to make it pertinent to their present situation. The POC has thus far been unable to obtain a copy of the report on disk. If possible the POC would like to obtain funding in order to bring the document up to date and to ensure that YPG will be

continually informed of sound hazardous material and waste practices as the nature of their testing changes.

### **Other Areas of Interest**

YPG would like to obtain DERA funding to evaluate projects. With this money an outline and scope of work would be established for a project to formally apply for DERA funding. An existing problem is that few identified projects have been documented to the point where funding can be requested.

The schedule of obligating DERA funds has presented a problem for YPG. A maximum of six months are typically provided to establish a statement of work, to write a request for proposal (RFP), to review the RFP and to award a purchase order. Working within this time frame has proven to be difficult.

Although YPG generates some wastes from process streams in military and analytical chemistry testing, a higher priority funding requirement is remediation. Since YPG is not an NPL facility, obtaining funds for site remediation has been difficult. A testing area contaminated with approximately 500,000 gallons of gasoline from ruptured fuel bladders requires remediation. The results of chemical disposal activities also necessitate remediation. Buried munitions debris on site will be addressed and need to be further evaluated.

Discussion pertaining to tech transfer revealed that personnel at YPG attend the annual AMC Lessons Learned Workshop. The personnel think very highly of these meetings. Since the mission for YPG involves primarily testing as opposed to process manufacture, their focus on tech transfer is different than most installations and is mainly geared toward remediation.

The primary waste streams at YPG are generated from the testing of military vehicles and aircraft, and chemical agents. These streams include Merachem lead, oil filters containing tin and lead, and rags used in vehicle maintenance. Used engine oil is recycled. YPG presently uses DRMO to handle its waste. The facility would consider using a local vendor, but this option is not possible since additional staffing would be needed. Open burn, open detonation (OB/OD) is still actively used in eliminating ordnance wastes and this practice is expected to continue based upon regulatory discussions with the State of Arizona. YPG has an antifreeze recycling unit and will evaluate the need for a second unit.

In order to manage hazardous wastes more efficiently, YPG uses a hazardous waste tracking system developed at Aberdeen Proving Ground. Through this system, approximately 23 assigned YPG hazardous waste generators can enter the amount of generated waste into the program either manually or through a barcode scanner. From this information a "turn-in" document is generated. An activity environmental coordinator approves the document and allows the drums to be moved to a RCRA Part B HWSF storage site. When the installation environmental coordinator approves the turn-in document, the generator then makes an appointment with the operator of YPG's hazardous waste storage facility to accept delivery. The inventory at this storage facility is checked weekly by Mr. Harper. In general, the generators are pleased with the

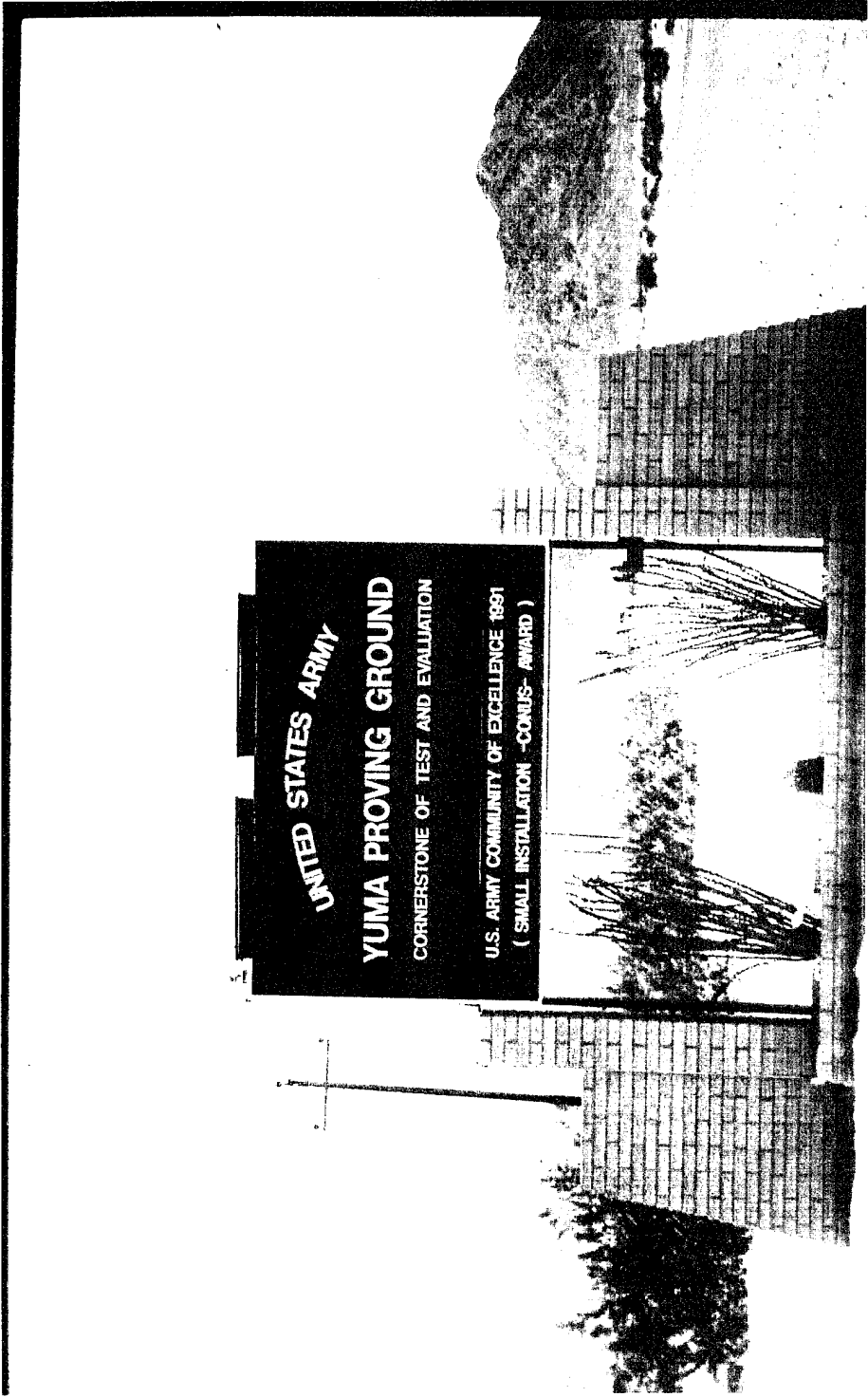
program, since the amount of administration decreased and the management of waste has been improved.

Within the past few years YPG has become proactive in its hazardous waste management practices. The hazardous waste storage facility has its drums segregated by EPA class. A new building is planned to allow for easy access to the drums. A parking area for fuel tanker truck rupture has been built and is capable of containing 5000 gallons of fuel should the release occur.

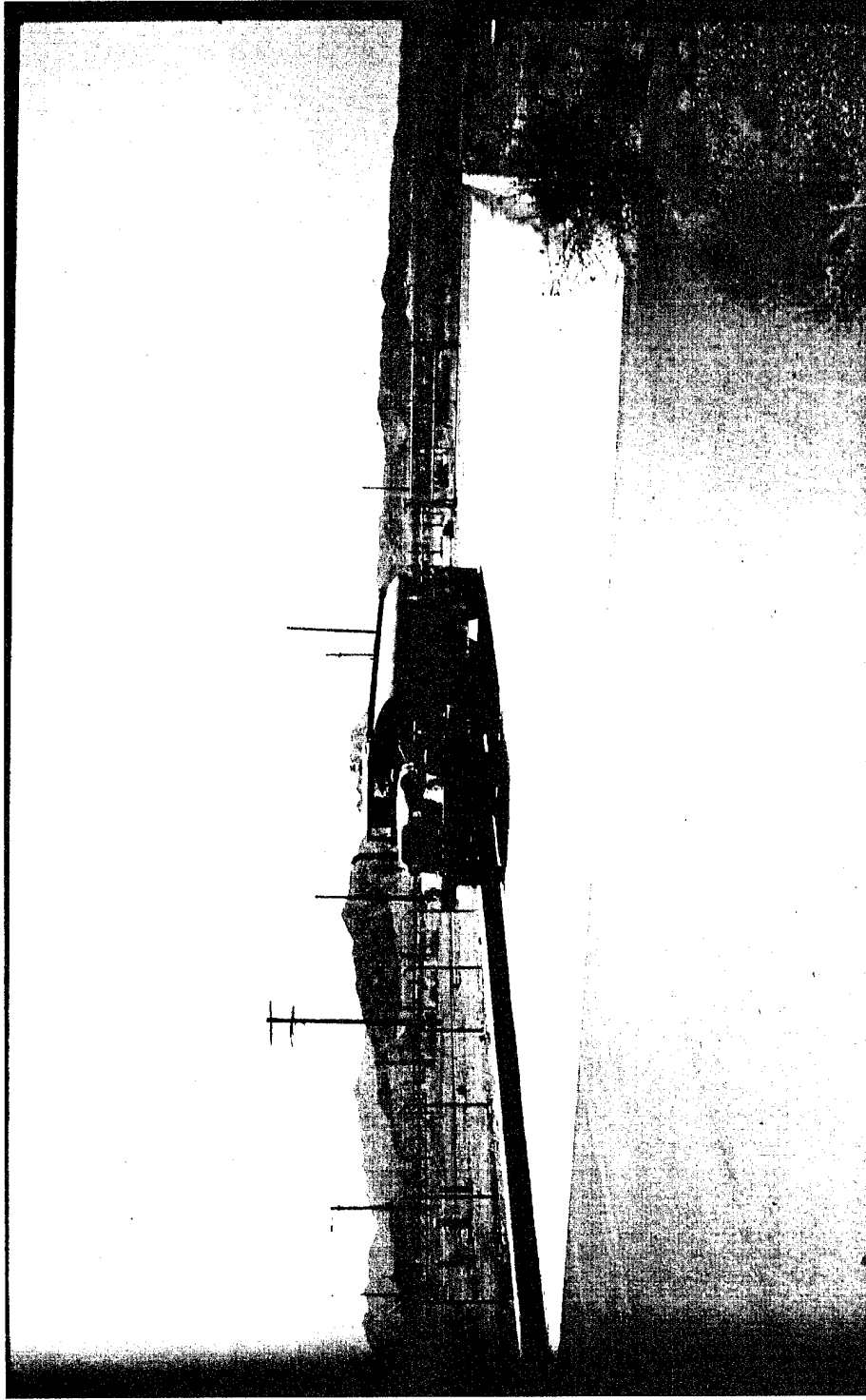
A camera was brought into the YPG facility with prior permission and was used to take photographs of in-process operations.

### **Conclusions**

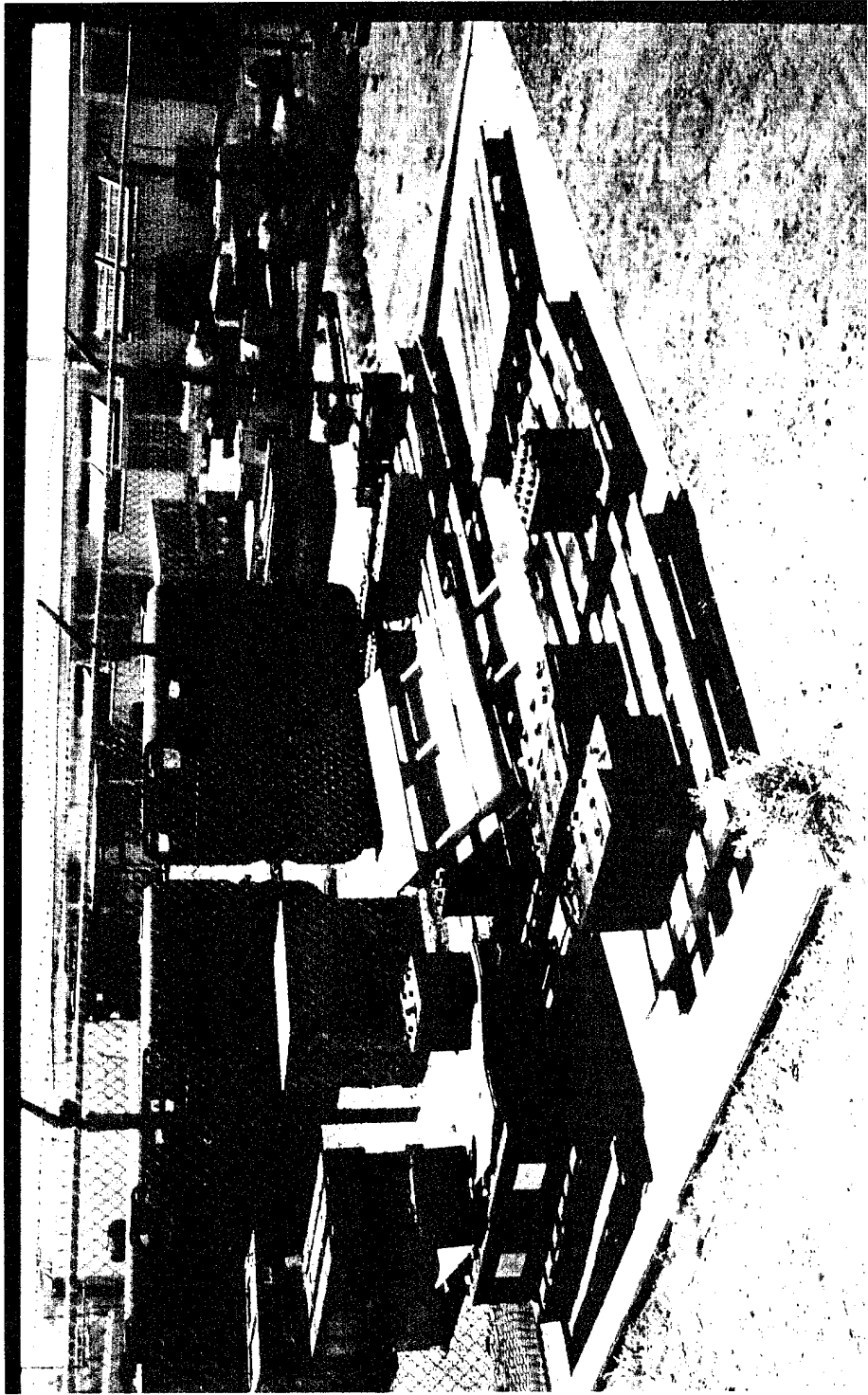
Operations at YPG are expected to expand over the next few years with the consolidation of Army activities. YPG's mission necessitates the need for a dynamic infrastructure for the testing of equipment and munitions. Therefore, the ability to update, maintain and continually improve hazardous materials and hazardous waste management practices are vital.



The sign at the main entrance to Yuma Proving Ground

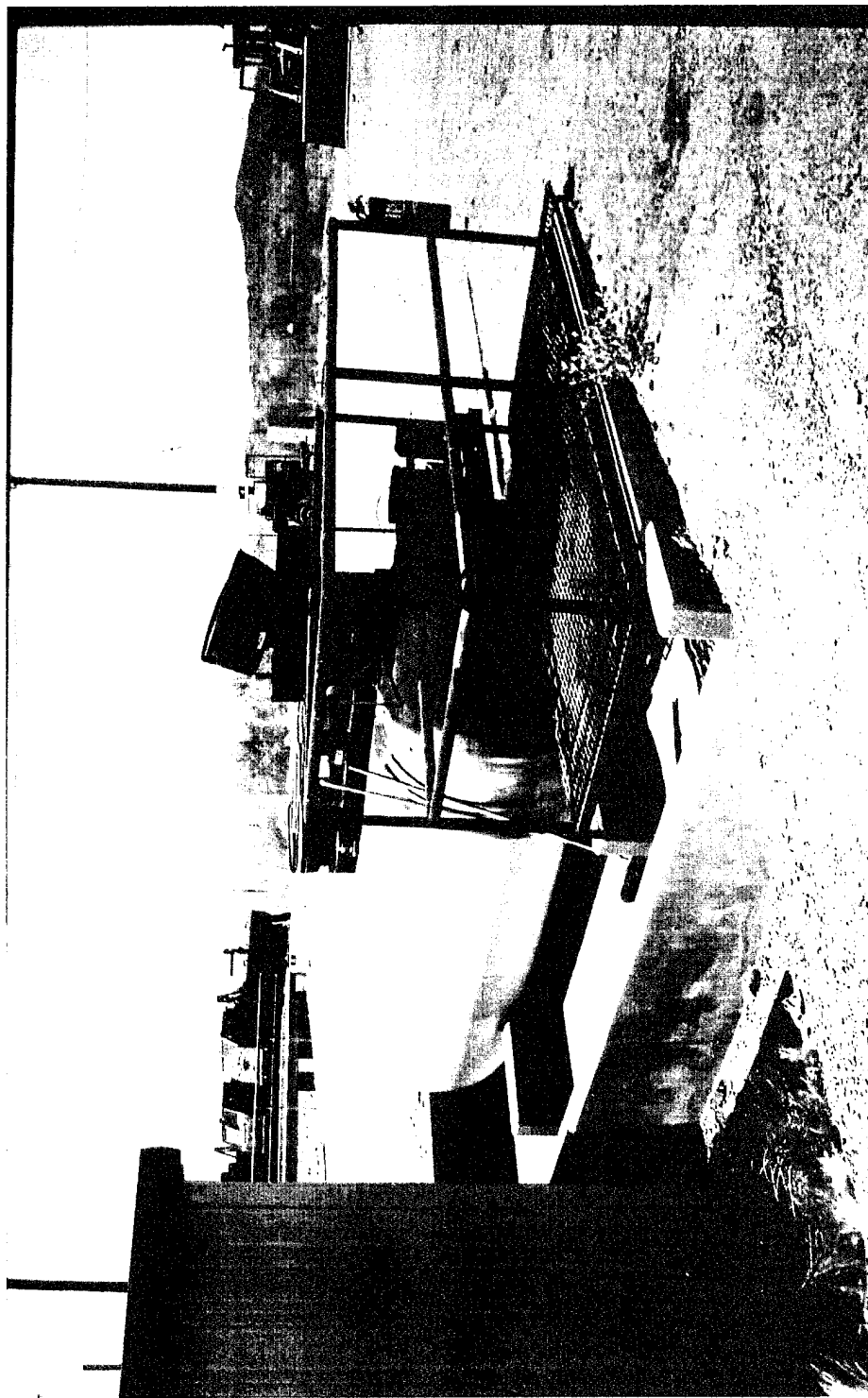


YPG's flexible fuel storage bladder test facility with 5,000 gallon underground catch basin

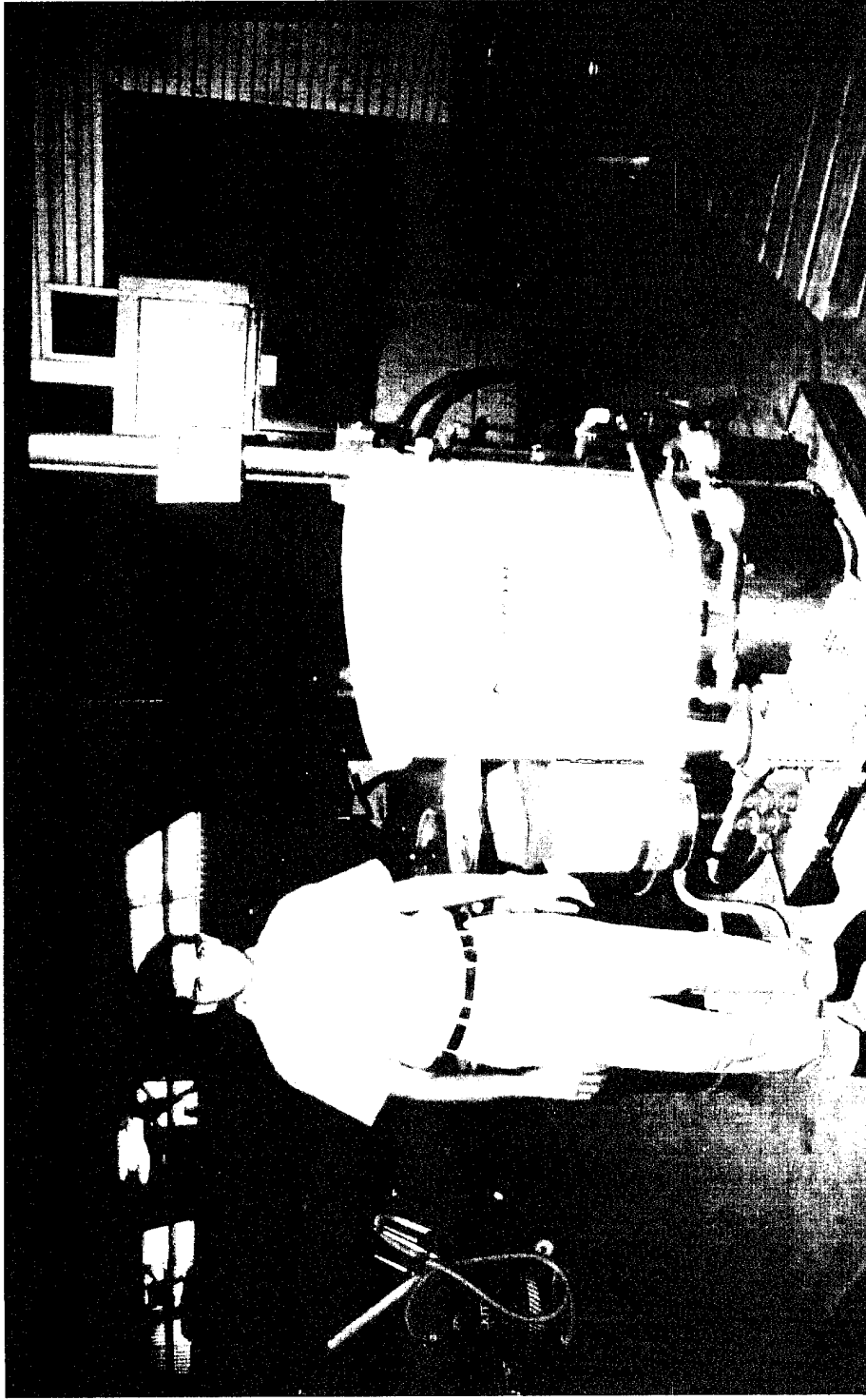


Used battery storage in the recycling storage yard at YPG





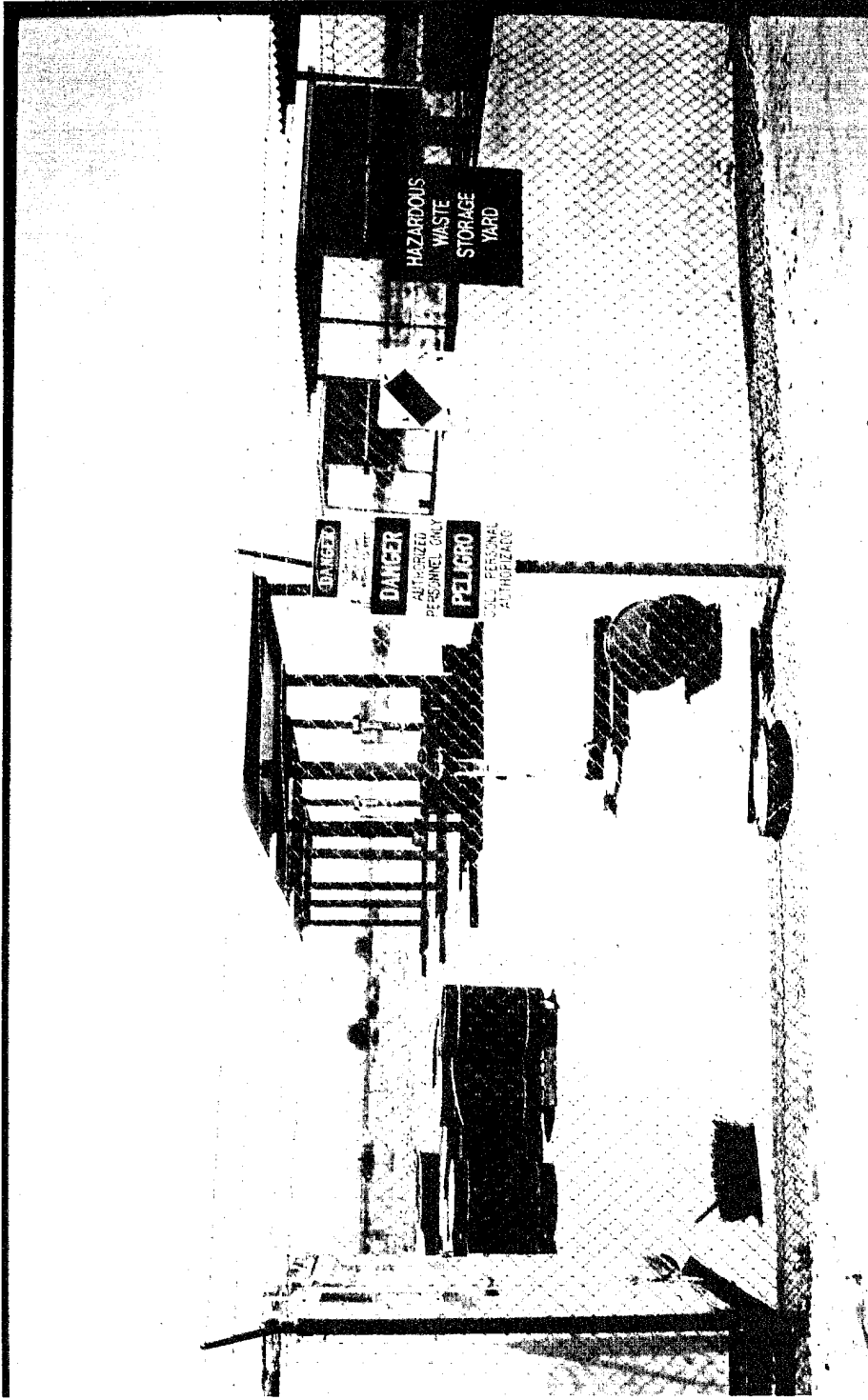
A waste oil storage tank at YPG's recycling storage yard



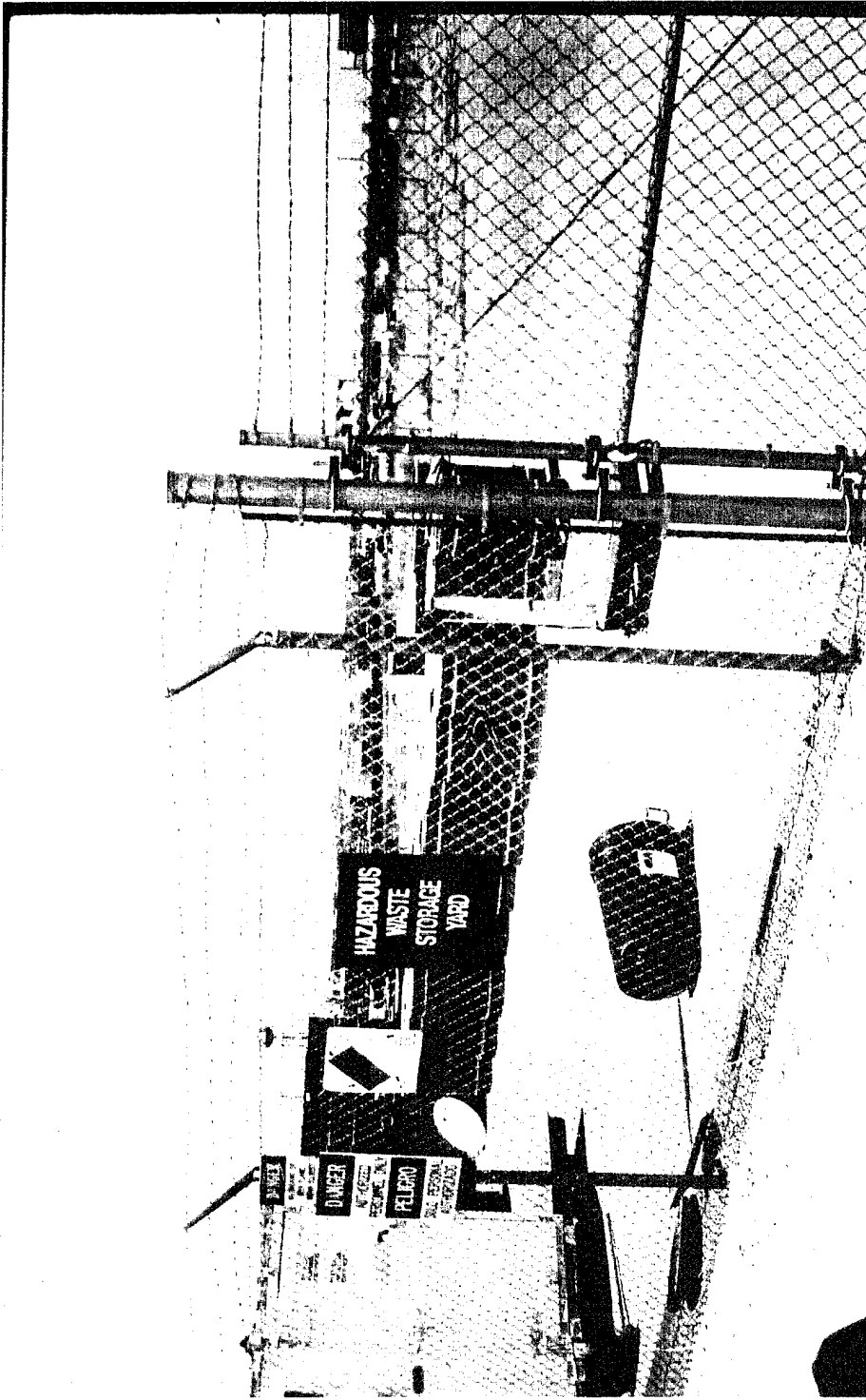
An automotive antifreeze recycling system at YPG



The site side entrance with sign and Army tank at YPG



YPG's hazardous waste storage yard



YPG's hazardous waste storage yard



A sign at YPG's main entrance with large caliber cannon

**Appendix D: Audit and Survey Summaries**

**Summary of HAZMIN Recommendations**



**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Lone Star AAP (PBMA Audit - Report Dated April 1991)**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| Painting               | 1 Implement high volume, low pressure (HVLV) spray guns to reduce paint use, overspray, and VOC emissions  |
|                        | 2 Implement recirculating spray gun cleaning station to reduce solvent use and VOC emissions   |
|                        | 3 Implement solvent recovery still to recover solvent from waste thinner currently being discarded   |
|                        | 4 Use water-based paints where possible to minimize VOC emissions and reduce reliance on paint thinners  |
| Parts Cleaning         | 5 Attempt to reduce number of aerosol cans used for degreasing solvent (TCA)   |
|                        | 6 Discontinue triple-rinsing of vehicle filters to extend life of degreasing baths and requirements for makeup solvents                                      |
|                        | 7 Distill solvents (TCA, Stoddard, Freon) that are not explosive-contaminated in available recovery still  |
|                        | 8 Continue investigation into use of aqueous/alkaline cleaners   |
| Pink Water Treatment   | 9 Consider the use of polyelectrolyte coagulants and improved methods of equalization and settling in existing equipment to eliminate the need for anthrafil |
| Lead Treatment Plant   | 10 Investigate solar evaporation as an inexpensive means to enhance dewatering of treatment sludge   |
|                        | 11 Investigate treatment processes that would minimize the contribution of non-hazardous metals (e.g., iron) to the sludge                                   |
| Chrome Treatment Plant | 12 Examine feasibility of treating chromium-contaminated wastewaters together with lead-contaminated wastewaters in the new Andco lead treatment facility    |
|                        | 13 Implement procedures to dewater chromium sludge in the lead treatment plant's filter press  |
|                        | 14 Examine the use of solar evaporation to enhance dewatering of the sludge  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Lone Star AAP (PBMA Audit - Report Dated April 1991) -  
page 2**

| <u>Operation/Waste</u> | <u>Recommendation</u>   |
|------------------------|---|
| Oily Wastes            | 15 Discontinue triple-rinsing of vehicle filters  |
|                        | 16 Investigate use of heavier oils in the compressors to reduce oil blowby  |
|                        | 17 Conduct tests to identify means of breaking down oil/water emulsions and sludges to allow for removal of excess water                      |
| Machine Shop           | 18 Implement procedure to aerate Trimsol solution when not in use to avoid or delay biological growth   |
|                        | 19 Conduct tests to determine if Trimsol emulsion can be readily broken   |
| Laundry                | 20 Discuss (with Red River AAP) changes necessary to discharge untreated laundry effluent to the Red River POTW to eliminate use of anthrafil |
|                        | 21 Investigate use of polyelectrolyte coagulant aids to reduce or eliminate the use of anthrafil  |
| Rags Management        | 22 Replace rags with shop towels that can be laundered  |
|                        | 23 Audit use of rags in LAP operations to determine opportunities to reduce the generation of explosive-contaminated rags                     |
|                        | 24 Implement laundering oil-contaminated towels (replacing rags) plant-wide   |
| Miscellaneous          | 25 Replace Freon TA with Propaklone in Building B-46 cleaning operations  |
|                        | 26 Modify conveyor lines in Building B-46 to reduce dragout   |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Tobyhanna AD (INEL Audit - Report dated October 1990)**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| Painting               | 1 Convert water wash paint booths in Building 1A to dry filter booths to reduce paint sludge generation  |
|                        | 2 As an alternative to use of dry filter booths, install a filter press or sludge drying system to enhance dewatering of the sludge  |
|                        | 3 Continue to install and use HVLP equipment to reduce overspray and VOC emissions   |
| Photo Fabrication      | 4 Identify substitute solvent for TCA used to remove organic contamination from the boards   |
|                        | 5 By using Ultrasonics Shop equipment, replace Stoddard solvent by using water-based solvents  |
| Sandblasting           | 6 Implement procedures to reduce the requirements for stripping vehicles by either stripping them when there is a demand for them or by storing the stripped vehicles in a shelter after stripping to protect them from corrosion                  |
| Plating                | 7 Modify the Sulfide Precipitation Treatment Plant to allow for the treatment of spent alkaline and acid solutions   |
|                        | 8 Investigate the implementation of metal recovery processes for concentrated metal plating solutions (will require extensive modification to plating shop due to space limitations)   |
|                        | 9 Investigate processes (such as counter-current rinsing, ion exchange, reverse osmosis, and evaporation) to reduce or eliminate discharges from plating operations (will require extensive modification to plating shop due to space limitations) |
| Sulfide Precipitation  | 10 Modify pretreatment process to allow for optimum equilibration in equalization tanks  |
|                        | 11 Install a filter press or sludge drying system to enhance dewatering of the sulfide sludge  |
| General                | 12 Implement improved methods of recording or accounting (such as individual generator logbooks or barcoding system) of the source and amounts of hazardous waste generated installation-wide.   |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Tooele AD (INEL Audit - Report dated October 1990)**

| <b><u>Operation/Waste</u></b> | <b><u>Recommendation</u></b>  |
|-------------------------------|---|
| Chemical Stripping            | 1 Investigate and implement procedures to ensure maximum utilization of caustic stripping solutions (including regeneration, filtration, and analysis)  |
|                               | 2 Investigate and implement procedures to ensure maximum utilization of aluminum conversion coatings (including analysis, control of pH and hexavalent chromium content, filtration of solution, and improved rinsing of parts) |
|                               | 3 Initiate use of a "no-dump" aluminum-etch additive (implemented at Tobyhanna AD) to eliminate dumping of existing weak caustic solution used for aluminum etching   |
| Grit Blasting                 | 4 Conduct pilot test of use of fluidized bed system to separate steel-grit from paint chips   |
|                               | 5 Use alternate grit (such as the harder Zirconia Alumina grit) to walnut shells  |
| Painting                      | 6 Investigate use of alternative (such as lead- and chromium-free) paint formulations   |
|                               | 7 Segregate paint booths by use (i.e., enamel application, CARC application, and lacquer application) to reduce generation of hazardous fiberglass prefilters   |
|                               | 8 Change paint filters based on pressure loss through the filters - not by time or number of parts processed  |
|                               | 9 Implement HVLP paint systems or a dry powder coating system for steel parts - or, as an alternative, the compressed-air paint systems in use could be converted to electrostatic systems                                      |
|                               | 10 Replace water-filter paint booth in Building 615 with dry filter system  |
|                               | 11 Reduce or eliminate practice of thinning paints before spraying  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Tooele AD (INEL Audit - Report dated October 1990) - page 2**

| <u>Operation/Waste</u> | <u>Recommendation</u>   |
|------------------------|---|
| Degreasing             | 12 Add or improve cooling coils, lids, and in-line TCA filtration to vaporize degreasers  |
|                        | 13 Ensure that degreasers are used only for degreasing, not for paint stripping or cleaning   |
|                        | 14 Investigate the use of alternative solvents to vapor degreasing  |
| General                | 15 Construct adequate storage for chemicals and waste   |
|                        | 16 Implement integrated material tracking and accounting systems  |
|                        | 17 Implement a centralized stock system to reduce on-hand stock   |
|                        | 18 Implement a rigorous system for ensuring adherence to written work procedures and enhance awareness of the importance of waste minimization in the workplace |
|                        | 19 Consider implementation of the sulfide precipitation process to replace current hydroxide process  |
|                        | 20 Reuse waste battery electrolyte (sulfuric acid) for pH adjustment in the IWTP  |
|                        | 21 Initiate complete sampling and analysis program to identify waste streams and their characteristics  |
|                        | 22 Improve accuracy of waste generation records by weighing each hazardous waste drum prior to filling (a standard tare weight is currently used)               |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Redstone Army Arsenal (INEL Audit - Report dated December 1991)**

**Operation/Waste**

**Recommendation**

General

- 1 Implement central computerized monitoring system covering all aspects such as inventory control, emissions monitoring, and reporting
- 2 Investigate potential uses of biotechnology to treat wastes

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Stratford Army Engine Plant (INEL Audit - Report dated  
December 1991)**

| <u>Operation/Waste</u> | <u>Recommendation</u>   |
|------------------------|---|
| General                | 1 Update engineering documents retained to eliminate obsolete documents - this will facilitate waste stream-process correlations to identify waste minimization opportunities |
|                        | 2 Implement improved methods of recording or accounting for waste sources and quantities as well as raw material use  |
| Plating                | 3 Implement cyanide-free copper plating process   |
|                        | 4 Replace cyanide-containing periodic reverse cleaner with cyanide-free metal cleaner   |
|                        | 5 Investigate potential for elimination of periodic reverse cleaning operation  |
|                        | 6 Implement procedures to cover vapor degreasers when not in use to reduce VOC emissions and solvent loss   |
|                        | 7 Adhere to rigorous maintenance schedule to ensure that conductivity meters are used properly to keep contamination levels in the rinse tanks at a minimum                   |
| IWTP                   | 8 Identify sources of organic contamination in IWTP effluent  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Anniston AD (PBMA Audit - Report dated June 1991)**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| General                | 1 Implement HAZMIN incentive program   |
| Disassembly            | 2 Eliminate solvent disposal into waste oil collection pits  |
| Steam Cleaning         | 3 Implement use of alternate solvent   |
|                        | 4 Perform a study of water use in steam cleaning areas to identify opportunities for reduction in wastewater discharges  |
|                        | 5 Replace most steam-cleaning operations with aqueous washers  |
| Small Parts Cleaning   | 6 Adjust Safety Kleen service schedule based on contamination rates  |
|                        | 7 Replace solvent washers with aqueous parts washers.  |
| Chemical Cleaning      | 8 Implement process to redistill TCE still bottoms   |
|                        | 9 Base disposal of chemical cleaning solutions on need rather than a specific disposal schedule to reduce disposal frequency   |
|                        | 10 Implement procedures for in-tank treatment of acid and alkaline cleaners for discharge to the IWTP  |
|                        | 11 Install filtration and oil skimming processes to remove contaminants from alkaline corrosion removal baths and acid cleaning baths  |
|                        | 12 Replace steam cleaning and chemical cleaning with aqueous parts washers and molten salt bath process  |
| Abrasive Blasting      | 13 Implement preventative measures (such as removing toxic surface deposits and coatings prior to abrasive blasting) to minimize the introduction of toxic metals to the abrasive blasting dusts |
|                        | 14 Implement molten salt bath process to replace abrasive blasting   |
|                        | 15 Restrict use of deposits and coatings causing hazardous characteristics   |



**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Anniston AD (PBMA Audit - Report dated June 1991) - page 2**

| <u>Operation/Waste</u> | <u>Recommendation</u>   |
|------------------------|---|
| Machining and Grinding | 16 Implement offsite recycling of cutting and hydraulic oils  |
|                        | 17 Implement procedures to limit the number of different cutting and hydraulic oils used  |
| Metal Finishing        | 18 Implement procedures for in-tank treatment of acid and alkaline cleaners   |
|                        | 19 Implement procedures to improve maintenance of alkaline baths  |
| Spray Painting         | 20 Substitute single-component CARC paint for multiple-component paint currently used   |
|                        | 22 Coat paint pots with Teflon to reduce amount of solvent required for cleanup   |
|                        | 23 Install spray gun cleaning stations at each paint booth  |
|                        | 24 Implement HVLP spray painting to reduce overspray and VOC emissions  |
|                        | 25 Initiate onsite recycling of solvent   |
|                        | 26 Install and implement portable filter presses to improve paint booth sludge dewatering   |
| IWTP                   | 27 Develop in-house program for evaluating IWTP process changes (including the use of alternative treatment reagents and IWTP operation optimization) |
|                        | 28 Investigate substitution of caustic for lime to reduce sludge generation   |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Letterkenny AD (INEL Audit - Report dated December 1991)**

| <u>Operation/Waste</u>  | <u>Recommendation</u>  |
|-------------------------|--|
| Paint Stripping         | 1 Investigate alternative media (other than agricultural or plastic) for abrasive stripping<br>2 Replace current degreasing solvents with biodegradable solvents   |
| Degreasing              | 3 Continue efforts to initiate point-source recycling of TCA<br>4 Investigate the use of ultrasonic cleaning (in combination with an aqueous alkaline cleaner) to replace vapor degreasing   |
| Painting                | 5 Investigate potential for paint waste reduction by use of HVLP paint spray systems   |
| Electroplating/Coatings | 6 Investigate the use of alternative coatings (for example, the use of zinc phosphate conversion coating which enhances corrosion protection thereby reducing requirements for coating recycles and associated wastes)<br>7 Investigate the potential for treatment and recycling of the waste effluent at Building 1N and thereby eliminate discharge to the IWTP |
| Diesel Fuel             | 8 Investigate potential for blending waste oil with diesel fuel and subsequent burning of the mixture in the heating plant boiler  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Red River AD (CERL/Versar Audit - Report dated April 1991)**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| Degreasing             | <ol style="list-style-type: none"><li>1 Substitute non-halogenated solvent for TCA</li><li>2 Implement distillation process to recover Stoddard solvent</li><li>3 Investigate the potential for recovery of MEK by distillation</li><li>4 Initiate field testing of the use of high-flashpoint naphtha or alkaline detergents as degreasing agents</li></ol> |
| IWTP                   | <ol style="list-style-type: none"><li>5 Investigate procedures to remove cadmium from the influent wastewater at the IWTP</li><li>6 Initiate application to EPA to delist F006 sludge (once cadmium is eliminated from the IWTP and data are available to adequately characterize the sludge)</li></ol>  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Louisiana AAP (PBMA Audit - Report dated December 1990)**

| <u>Operation/Waste</u> | <u>Recommendation</u>   |
|------------------------|---|
| Metal Forging          | 1 Investigate a means of eliminating the lead source in oily wastewater   |
|                        | 2 Investigate the use of a steel "curb" around one of the forge presses to collect excess forging compound and return it to the reservoir adjacent to the press   |
| Metal Parts Machining  | 3 Conduct regular cleaning of the "harpoon" system to lengthen coolant life   |
|                        | 4 Implement procedures to use high quality (deionized or RO-treated) water in the initial makeup of coolant in order to extend the useful life and quality of the coolant and reduce raw material usage |
|                        | 5 Install aboveground tank to hold all quench oil currently sent to outdoor sump in order to improve efficiency of the oily waste treatment system  |
|                        | 6 Investigate the use of ultrafiltration or pH adjustment/quiescent separation processes to break coolant emulsions allowing for enhanced oil/water separation  |
|                        | 7 Construct open-sided, roofed structure over sumps to eliminate collection of rainwater  |
| Metal Finishing        | 8 Implement procedures to extend the lives of the chromate seal baths by reformatting with phosphoric acid  |
|                        | 9 Reduce volume of waste sludges in by settling in drums and decanting off water  |
|                        | 10 Implement electrolytic process to convert trivalent chromium to reusable hexavalent chromium and remove metal impurities   |
| Vapor Degreasing       | 11 Undertake recommended steps to minimize evaporative solvent losses (including ensuring that all parts are dry prior to removal from the degreaser and conducting a maintenance inspection)           |
|                        | 12 Substitute vapor degreaser (M-4) with alkaline cleaning unit   |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Louisiana AAP (PBMA Audit - Report dated Dec 1990) -  
page 2**

| <u>Operation/Waste</u>   | <u>Recommendation</u>  |
|--------------------------|--|
|                          | 13 Reactivate "abandoned" solvent recovery still for recovery of spent solvent generated by the M-4 vapor degreaser (if alkaline cleaning substitute is implemented)                                     |
|                          | 14 Investigate the possible replacement of vapor degreasing solvent currently used with a non-CFC solvent  |
| Spray Painting           | 15 Undertake steps to improve paint management (including mixing of smaller volumes near the end of the day and completely emptying paint can prior to opening a new one)                                |
|                          | 16 Initiate batch painting operations (i.e., paint one type of item at a time)   |
|                          | 17 Initiate two-staged equipment cleaning practices (i.e., use "previously used" solvent first to remove the largest portion of paint and residue then follow up with "fresh" solvent to rinse the item) |
|                          | 18 Initiate procedures to segregate solvent wastes to allow for recovery and recycling of solvents by distillation and reduce paint waste generation   |
|                          | 19 Investigate potential of HVLP spray paint guns to reduce overspray and VOC emission   |
|                          | 20 Use Teflon-coated paint pots to reduce wastes associated with pot cleaning  |
|                          | 21 Implement paint spray gun cleaning stations   |
|                          | 22 Reactivate "abandoned" solvent still to recover paint solvents  |
| Dye Penetrant Inspection | 23 Install dry powder developer process to replace the use of the soluble developer solution to eliminate chrome (this will require modification of the MILSPEC)   |
| LAP Operations           | 24 Perform cost benefit analysis of off-site degreasing of aluminum overlays prior to shipment   |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Louisiana AAP (PBMA Audit - Report dated December 1990)  
page 3**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| Plant Support          | 25 Undertake recommended housekeeping and maintenance procedures in machine shop area to extend useful life of cutting oils, coolants, and solvents  |
|                        | 26 Add bacteria inhibitor to coolant in unused machining equipment   |
|                        | 27 Implement procedures to segregate solvent wastes in the vehicle maintenance area to facilitate waste tracking and solvent recovery operations and potentially reduce disposal costs                 |
|                        | 28 Initiate procedures to preclean parts by wiping down prior to immersing or rinsing in a solvent bath  |
| Oily Wastewater Tmt    | 29 Initiate measures to increase the effectiveness of existing waste oil/oily waste management program (including the direct collection of all concentrated oil wastes for off-site disposal/recovery) |
| Lancy Treatment System | 30 Investigate potential for reducing sludge volumes and improve dewatering characteristics by lowering the pH used for metals and phosphorus removal  |
| Pinkwater Tmt Plant    | 31 Investigate feasibility of eliminating diatomaceous earth filters from the treatment train  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Longhorn AAP (PBMA Audit - Report dated June 1991)**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| Painting               | 1 Reinstigate use of thinner bath at Building 722-P  |
|                        | 2 Purchase and implement a HVLP paint spray gun to reduce overspray and VOC emissions  |
|                        | 3 Purchase and implement a spray gun cleaning station  |
|                        | 4 Coat paint pots with Teflon to reduce cleanup wastes   |
|                        | 5 Investigate the use of water-based paints  |
| Maintenance            | 6 Improve procedures associated with maintenance activities (including preventive maintenance, precleaning of parts before use of dip tanks, cascade reuse of solvents, adding bactericide to coolant) |
| Solvents               | 7 Investigate the use of aqueous cleaners in dip tanks to replace solvents   |
|                        | 8 Consider consolidation of vapor degreasers into one or two units to facilitate the installation of integral stills for solvent recovery  |
| Explosive Wastes       | 9 Handle waste pyrotechnic mix in dry form to reduce scrubber and other wastewater   |
|                        | 10 Install mechanical/electronic weighing, check weighin, and dispensing devices where pyrotechnic mix is manually weighed and dispensed to reduce generation of waste powder                          |
|                        | 11 Recover manganese delay composition currently disposed by regranulation   |
|                        | 12 Encapsulate burning ground ash for on-site disposal as a non-hazardous waste  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Lake City AAP (PBMA Audit - Report dated February 1991)**

| <u>Operation/Waste</u>      | <u>Recommendation</u>   |
|-----------------------------|---|
| Solvents                    | 1 Investigate alternatives for bullet tip degreasing to reduce methyl chloroform (MC) wastes (e.g., use of hot aqueous detergent or alkaline cleaner, elimination of bullet lubrication, bullet tip precoloring, and development of central bullet tip ID facility) |
|                             | 2 Investigate alternatives for mouthwaterproofing wastes (e.g., alternative mouthwaterproofing materials, use of strippable plastic liners in place of rags, use of Teflon lined-pots, on-site distillation/recovery of MC, dry cleaning rags)                      |
|                             | 3 Investigate alternative solvents to replace degreasing and cleaning solvents  |
|                             | 4 Purchase and implement on-site distillation for recovery of kerosene, Stoddard solvent, and ethyl acetate   |
| HgNO <sub>3</sub> Solutions | 5 Design and install ion exchange process for recovery of Hg  |
| Hg-Contaminated Wastes      | 6 Evaluate methods to improve housekeeping procedures   |
| Spray Paint Wastes          | 7 Evaluate potential for use of latex paints  |
|                             | 8 Purchase and implement HVLP spray guns  |
|                             | 9 Purchase and install paint gun cleaning stations  |
| EWTP Wastes                 | 10 Rebuild EWTP manholes  |
|                             | 11 Agitate kill tanks to suspend sludge   |
|                             | 13 Install UV/oxidation treatment unit  |
|                             | 14 Investigate use of sludge drier to further dewater filter press solids   |
| Lead Forming Wastes         | 15 Install hydrocyclone separators to minimize Pb waste in IWTP sludge  |
|                             | 16 Purchase wringer and collection drum to recycle pig-sock and oil   |



**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Lake City AAP (PBMA Audit - Report dated February 1991) -  
page 2**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| Reject Primers         | 17 Install Eleyprime process   |
|                        | 18 Revise specifications and primer loading procedure to<br>eliminate maximum charge weight limits in primer loading |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Riverbank AAP (PBMA Audit - Report dated July 1992)**

| <u>Operation/Waste</u>          | <u>Recommendation</u>   |
|---------------------------------|---|
| Vehicle Maintenance<br>Used Oil | 1 Recycle in the oil recovery unit<br>2 List in California Waste Exchange for sale  |
| Used Battery                    | 3 Turn in 10 batteries or less at a time to a local retailer<br>4 Reuse sulfuric acid drained from battery in Operation 65 in the grenade line  |
| Waste Solvent                   | 5 Replace with non-hazardous alternative<br>6 Recycle used solvent with an on-site still  |
| Machine Shop<br>Waste Coolant   | 7 Filter solutions periodically to remove solids and prolong coolant life   |
| Waste Solvent                   | 8 Recycle used solvent with an on-site still  |
| Oily Waste                      | 9 Use rags only for wiping off oil from operator's hands and for light cleaning of machinery<br>10 Investigate more efficient booms that can be reused<br>11 Purchase PIG Squeezer to extract fluid and reuse PIGS<br>12 Perform heavy cleaning with solvents |
| Paint Stripping                 | 13 Increase efficiency of operations (good housekeeping)<br>14 Send spent soap and rust preventative compound to IWTP   |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Detroit Army Tank Plant (INEL Audit - Report dated  
December 1991)**

| <u>Operation/Waste</u> | <u>Recommendation</u>   |
|------------------------|---|
| General                | 1 Use General Dynamics Land Systems Division (GDLS) hazardous material screening and material tracking system   |
| Machining              | 2 Replace existing coolants in seven milling machines with the synthetic coolant, Tech Cool 3700  |
| Surface Preparation    | 3 Invest in substitute biodegradable cleaning and paint stripping solvents as identified by EG&G Idaho<br>4 Investigate mechanical agitation in the surface treatment tanks and potential for filtration of the baths |
| Waste Batteries        | 5 Investigate the potential of using waste battery acid as a "treatment chemical" to reduce heavy metal discharges at the IWTP  |
| IWTP                   | 6 Update the IWTP Operating Manual to reflect current operations  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Sharpe Army Depot (INEL Audit - Report dated December 1991)**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| General                | 7 The environmental office should implement a computerized environmental monitoring system (covering environmental regulations, inventory control, emissions monitoring, and reporting)  |
| Grit Blasting          | 8 Improve hazardous waste classification process (particularly with respect to garnet grit waste)<br>9 Implement a quality control program within the sandblast facility (addressing part identification, pressures used, part condition, time spent per part, and garnet amounts per part)<br>10 Investigate the use of vacuum blasting allowing for self containment and recycling |
| Painting               | 11 Implement HVLP painting systems to increase transfer efficiencies (thereby reducing overspray waste and paint consumption)  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Watervliet Arsenal (PBMA Audit - Report dated May 1991)**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
| General                | 1 Implement HAZMIN incentive program   |
| Machinery and Grinding | 2 Purchase flexible machining system (FMS) coolant without dye to enable its treatment in the IWTP                                   |
|                        | 3 Eliminate the use of leaking waste oil sumps to reduce amount of water in waste oil that is disposed offsite                       |
|                        | 4 Improve housekeeping and maintenance to reduce fluid contamination, leaks (including tracking and checking fluid quality and use)  |
|                        | 5 Use offsite recycling service to recover spent machine cutting oils  |
|                        | 6 Filtration of Isopar-M to remove dirt particles and extend the useful life of this fluid   |
|                        | 7 Install central cutting oil recycle systems to remove metal fines, water, and other contaminants                                   |
|                        | 8 Install a coolant recycle system in the FMS area   |
|                        | 9 Limit the number of different cutting and hydraulic oils used to facilitate the implementation of HAZMIN options such as recycling |
| Heat Treatment         | 10 In-tank treatment of spent cleaner solution and associated rinse for discharge to the IWTP  |
| Metal Finishing        | 11 Substitute new electrode material for EP cell units to replace lead allow currently used  |
|                        | 12 Investigate the use of a waste exchange to locate potential firms for offsite reuse of wastes                                     |
|                        | 13 Change NMT Cr rinse configuration and operation   |
|                        | 14 Change 8-in. Line Cr rinse configuration by converting the first overflow rinse to a drag-out recovery tank                       |
|                        | 15 Replace EP cell units with state-of-the-art chrome bath purification technology   |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Watervliet Arsenal (PBMA Audit - Report dated May 1991) -  
page 2**

| <u>Operation/Waste</u> | <u>Recommendation</u>  |
|------------------------|--|
|                        | 16 Use electro dialysis to treat spent EP Cell solution (chromic acid) to allow for its reuse  |
|                        | 17 Conduct continuous bath maintenance of electropolisher solution to extend its life and reduce disposal frequency                    |
|                        | 18 Install filtration and oil skimming equipment to remove contaminants from alkaline cleaning solutions thereby extending their lives |
|                        | 19 Implement in-tank treatment of spent alkaline solutions to allow for discharge to the IWTP for additional treatment                 |
| Painting               | 20 Coat paint pots and cups with Teflon to reduce solvent requirements for cleanup   |
|                        | 21 Purchase and implement solvent still for the recovery of solvent used in paint cleanup operations and in the Carpenter Shop         |
| Benet Laboratories     | 22 Reduce sample volume of electroplating solutions  |
|                        | 23 Limit quantity of chemicals purchased   |
| IWTP                   | 24 Purchase and implement a filter press and sludge dryer for dewatering chromium and oil waste sludge to reduce volume to be disposed |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Holston (PBMA Audit - Report dated December 1992 - Note:  
Only Volume II of report was available at time of review)**

| <u>Operation/Waste</u>                | <u>Recommendation</u>  |
|---------------------------------------|--|
| <i>Area B Utilities</i>               |  |
| Alum Sludge                           | 1 Identify secondary market for the sludge as input material for cement  |
|                                       | 2 Improve sludge dewatering prior to disposal in landfill  |
| Cinders                               | 3 List with Southeast Waste Exchange in the event current means of selling off-plant is unavailable  |
| Flyash                                | 4 Investigate alternate (secondary) market for the flyash in the event the cinder block manufacturer currently using the material can not accept it due to capacity requirements |
| <i>Machine Shop</i>                   |  |
| Waste Oil                             | 5 Install a portable filtration system to extend life of oil   |
|                                       | 6 Replace petroleum-based oil with synthetic oils  |
| Spent Absorbent                       | 7 Use absorbent until completely saturated   |
|                                       | 8 Purchase reusable absorbent booms as a supplement to sawdust   |
| Spent Mineral Spirits                 | 9 Replace with biodegradable cleaner   |
|                                       | 10 Implement good housekeeping procedures to minimize solvent usage  |
| <i>Instrument and Electrical Shop</i> |  |
| Waste Batteries                       | 11 Investigate and identify market that pays for used batteries  |
| <i>Storage Warehouse</i>              |  |
| Spent Packing Material                | 12 Obtain market for recycling through Southeast Waste Exchange  |
| <i>Paint Shop</i>                     |  |
| Paint Sludge                          | 13 Schedule paint operations close together and optimize use of paint colors to minimize paint cleanup requirements  |
|                                       | 14 Prefilter waste thinner through burlap  |

**Summary of HAZMIN Recommendations  
Resulting from AMC Surveys**

**Installation: Holston AAP (PBMA Audit - Report dated December 1992)-  
page 2**

| <u>Operation/Waste</u>             | <u>Recommendation</u>  |
|------------------------------------|--|
|                                    | 15 Implement countercurrent multi-stage rinsing in cleaning operations |
|                                    | 16 Use nonstick-coated paint cups and pot liners                       |
| Empty Paint Cans                   | 17 Install paint can crusher to reduce volume to be disposed           |
| <i>Miscellaneous</i><br>Dispersant | 18 Substitute Versatec Clear Dispersant with less hazardous dispersant |
|                                    | 19 Recycle dispersant through contract with Safety Kleen               |



## Summary of Audit Recommendations Status

**Letterkenny Army Depot**

**Point of Contact: Dennis Reed (717) 267-9506** (No cost savings data was available)

**Recommendation 1:** Investigate alternative blast media (other than agricultural or plastic) for abrasive stripping.

**Status:** Letterkenny has had a continuing program to investigate alternative media and found the alternatives either:

- a. Ineffective
- b. Expensive (with no significant benefit over current methods)
- c. Both of the above.

**Recommendation 2:** Replace current degreasing solvents with biodegradable solvents.

**Status:** The cleaners that were evaluated included simple greens and citri-kleens. These cleaners do not clean as well until the solution is heated to about 150F at which point detergent and water clean just as well. Letterkenny has purchased 9 parts washers that use detergent and hot water, and are in the process of purchasing 123 more. For applications where detergent and water are not adequate, Letterkenny is continuing to use Stoddard solvent with on-site recycling. For those operations where neither detergent or stoddard solvent is a suitable substitute, Letterkenny is looking at formulated organics and some biodegradables.

**Recommendation 3:** Continue efforts to initiate point-source recycling of TCA.

**Status:** Because TCA is being phased out, all work on the auxiliary distillation units was stopped. Letterkenny is using a centralized, on-site distillation unit until TCA is totally replaced.

**Recommendation 4:** Investigate the use of ultrasonic cleaning (in combination with an aqueous alkaline cleaner) to replace vapor degreasing

**Status:** USAEC and Oak Ridge National Laboratory are investigating the use of large scale high energy ultrasonics. Letterkenny plans to use high pressure spray washers and steam cleaning in the meantime.

**Recommendation 5:** Investigate potential for paint waste reduction by use of HVLP paint spray systems.

**Status:** HVLP is in use wherever it works, i.e. where a high solids paint is not being used. HVLP has no impact on liquid paint waste but has some impact on the generation of dry paint waste (filters). Letterkenny's paint filters are non-hazardous, and the impact of the HVLP conversion is difficult to quantify due to workload changes. Conversion to HVLP was based on VOC emissions, not hazardous waste. HVLP guns are used for approximately 25% of the workload.

**Recommendation 6:** Investigate the use of alternative coatings (for example, the use of zinc phosphate conversion coating which enhances corrosion protection thereby reducing requirements for coating recycles and associated wastes).

**Status:** Letterkenny is constantly trying to convince customers that alternative metal finishes should be used.

**Recommendation 7:** Investigate the potential for treatment and recycling of the waste effluent at Building 1N and thereby eliminate discharge to the IWTP.

**Status:** To treat and recycle the waste effluent from Building 1N an extensive rework of the entire operation would be required. In addition, the spatial constraints for the amount of equipment required to be installed in the building would make it difficult. Zero discharge from Building 1N would likely have only a minor impact on the IWTP. The IWTP sludge is a listed waste, thus zero discharge in Building 1N would remove the F006 listing, but the sludge will still be F019 because of the chromate conversion operations in buildings 350, 351, and 370. The layout of an environmentally optimized metal finishing facility has been forwarded to the facility engineers to bring all of the dip tank operations up to current standards, but the \$5M cost is stifling enthusiasm.

**Recommendation 8:** Investigate potential for blending waste oil with diesel fuel and subsequent burning of the mixture in the heating plant boiler.

**Status:** This is still being investigated by LEAD.

**Stratford Army Engine Plant**  
**Point of Contact: Dr. John Fleming (203) 385-3964**

**Recommendation 1:** Update engineering documents retained to eliminate obsolete documents.

**Status:** The point of contact indicated that the documents are still presently being reviewed. There has not been a determination of the waste reduction of this measure.

**Recommendation 2:** Implement improved methods of recording or accounting for waste sources and quantities as well as raw material use.

**Status:** This recommendation was implemented before the December 1991 audit and continued to be implemented after the audit. No determination of the waste reduction was made.

**Recommendation 3:** Implement cyanide-free copper plating process

**Recommendation 4:** Replace cyanide-containing periodic reverse cleaner with cyanide-free metal cleaner

**Recommendation 5:** Investigate potential for elimination of periodic reverse cleaning operation

**Status:** These present recommendations have been under review from before the audit. The study and design of the plating room have been completed. HAZMIN funds which have been requested are:

|      |             |
|------|-------------|
| 1990 | \$40,000    |
| 1991 | \$40,000    |
| 1992 | \$77,000    |
| 1993 | \$5,000,000 |

The last figure is for a request to rebuild the plating room entirely. Funding for the project was not appropriated, since SAEP's contract terminates in 1994 and is not expected to be renewed.

**Recommendation 6:** Implement procedures to cover vapor degreasers when not in use to reduce VOC emissions and solvent loss.

**Status:** This recommendation was implemented before the audit and is continuing to be implemented.

**Recommendation 7:** Adhere to rigorous maintenance schedule to ensure that conductivity meters are used properly to keep contamination levels in the rinse tanks to a minimum.

**Status:** The point of contact indicated that this action was still being reviewed. There are problems with the high maintenance requirements for the equipment and maintaining proper operation of the equipment.

**Recommendation 8:** Identify sources of organic contamination in IWTP effluent.

**Status:** This recommendation is still under review.

**Red River Army Depot**  
**Point of Contact: Mike Lockard (903) 334-4490**

**Recommendation 1:** Substitute non-halogenated solvent for TCA

**Status:** This project was underway when the audit was conducted. TCA has been phased out and replaced with aqueous cleaners and Safety Kleen solvent 150.

**Recommendation 2:** Implement distillation process to recover Stoddard solvent.

**Status:** Stoddard solvent reclamation was contracted out to Safety Kleen. RRAD did not want to handle the reclamation system due to the hazardous, and the ease of using the outside contractor.

**Recommendation 3:** Investigate the potential for recovery of MEK by distillation.

**Status:** The distillation system is currently being used to recovery pure MEK which is used to flush out paint lines and paint guns. RRAD does not want to be involved in distilling and reclaiming higher grade MEK which requires additives.

**Recommendation 4:** Initiate field testing of the use of high-flashpoint naphtha or alkaline detergents as degreasing agents.

**Status:** DESCOM originally directed RRAD to conduct this field testing. Prior to the audit, RRAD had already switched from solvent 105 to 140, however, it did not work as well. RRAD also began using alkaline detergent in the high pressure washers prior to the audit.

**Recommendation 5:** Investigate procedures to remove cadmium from the influent wastewater at the IWTP.

**Status:** RRAD has eliminated the use of cadmium in their plating shop as a means to eliminate the cadmium in the IWTP. This audit finding actually refers to a recovery system involving evaporation which was not approved for funding. RRAD is currently in the planning stages for a new plating facility which will utilize electro dialysis, reverse osmosis and other recovery technologies to recover all heavy metals and rinse waters.

**Recommendation 6:** Initiate application to EPA to delist F006 sludge (once cadmium is eliminated from the IWTP and data are available to adequately characterize the sludge).

**Status:** RRAD's F006 sludge cannot be delisted because of the presence of other heavy metals. One step in the direction of delisting would be if RRAD receives approval to eliminate the chromate conversion step prior to CARC paint application. Delisting of the sludge could potentially be achieved in the planned new plating facility with the use of recycle and recovery technologies being included in the facility design.

**Tobyhanna Army Depot**

**Point of Contact: Mike Parrent (717) 894-6105** (No cost savings data was available)

**Recommendation 1:** Convert water wash paint booths in Building 1A to dry filter booths to reduce paint sludge generation

**Status:** This recommendation was implemented. The project was initiated in 1991 and \$18,000 was requested for FY 92-93. Equipment is presently being installed.

**Recommendation 2:** As an alternative to use of dry filter booths, install a filter press or sludge drying system to enhance dewatering of the sludge

**Status:** This recommendation was not implemented.

**Recommendation 3:** Continue to install and use HVLP equipment to reduce overspray and VOC emissions.

**Status:** This recommendation is being implemented and equipment is presently being installed. The project was started in 1991 and \$14,800 was appropriated in FY92.

**Recommendation 4:** Identify substitute solvent for TCA used to remove organic contamination from boards

**Recommendation 5:** By using Ultrasonics Shop equipment, replace Stoddard solvent by using water-based solvents

**Recommendation 6:** Implement procedures to reduce the requirements for stripping vehicles by either stripping them when there is a demand for them or by storing the stripped vehicles in a shelter after stripping to protect them from corrosion

**Recommendation 7:** Modify the Sulfide Precipitation Treatment Plant to allow for the treatment of spent alkaline and acid solutions

**Recommendation 8:** Investigate the implementation of metal recovery processes for concentrated metal plating solutions (will require extensive modifications to plating shop due to space limitations)

**Status:** None of the above were implemented. Implementing Recommendation 6 is not necessary since there is no need to store the vehicles outside anymore.

**Recommendation 9:** Investigate processes (such as counter-current rinsing, ion exchange, reverse osmosis and evaporation) to reduce or eliminate discharges from plating operations (will require extensive modifications to plating shop due to space limitations)

**Status:** This recommendation was implemented and the project was started in 1992. Electrodialysis, electrowinning and spray rinse equipment were purchased and are in the process of being installed. \$120,000 was budgeted for FY 92. The Center For Technical Excellence mandated this project and additional space was added to accommodate the project.

**Recommendation 10:** Modify pretreatment process to allow for optimum equilibration in equalization tanks

**Status:** This recommendation was not implemented.

**Recommendation 11:** Install a filter press or sludge drying system to enhance dewatering of the sulfide sludge

**Status:** This recommendation was implemented and the project was started in 1992. A dehydrator was purchased and is in the process of being installed with \$63,000 that was budgeted for FY 92. The Center For Technical Excellence mandated this project.

**Recommendation 12:** Implement improved methods of recording or accounting (such as individual generator logbooks or barcoding system) of the source and amounts of hazardous waste generated installation-wide

**Status:** This recommendation has been implemented.

## Summary of AEHA HAZMIN Surveys





DEPARTMENT OF THE ARMY  
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY  
ABERDEEN PROVING GROUND, MARYLAND 21010-6422



REPLY TO  
ATTENTION OF

HSHB-ME-SH (40)

17 NOV 1992

MEMORANDUM FOR Commander, U.S. Army Toxic and Hazardous Materials  
Agency, ATTN: CETHA-EC (Mr. Tom Eccles),  
Aberdeen Proving Ground, MD 21010-5401

SUBJECT: Arthur D. Little HAZMIN Project Effectiveness Study

1. Information from U.S. Army Environmental Hygiene Agency conducted Hazardous Waste Minimization projects are enclosed for incorporation into the subject study.
2. Copies of the reports from which this information was extracted can be obtained by contacting the undersigned or Mr. Brian D. Jones, Pollution Prevention Team Leader, at DSN 584-3652 or commercial 410-671-3652.

FOR THE COMMANDER:

JOHN J. RESTA, P.E.  
Program Manger  
Hazardous and Medical Waste  
Waste Disposal Engineering Division

Encl

**Arthur D Little**

1. **Installation:** Fort Bragg  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Water Quality Engineering Division  
**Project Number:** 32-21-8825-90  
**Dates of Consultation:** 26-29 June 1989  
**Date of Transmittal Letter:** 21 December 1989  
**Project Costs:** \$1,082  
**Conclusions:**

a. The Fort Bragg hazardous waste management program is well maintained by ENRD and DRMO personnel. The installation's written HAZMIN Plan was being completed at the time of the survey. It will be incorporated into the formal Hazardous Waste Management Plan.

b. The post wide Safety-Kleen solvent recycling contract has greatly reduced manpower needs for solvent disposal at Fort Bragg.

c. Fort Bragg had begun to implement a computerized solvent management program with post supply groups for tracking solvent purchases and use. This data base tracking system will enable the IHWA to monitor solvent purchases and cross-reference unit solvent usage with the DRMO HW tracking data base. Automated tracking will reduce manpower demands.

d. Lithium batteries are disposed of as HW long before they are dead.

e. Lead-contaminated sand generated from the MMD paint shop sand blasting operation for military vehicles and equipment created large quantities of toxic HW. The use of recyclable synthetic and plastic blasting media may produced much smaller quantities of leaded HW, but cannot remove rust adequately.

f. Corroded containers of DS-2 are often turned-in to DRMO for disposal. Unit level container storage requirements result in unconsolidated stockpiles.

**Recommendations:**

a. Complete the written HAZMIN Plan.

b. Identify all users of small quantities of solvent usage through the installation solvent management data base. Perform a cost and manpower analysis to determine the feasibility of cooperative use of a small still. Units that may benefit from the Safety-Kleen recycling contract should be included in that program as soon as possible.

c. Increase the lithium battery use time in field radios from 12 to 72 hours to reduce the quantity of waste batteries turned-in to DRMO for disposal as HW.

d. Implement unit level container management and inspection programs for DS-2 stockpiles.

2. **Installation:** Fort Devens  
**Consultation Conducted By:** U.S. Army Environmental Hygiene  
Agency, Water Quality Engineering Division  
**Project Number:** 32-24-8827-90  
**Dates of Consultation:** 26 June - 3 July 1989  
**Date of Transmittal Letter:** 8 February 1990  
**Project Costs:** \$7,786  
**Conclusions:**

a. Fort Devens does not have a Hazardous Waste Management Plan, nor is it tracking the hazardous waste that is being generated onsite.

b. More than 70 percent of the hazardous waste generated during the period of investigation is POL-contaminated soil and absorbents. Because this is a State-designated hazardous waste (and not an EPA), it becomes an "added" cost for doing business in the State of Massachusetts.

c. Fort Devens is doing a good job in exploring the various options and technologies that are available for reducing the volume of hazardous waste that is being generated. These efforts encompass: a soil remediation process, a waste oil burner, and a solvent recycling company.

**Recommendations:**

a. To ensure regulatory compliance, the following recommendation is made: develop a Hazardous Waste Management Plan and maintain an ongoing record of the sources, volumes, and costs of the hazardous waste that is being generated onsite.

b. To follow good engineering management practices, the following recommendations are made:

(1) Pursue the HAZMIN actions which are currently under investigation: the soil remediation process for POL-contaminated soil, the installation of a waste oil burner at the Cutler Army Hospital, and the substitution of Safety Kleen for Stoddard and other cold cleaning solvents.

(2) Consider the following administrative and technical suggestions for Fort Devens' HAZMIN program: educate motor pool personnel, the soldiers undergoing training, and those excavating underground tanks on the cost of disposal for POL-contaminated solid waste; investigate the rationale for disposing of the magnesium oxide batteries as a hazardous waste; consider the use of portable oil/water skimmers and drying beds for separating the waste generated in the oil/water separators; and develop a management approach for reducing the amount of paint that is being turned-in as unserviceable.

3. **Installation:** Fort Drum  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Water Quality Engineering Division  
**Project Number:** 32-24-8828-90  
**Dates of Consultation:** 22-26 May 1989  
**Date of Transmittal Letter:** 26 January 1990  
**Project Costs:** \$5,555  
**Conclusions:**

a. Fort Drum HAZMIN program is effective, but must be documented in a written HAZMIN Plan and submitted to the New York DEC within 150 days of the OB/OD RCRA Permit issue. Fort Drum did not have a written HAZMIN Plan.

b. Spent solvent, used oil, waste ammo boxes, and waste lithium batteries are the significant HW types at Fort Drum.

c. Fort Drum has reduced its HW generation by 72 percent through solvent and used oil recycling.

d. Fort Drum has previously implemented HAZMIN efforts which should be recognized in the HAZMIN Plan.

e. Additional HAZMIN opportunities exist which may allow Fort Drum activities to further reduce their HW generation.

**Recommendations:**

a. To ensure compliance with New York HW TSD permit requirements and FORSCOM guidance, develop a written HAZMIN Plan.

b. To ensure good environmental engineering practices, and to assist in the development of the above HAZMIN Plan, the following recommendations are made:

(1) Emphasize in the installation's HAZMIN Plan the importance of segregation of hazardous and nonhazardous materials and wastes.

(2) Initiate a yearly training program for all activities that are involved in HM or HW management. The training should stress the importance of segregation, proper storage, and job planning.

(3) Incorporate the existing HAZMIN efforts into the HAZMIN Plan.

(4) Consider implementing potential HAZMIN opportunities for the HW generating activities at Fort Drum.

4. **Installation:** Fort Richardson, Fort Wainwright, Fort Greely  
**Consultation Conducted By:** U.S. Army Environmental Hygiene  
Agency, Water Quality Engineering Division  
**Project Number:** 32-24-8829-90  
**Dates of Consultation:** 10-25 July 1989  
**Date of Transmittal Letter:** 14 November 1989  
**Project Costs:** \$12,049  
**Conclusions:**

a. Fort Richardson.

(1) Fort Richardson had instituted a HAZMIN Program although some parts of such a program were missing.

(2) Some wastes, which had not been analyzed and could possibly be hazardous, were disposed of as nonhazardous

(3) Fort Richardson has instituted several HAZMIN programs. The minimization effort has also included some solid wastes which are not hazardous.

(4) Several future HAZMIN efforts have been identified.

b. Fort Wainwright.

1. Fort Wainwright had not prepared a written HAZMIN Plan; however, some HAZMIN projects/actions had been carried out successfully. Although there are some potential HAZMIN opportunities to be investigated, the certification can be made on the Fort Wainwright manifests that a HAZMIN program is in place at that installation.

2. Several presently feasible future HAZMIN efforts have been identified.

3. Several potential future HAZMIN opportunities which require either some additional information, funds or R&D efforts have also been discussed.

c. Fort Greely.

(1) Fort Greely had not prepared a written HAZMIN Plan; however, some HAZMIN projects/actions had been carried out successfully. Although there are some potential HAZMIN opportunities to be investigated, if Fort Greely is identified as a 100-1,000 kg/mo generator, the certification can be made on the Fort Greely manifests that a HAZMIN program is in place.

(2) Several presently feasible future HAZMIN efforts have been identified.

(3) Several potential future HAZMIN opportunities which require either some additional information, funds or R&D efforts have also been discussed.

**Recommendations:**

a. Fort Richardson.

(1) To ensure regulatory compliance, the following recommendations are made:

(a) Ensure that all installation personnel involved with the handling, storage and disposal of HW receive adequate training with special emphasis on waste segregation.

(b) Analyze all potential hazardous wastes to determine whether or not they are hazardous and dispose of them accordingly.

(2) To ensure good environmental engineering practices, the following recommendations are made:

(a) Develop a written HAZMIN plan.

(b) Develop a system to maintain a current HW inventory.

(c) Pave and berm temporary HW storage areas to prevent contamination of the soil.

(d) Transfer operation of the HW storage facility (Building 45125) to DEH personnel or allow them greater control and access to it.

(e) Analyze filtered antifreeze to verify that it meets the specifications required. If it proves usable, consider implementing this recycling system post-wide.

(f) Emphasize employee awareness and an employee suggestion program in the areas of HM/HW management.

b. Fort Wainwright.

(1) To ensure regulatory compliance, the following recommendations are made:

(a) Perform HW characteristics analyses for potential HW's such as the silver recovery unit effluent, paint stripping residue, maintenance shop floor sweepings, dirty air filters from the spray paint booth, and rags for machine part and printing roller cleaning. Manage and dispose of these wastes according to the analytical results.

(b) Analyze and review the used oil specification level if the used oil is burned for energy recovery.

(c) Collect and dispose of the waste paint stripper generated at the 123rd Aviation Regiment at Building 2077.

(d) Provide an indoor spray paint booth for the 98th Maintenance Service Branch to paint the 400 5,000-gallon fuel tank trucks.

(2) To ensure good environmental engineering practices, the following recommendations are made:

(a) Develop a written HAZMIN plan.

(b) Develop a system to maintain a current HW inventory.

(c) Closely monitor the generation of used solvent at various maintenance activities to facilitate the onsite solvent distillation operation.

(d) Emphasize employee awareness and an employee suggestion program in the areas of HM/HW management.

(e) Provide berms or containment at the HM/HW storage areas at the DEH and the DOL POL storage areas.

(f) Provide solvent recovery service for Fort Greely if feasible. Fort Greely's still unit could be used as a standby at Fort Wainwright.

c. Fort Greely.

(1) To ensure regulatory compliance, the following recommendations are made:

(a) Change the current generator status from a CESQG to a 100-1,000 kg/mo generator and initiate the use of a manifest system.

(b) Perform HW characteristics analyses for potential HW's such as silver recovery unit effluent, maintenance shop floor sweepings, and rags for machine part cleaning. Manage and dispose of these wastes according to the analytical results.

(c) Analyze and review the used oil specification level if the used oil is burned for energy recovery.

(d) Dispose of the used carburetor cleaner from the DEH maintenance shop through the DRMO instead of discharging it into the sanitary sewer system.

(2) To ensure good environmental engineering practices, the following recommendations are made:

(a) Develop a written HAZMIN plan.

(b) Develop a system to maintain a current HW inventory.

(c) Emphasize employee awareness and an employee suggestion program in the areas of HM/HW management.



(d) Provide berms or containment at the HM/HW storage areas at the DEH and the DOL POL storage areas.

(e) Evaluate the option to recover used solvent at Fort Wainwright and ship them the on-hand still to be used as a standby.

(f) Recycle CRTC's used antifreeze as was done by the DEH maintenance shop if their analysis proves it feasible.

5. **Installation:** Fort Riley  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Water Quality Engineering Division  
**Project Number:** 32-24-8831-90  
**Dates of Consultation:** 7-11 August 1989  
**Date of Transmittal Letter:** 14 November 1989  
**Project Costs:** \$785  
**Conclusions:**

a. Fort Riley has very satisfactory ongoing HAZMIN activities and has also prepared a HAZMIN Plan. The plan needs to be revised/updated to reflect current HW generations and ongoing HAZMIN activities.

b. Fort Riley can definitely certify in their HW manifest that a HAZMIN program is in place at their installation.

c. Potential future HAZMIN efforts identified for Fort Riley are as follows:

(1). Installation of cartridge filters for the two machine parts ("tornado") washers, located in Bldg 8100, should reduce the frequency of dumping the wash water by as much as 50 percent.

(2). Consolidation and treatment of waste streams from machine parts washers, caustic waste from dip tanks and waste battery electrolytes. It should be noted that this potential HAZMIN opportunity will require research and development efforts to ascertain its technical and economic feasibility. Coordination with regulatory authorities is also necessary to ascertain whether or not a RCRA permit will be required. It is envisioned that this type of industrial wastewater pretreatment is fully covered under Pretreatment Regulations because the effluent from this pretreatment system will be discharged to the installation's sewage treatment regulated by an National Pollutant Discharge Elimination System (NPDES) permit.

(3) Disposal of unserviceable lead-acid batteries with the electrolyte. This manner of disposal has been going on with other DRMO.

d. To ensure that the ongoing HAZMIN activities will be carried out effectively and that future economically feasible HAZMIN opportunities will be considered in Fort Riley master planning, it is necessary that a HAZMIN Coordinator/Manager should be officially designated.

**Recommendations:**

a. To ensure regulatory compliance, the following recommendations are made:

(1) Ensure that the contractor for disposal of waste oil is actually selling Fort Riley's waste oil to a legitimate waste oil recycler. Random check or verification should be conducted.

(2). Ensure that the effluent from the silver recovery unit are analyzed for HW characteristics prior to discharging into the sanitary sewer.

b. To conform with good environmental engineering practices, the following recommendations are made:

(1) Install cartridge filters for the machine parts washers.

(2) Pursue efforts to dispose of unserviceable lead-acid batteries containing electrolytes.

(3) Officially designate a HAZMIN manager or HAZMIN coordinator for Fort Riley.

(4) Pursue the identified HAZMIN opportunity for the industrial wastewater from Bldg 8100 and auto-craft shop.

6. **Installation:** Fort Bliss  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8832-89  
**Dates of Consultation:** 13-17 February 1989  
**Date of Transmittal Letter:**  
**Project Costs:** \$8,173  
**Conclusions:**

a. Several HAZMIN efforts, applicable to specific HW sources or installation-wide HW generation, have already been initiated by Fort Bliss personnel. Therefore, although some additional HAZMIN efforts can be investigated, the certification can be made on the Fort Bliss manifests that a HAZMIN program is in place at the installation.

b. Several potential future HAZMIN efforts have been identified.

**Recommendations:**

a. Analyze battery electrolyte for EP toxic metals to determine if a Part B Permit is required to perform acid neutralization on post.

b. Emphasize HAZMIN methods during installation HW training sessions.

c. Establish a screening system for hazardous material procured by the installation.

d. Encourage HAZMIN suggestions in the employee suggestion system.

e. Investigate the availability of commercial recyclers who will accept undrained lead acid batteries.

f. Identify the availability of metal reclaimers for the waste chromic acid through the DRMO.

g. Keep current on the progress being made at the STB recycling plant at PBA.

h. Investigate the availability of commercial solvent recyclers for waste paint thinners generated at the Ratheon Corp. on Fort Bliss.

i. Repeat analysis of spent paint filters generated at the Ratheon Corp.

j. Discuss with the appropriate State and local regulators the possibility of discharging small quantities of hospital laboratory HW containing mercuric thiocyanate to the sanitary sewer.

k. Determine the availability of other equivalent test procedures, where no hazardous material such as mercuric thiocyanate is used.

l. Discuss with the State HW regulators the acceptability of managing small quantities of magnesium batteries as non-HW.

m. Keep current on the latest developments on lithium batteries.

7. **Installation:** Fort Chaffee  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8833-89  
**Dates of Consultation:** 20-24 March 1989  
**Date of Transmittal Letter:** 26 July 1989  
**Project Costs:** \$5,626  
**Conclusions:**

a. The Fort Chaffee HAZMIN Plan is well written, and some of the HAZMIN projects/actions have been carried out successfully. However, complete HW inventories for CY 86, 87, and 88, a more thorough discussion on the method(s) used to reduce specific HW generation, and the economic analyses for reduction alternatives should be included. Although there are some potential HAZMIN opportunities to be investigated, the certification can be made on the Fort Chaffee manifests that a HAZMIN program is in place at that installation.

b. Several presently feasible future HAZMIN efforts have been identified.

c. Several potential future HAZMIN opportunities which require either some additional information, funds or R&D efforts have also been discussed.

**Recommendations:**

a. Implementation of the following recommendations will help you ensure regulatory compliance:

(1) Perform HW characteristics analyses for potential HW's such as silver recovery unit effluent, paint stripping residue, maintenance shop floor sweepings, and rags for machine part and silk screen cleaning. Manage and dispose of these wastes according to the analytical results.

(2) Analyze and review the used oil specification levels if the used oil is burned for energy recovery.

(3) Analyze the EP Toxicity of the waste electrolyte to accommodate the elementary neutralization project if this project will be proceeded.

(4) Segregate different types of used POL products to facilitate recovery or reuse if feasible.

b. Implementation of the following recommendations will help you ensure recognized standards of good HW management and environmental engineering practices are in use:

(1) Initiate the following presently feasible HAZMIN efforts, listed in the order of highest to lowest priority.

(a) Emphasize employee awareness and an employee suggestion program in the areas of HM/HW management.

(b) Turn-in the unserviceable lead-acid batteries to the DRMO with acid undrained when weather permits and conduct waste electrolyte neutralization only during cold weather seasons (assuming the waste electrolyte is not EP toxic). Provide a heated storage area for unserviceable lead-acid batteries during cold weather seasons and avoid the operation of waste electrolyte neutralization.

(c) Conduct a more detailed economic analysis for used solvent recycling alternatives between onsite distillation and contractor-provided services, and then select the more advantageous option.

(d) Provide berms or containment at the HM/HW storage areas at the DEH and the DOL POL storage areas.

(2) Evaluate the feasibility of the following potential HAZMIN opportunities by further studies/R&D efforts, or by providing funds:

(a) Evaluate the substitution of solvents proposed by the Safety-Kleen contract with the solvent type having a flash point of 140 °F or higher.

(b) Install the steel burning pans at the OB site.

8. **Installation:** Fort Gordon  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8834-90  
**Dates of Consultation:** 21-25 August 1989  
**Date of Transmittal Letter:** 24 November 1989  
**Project Costs:** \$5,243  
**Conclusions:**

a. There was no written Fort Gordon HAZMIN Plan; however, some HAZMIN projects/actions had been carried out successfully. A written HAZMIN Plan should be prepared to include complete HW inventories for CY 86, 87, and 88, a discussion on the method(s) used to reduce specific HW generation, and the economic analyses for reduction alternatives. Although there are some potential HAZMIN opportunities to be investigated, the certification can be made on the Fort Gordon manifests that a HAZMIN program is in place at that installation.

b. Several presently feasible future HAZMIN efforts have been identified.

c. Several potential future HAZMIN opportunities which require either some additional information, funds or R&D efforts have also been discussed.

**Recommendations:**

a. Implementation of the following recommendations will help you ensure regulatory compliance:

(1) Change the current generator status from a 100-1,000 kg/mo generator to a regular generator and provide the additional reporting requirements such as a biennial report, additional recordkeeping and exception reporting.

(2) Submit a RCRA Part B permit application for the OB/OD site.

(3) Analyze and review the used oil specification levels if the used oil is burned for energy recovery.

(4) Sample and analyze the potential HW for their HW characteristics, at least once, and manage according to the analytical results.

b. Implementation of the following recommendations will help you ensure recognized standards of good HW management and environmental engineering practices are in use:

(1) Initiate the following presently feasible HAZMIN efforts, listed in the order of highest to lowest priority.

(a) Emphasize employee awareness and an employee suggestion program in the areas of HM/HW management.



(b) Conduct a more detailed economic analysis for used solvent recycling alternatives between onsite distillation, contractor-provided service, and disposal without recovery, and then select the more advantageous option.

(c) Install a steel burn pan at the OB site.

(d) Provide berms or containment at the HM/HW storage areas, and at the Battery Shop (Bldg 948).

(2) Evaluate the feasibility of the following potential HAZMIN opportunities by further studies/R&D effort, or by providing funds.

(a) Evaluate feasibility of onsite distillation of the used xylene generated at the Histology Lab, EAMC.

(b) Include the used oil generated from the Army reserve in August and revise the used oil contract to continue the sale of used oil to burn for energy recovery.

(c) Consider the use of waste fuel for fire fighter training or donate the waste fuel to the local community for the same purpose, or include the waste fuel as part of the used oil contract and burned for energy recovery.

(d) Develop a means to efficiently segregate infectious wastes from the noninfectious wastes at the EAMC. Participate in the design review when the design of the new pathological incinerator(s) is initiated.

9. **Installation:** Fort Jackson  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8835-89  
**Dates of Consultation:** 10-14 July 1989  
**Date of Transmittal Letter:** 6 October 1989  
**Project Costs:** \$7,017  
**Conclusions:**

a. The Fort Jackson HAZMIN Plan was not updated and a HAZMIN Committee was not formed; however, some HAZMIN actions were being carried out successfully. There is a need for better HW recordkeeping practices and coordination between HW generating activities and the DEH. Although there are some potential future HAZMIN opportunities to be investigated, the certification can be made on the Fort Jackson manifests that a HAZMIN program is in place.

b. Several presently feasible future HAZMIN efforts have been identified.

c. Several potential future HAZMIN opportunities which require either additional information, funds or R&D efforts, have also been identified.

**Recommendations:**

a. Implementation of the following recommendations will help you ensure regulatory compliance:

(1) Update the Fort Jackson HAZMIN Plan including an accurate HW inventory.

(2) Establish a HAZMIN Committee.

(3) Perform HW characteristics analysis for potential HW's. Manage and dispose of these wastes according to the analytical results.

(4) Analyze and review the used oil specification levels if the used oil is burned for energy recovery.

(5) Analyze the waste electrolyte at the WETSITE, UTES for EP Toxicity to accommodate the elementary neutralization process.

b. Implementation of the following recommendations will help ensure that recognized standards of good HW management and environmental engineering practices are in use:

(1) Turn-in all nonsealed unserviceable lead-acid batteries to the DRMO with acid undrained.

(2) Conduct an economic analysis for the feasibility of used solvent recycling alternatives to the contractor-provided service.

(3) Evaluate the feasibility for lengthening the service period for degreasing solvents under the current Safety-Kleen contract.

(4) Pursue substituting less hazardous and less toxic solvents at the Furniture Repair Shop, Building No. 1555 and the TASC's plastics operation.

(5) Reevaluate the procurement and dispersal strategy to limit the amount of mission stock that requires eventual disposal as HW.

(6) Pursue segregating burn residues at the Open Burning Grounds and install steel burning pans as soon as possible.

(7) Emphasize the reporting of HAZMIN-related suggestions in an employee suggestion system.

(8) Use lithium batteries with discharge switches when they become available and coordinate with SCDHEC for solid waste disposal.

(9) Provide sufficient command emphasis to ensure that units follow proper HW and HM management procedures.

(10) Upgrade recordkeeping practices.

10. **Installation:** Fort Knox  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8836-89  
**Dates of Consultation:**  
**Date of Transmittal Letter:**  
**Project Costs:** \$6,669  
**Conclusions:**

a. The Fort Knox HAZMIN Plan is included as part of the HWMP, and some HAZMIN projects/actions have been carried out successfully. However, the complete HW inventories for CY's 86, 87, and 88, a more thorough discussion on the method(s) used to reduce specific HW generation, and the economic analyses for the reduction alternatives should be included. There are some potential HAZMIN opportunities to be investigated. The certification can be made on the Fort Knox manifests that a HAZMIN Program is in place at that installation.

b. Several presently feasible HAZMIN efforts have been identified.

c. Several potential HAZMIN opportunities, which require either some additional information or R&D efforts, have also been discussed.

**Recommendations:**

a. Perform HW characteristics analyses for potential HW's such as media blasting residue and radiator flushing tank caustic solution. Manage and dispose of these wastes according to the analytical results.

b. Analyze and review the used oil specification level if the used oil is burned for energy recovery.

c. Notify the regulatory agencies on the silver recovery activity at Fort Knox and record the "mass balance" of waste fixer generated/stored and the silver recovered.

d. Repair the roof leaks at the PCB storage facility (Bldg T-6), and provide a monthly inspection log.

e. Discontinue the burning of PCP-treated ammunition boxes at the OB site. The OB unit is not permitted for treating PCP-treated woods.

f. Initiate the following presently feasible HAZMIN efforts:

(1) Prepare an official Fort Knox HAZMIN Plan according to the TRADOC guidance.

(2) Emphasize the employee awareness and the

employee suggestion in the areas of HM/HW management.

(3) Conduct a more detailed economic analysis for used solvent recycling alternatives between onsite distillation, disposal without recovery, and contractor-provided service.

(4) Provide berms or containment at the HM/HW storage areas at the DOL lead-acid battery and POL storage areas, the DEH POL storage yard, the waste fixer silver recovery units at IACH, the Printing Plant and the Photo Lab.

g. Evaluate the feasibility of the following potential HAZMIN opportunities by further studies/R&D efforts:

(1) Evaluate the substitution of solvent presently in use at various maintenance shops with the types having flash points of 140 °F or higher.

(2) Return the PCP-treated boxes to the ammunition depot for reuse.

(3) Provide a guidance to properly segregate infectious waste from noninfectious waste at the IACH.

(4) Evaluate/monitor the performance of the pesticide-laden wastewater pretreatment unit (Carbolator unit) at the pesticide preparation area in Bldg 112.

(5) Evaluate the recovery of the used ethyl alcohol with a small still at IACH.

(6) Initiate future HAZMIN actions/projects as discussed in paragraph VID.

11. **Installation:** Fort Lee  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8837-89  
**Dates of Consultation:** 30 January - 3 February 1989  
**Date of Transmittal Letter:** 8 June 1989  
**Project Costs:** \$13,716  
**Conclusions:**

a. The Fort Lee HAZMIN Plan is included as part of the HWMP, and some HAZMIN projects/actions have been carried out successfully. However, the complete HW inventories for CY 86, 87, and 88, a more thorough discussion on the method(s) used to reduce specific HW generation, and the economic analyses for the reduction alternatives, should be included. There are some potential HAZMIN opportunities to be investigated. The certification can be made on the Fort Lee manifests that a HAZMIN program is in place at that installation.

b. Several presently feasible future HAZMIN efforts have been identified.

c. Several potential future HAZMIN opportunities which require either some additional information or R&D efforts have also been discussed.

**Recommendations:**

a. Implementation of the following recommendations will help you ensure regulatory compliance:

1. Prepare an official Fort Lee HAZMIN Plan according to the TRADOC guidance.

2. Perform HW characteristics analyses for the potential HW's such as silver recovery unit effluent, paint stripping residue, maintenance shop floor sweepings, radiator flushing tank caustic solution, and rags for machine part cleaning and silk screen cleaning. Manage and dispose of these wastes according to the analytical results.

Analyze and review the used oil specification levels if the used oil is burned for energy recovery.

4. Analyze the EP Toxicity of the waste lead-acid electrolyte to accommodate the elementary neutralization project if this project will be proceeded.

5. Segregate different types of used POL products to facilitate recovery or reuse if feasible.

b. Implementation of the following recommendations will help you ensure recognized standards of good HW management and environmental engineering practices are in use:

1. Initiate the following presently feasible HAZMIN efforts, listed in the order of highest to lowest priority.

(a) Emphasize the employee awareness and the employee suggestion in the areas of HM/HW management.

(b) Turn-in the unserviceable lead-acid batteries to the DRMO with acid undrained when weather permits and conduct waste electrolyte neutralization only during the cold weather season (assuming the waste electrolyte is not EP toxic); or provide a heated storage area for unserviceable lead-acid batteries during cold weather season and avoid the operation of waste electrolyte neutralization.

(c) Collect and turn-in the waste acid and waste caustic generated from the Seaman POL Laboratory to the DRMO in lieu of discharging these wastes to the sanitary sewer system.

(d) Test the integrity of the POL storage tank or provide a new one for use at the Seaman POL Laboratory (Bldg 11430) and place the tank on a paved and bermed area.

(e) Conduct a more detailed economic analysis for used solvent recycle alternatives between onsite distillation and contractor-provided services.

(f) Provide berms or containment at the HM/HW storage areas at the DEH and the DOL POL storage areas.

2. Evaluate the feasibility of the following potential HAZMIN opportunities by further studies/R&D efforts:

(a) Evaluate the substitution of solvent present in use at various maintenance shops with the type having a flash point 140 °F or higher.

(b) Provide a guidance to properly segregate infectious waste from noninfectious waste at the KACH.

(c) Collect and turn-in the waste xylene generated from the KACH to the DRMO, or evaluate the use of a small still designed for small quantity solvent recovery if the biodegradable solvent is unsuitable to replace xylene at the Pathology Lab of KACH.

12. **Installation:** McAlester Army Ammunition Plant  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8838-89  
**Dates of Consultation:** 5-8 December 1988  
**Date of Transmittal Letter:** 28 April 1989  
**Project Costs:** \$12,712  
**Conclusions:**

a. Several HAZMIN efforts, applicable to specific HW sources or installation wide HW generation, have already been initiated by MCAAP personnel. Therefore, although some additional HAZMIN efforts can be investigated, the certification can be made on the MCAAP manifests that a HAZMIN program is in place at the installation.

b. Several potential HAZMIN efforts have been identified.

c. The installation needs to develop better record keeping practices.

**Recommendations:**

a. Upgrade recordkeeping practices.

b. Emphasize the reporting of HAZMIN-related suggestions in the existing employee suggestion system.

c. Use, where feasible, paints containing no toxic heavy metals.

d. Review safety requirements for covering waste paint filters with water.

e. Perform a total chemical analysis of metal blast residue and deactivation furnace residue to determine if a chemical market exists to reclaim these wastes.

f. Investigate the feasibility of segregating waste types at the OB Grounds.

g. Replace, where practical, ignitable solvents with PD-680, type 2 solvent.

h. Expand the use of the solvent recycling contract.

i. Develop better segregation practices for the methylene chloride/urethane foam waste generated at Building 180.

j. Coordinate with the Defense Reutilization and Marketing Service (DRMS) Precious Metals Division to determine if a more efficient silver recovery unit can be procured for the installation.



13. **Installation:** Rock Island Arsenal  
**Consultation Conducted By:** U.S. Army Environmental Hygiene  
Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8839-89  
**Dates of Consultation:** 24-28 October 1988  
**Date of Transmittal Letter:** 21 April 1989  
**Project Costs:** \$17,241  
**Conclusions:**

a. rock Island has implemented a comprehensive HAZMIN Plan. Hazardous waste generation, however, has increased over the past 5 years.

b. The installation does not normalized its hazardous waste operation rate to a production or man-hour basis. Without such a basis, the installation has difficulty assessing the real impact of HAZMIN efforts as mission requirements change.

c. The major types of hazardous waste at Rock Island are spent cleaning and degreasing solvents, wastewater treatment sludges, metal working wastes and electroplating wastes.

d. Waste oil represents more than 30 percent of Rock Island's annual waste disposal costs.

e. The installation summarizes waste disposal volumes for each calendar year, while it tabulates disposal costs for each fiscal year.

**Recommendations:**

a. To comply with AMC's HAZMIN reporting requirements, express hazardous waste generation in terms of production.

b. Increase recycling of petroleum naphtha. Enhance still efficiency or offer still bottoms to an offpost recycler to improve recovery of 1,1,1-trichloroethane.

c. Dewater sludge from the treatment of painting waste water.

d. Investigate recycling opportunities for electric arc furnace dust.

e. Reuse and recycle waste oil.

f. Summarize waste disposal volumes and cots over the same time periods. Consistent volume and cost summaries will help in prioritizing HAZMIN objectives.

14. **Installation:** Tooele Army Depot  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-8840-89  
**Dates of Consultation:** 14-17 November 1988  
**Date of Transmittal Letter:** 28 April 1989  
**Project Costs:** \$15,612  
**Conclusions:**

a. The TEAD HAZMIN Plan is well written, and some of the HAZMIN projects/actions listed in the Plan have been carried out successfully. However, there were several past and present HAZMIN efforts not listed in the Plan. There were also some potential HAZMIN opportunities to be investigated. The HW inventory should be updated. Still the certification can be made on the TEAD manifests that a HAZMIN program is in place at that installation.

b. Several presently feasible future HAZMIN efforts have been identified.

c. Several potential future HAZMIN opportunities which require either coordination, R&D efforts or funds have also been discussed.

**Recommendations:**

a. Ensure the potential HW's are analyzed for their HW characteristics or constituents.

b. Segregate different types of POL products to facilitate their recovery or recycle and to avoid the commingling of HW (Stoddard Type I solvent) with nonhazardous POL products (waste oil).

c. Analyze the waste oil for the parameters specified in 40 CFR 266.40 if the waste oil will be burned for energy recovery.

d. Initiate the following presently feasible HAZMIN efforts, listed in the order of highest to lowest priority.

(1) Emphasize the HAZMIN-related suggestions in the existing employee suggestion system.

(2) Transport the waste fixer generated from the Audiovisual Service Center at Bldg. 1000 to the X-Ray Lab in Bldg 1221 for silver recovery.

(3) Expedite the connection of the boiler blowdown to the Tooele regional sewer system.

(4) Revise the HW inventory in the TEAD HAZMIN Plan. Also evaluate the manifested HW quantities to make sure the HW generated from DPG is not included as TEAD's HW.

e. Evaluate the feasibility of the following potential HAZMIN opportunities by coordination , R&D efforts or make funds available.

(1) Coordinate the DRMO to keep the electrolyte intact in the unserviceable batteries, and sell the batteries to the reclaimers.

(2) Coordinate with the AED, Air Pollution Engineering Division of the USAEHA, and the regulatory agencies on the trial burn of HW, such as paint thinner sludge at the deactivation furnace at Bldg. 1345.

(3) Test the usage of cartridge filters to remove the excess solids in the metal cleaning solution vats in order to prolong the usage life of the chemical solutions.

(4) Evaluate the substitution of Stoddard Type I solvent with Type II solvent. Type II solvent has a flash point of 142 °F and is not a HW when spent.

(5) Evaluate the substitution of CARC paints with the type without heavy metals and/or F-listed solvent.

(6) Reclassify the IWTS effluent being recycled as nonhazardous waste.

(7) Investigate recycling opportunities of steel short blasting residue.

(8) Conduct feasibility studies for chemical fixation of the IWTS sludge and the waste blasting grit.

15. **Installation:** Aviation Classification & Repair Activity Depot  
**Consultation Conducted By:** U.S. Army Environmental Hygiene  
Agency, Water Quality Engineering Division  
**Project Number:** 32-24-8842-90  
**Dates of Consultation:** 10-12 July 1989  
**Date of Transmittal Letter:** 20 October 1989  
**Project Costs:** \$15,875  
**Conclusions:**

a. The CT AVCRAD has minimized its HW by recycling waste solvent and segregating HW from nonhazardous waste.

b. Cost comparison, chemical stripping versus bead-blasting of aircraft surfaces, indicated that bead-blasting would significantly reduce the amount/cost of HW disposal at the CT AVCRAD.

c. Bead-blasting of aircraft surfaces cannot be implemented until the method has been approved by AVSCOM.

d. The SPCCP needs to be revised with respect to the waste storage area.

e. Complete containment was not provided at the waste storage area.

**Recommendations:**

a. Keep abreast of AVSCOM's evaluation of the use of bead-blasting for paint stripping aircraft; implement method if approved by AVSCOM.

b. Update SPCCP to reflect the location and description of spill prevention and control measures of the waste storage area.

c. Provide complete containment at waste storage area.

16. **Installation:** Fort Polk  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Water Quality Engineering Division  
**Project Number:** 32-24-8868-89  
**Dates of Consultation:** 6-10 March 1989  
**Date of Transmittal Letter:** 31 July 1989  
**Project Costs:** \$4,994  
**Conclusions:**

a. Fort Polk has initiated several HAZMIN activities. This minimization program has included other solid wastes that are not classified as HW (i.e., waste oil, POL-contaminated dirt and etc.).

b. Fort Pol, as an HW generator, can certify on their HW manifest that they have adopted a HAZMIN program.

c. Fort Polk has not developed a HAZMIN plan identifying all their HW streams and ongoing minimization efforts.

d. Fort Polk has not developed a waste analysis plan.

f. The HW and potential HW generated from the TMP were not being managed properly. (Note: The TMP is presently run by a contractor.)

**Recommendations:**

a. Prepare waste analysis and HAZMIN plans.

b. Ensure that the HW and/or potential HW generated from the TMP (i.e., waste solvents, battery acids and waste POL products ) are disposed of in accordance with the provisions of 40 CFR 260 and 40 CFR 262 relating to waste identification and manifesting.

c. Segregate waste synthetic oil and oily waste collected from oil water separators from the regular waste oil to enhance its salability for recycling.

d. Explore the economic feasibility of expanding the AOAP to include all combat and noncombat vehicles.

e. Rehabilitate the existing HW storage facility.

f. Perform analysis of waste oil sold to contractor to ascertain it is not HW by virtue of EP Toxicity.

17. **Installation:** Fort Indiantown Gap  
**Consultation Conducted By:** U.S. Army Environmental Hygiene  
Agency, Water Quality Engineering Division  
**Project Number:** 32-24-H933-90  
**Dates of Consultation:** 4-6 June 1990  
**Date of Transmittal Letter:** 19 July 1990  
**Project Costs:** \$3,577.58  
**Conclusions:**

a. Fort Indiantown Gap has an excellent HAZMIN Program. A HAZMIN Plan has been completed but needs managerial signatures to be implemented.

b. Good HAZMIN methods have been applied to all recurring waste streams.

c. No further feasible HAZMIN opportunities exist for recurring waste streams.

d. Fort Indiantown Gap covers all administrative aspects necessary to ensure the future effectiveness of its HAZMIN Program.

**Recommendations:**

a. Investigate the possibility of increasing the interval between solvent pickups by the contract recycler. This can be done through discussions with shop users of the solvent.

b. Check with the DRMO about the disposition of fuels from the closure of UST's. If the material was recycled or burned for energy recovery, then no HW was generated.

c. Amend the WAP to replace references to the Extraction Procedure Toxicity Test with the newly promulgated TCLP.

18. **Installation:** Camp Grayling  
**Consultation Conducted By:** U.S. Army Environmental Hygiene  
Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-J843-91  
**Dates of Consultation:** 13-17 August 1990  
**Date of Transmittal Letter:** January 1991  
**Projected Costs:** \$3,577.57  
**Conclusions:**

a. The USAEHA study team found a high level of environmental awareness at Camp Grayling. Operational personnel are knowledgeable of environmental regulatory requirements as they pertain to their missions and are conscious to follow them. Several HAZMIN efforts were being carried out successfully. Camp Grayling's statement on its HW manifests that an HAZMIN program is in place is valid.

b. Camp Grayling needs a formal HWMP. An HAZMIN plan should be a part of the HWMP. The USAEHA personnel supplied examples of both HWMPs and HAZMIN Plans to the Camp Grayling Environmental Office.

c. The study team also identified several potential HAZMIN opportunities for specific HW streams. These opportunities include the substitution of non-hazardous paint thinners and solvents for the hazardous ones currently used, distillation of used paint thinner to allow reuse, and extension of the Safety-Kleen solvent servicing period.

**Recommendations:**

a. Improve recordkeeping practices. Central files should contain HW generation data, all manifests, and training records, especially at the Cantonment and AASF areas.

b. Upgrade container labeling procedures. Accumulation drums should be labeled as soon as waste is entered; this includes accumulation drums from weekend training activities.

c. Improve the tracking of HW. Hazardous wastes should not be transferred from one Camp Grayling area to another for storage and turn-in purposes without manifests.

d. Develop a written HWMP for Camp Grayling including all standard operating procedures (SOP) for each area. This can include the SOP for recordkeeping, container labeling, and HW tracking. The USAEHA has supplied Camp Grayling's Environmental Office with examples and guidance for this requirement.

e. Develop a written HAZMIN plan for inclusion in the HWMP. This plan would also facilitate the tracking of waste reductions when applying for state refunds. Examples of HAZMIN plans have been supplied to the Environmental Office.

f. Provide secondary containment and protection from weather stress at all HM/HW and used oil at storage sites. Specifically, upgrade Building 23 of the Cantonment Area and Building 1401 at the MATES. Waste oils and fuels turned-in to Building 560 should be kept indoors.

g. Continue to emphasize the reporting of HAZMIN-related suggestions in the employee suggestion system.

h. Investigate possible non-hazardous substitutions for HM such as replacing 105°F flash point Safety-Kleen parts washing solvent with 140°F flash point solvent.

i. Consider lengthening the service period for replacing spent Safety-Kleen parts washing solvent.

j. Turn-in spent, nonleaking, lead-acid batteries intact to either the Defense Reutilization and Marketing Office (DRMO) or the United States Property and Fiscal Office (USPFO).

k. Institute an SOP to completely use one lot number of ammunition before beginning another.

l. Investigate distillation of used paint thinner for reuse.

m. Investigate blending contaminated fuels into quantities of unused fuel to allow reuse.



19. **Installation:** Fort Benning  
**Consultation Conducted By:** U.S. Army Environmental Hygiene  
Agency, Direct Support Activity - South  
**Project Number:** 37-62-J920-90  
**Dates of Consultation:** 4-15 December 1989  
**Date of Transmittal Letter:** 16 March 1990  
**Project Costs:** \$3,577.57  
**Conclusions:**  
**Recommendations:**

20. **Installation:** Fort Monroe  
**Consultation Conducted By:** U.S. Army Environmental Hygiene  
Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-J925-90  
**Dates of Consultation:** 5-9 March 1990  
**Date of Transmittal Letter:** 27 April 1990  
**Project Costs:** \$3,577.57  
**Conclusions:**

a. Fort Monroe has an acceptable HAZMIM Program. A HAZMIN Plan was written in 1986 and is currently being updated.

b. Past HAZMIN actions include the initiation of solvent recycling, photographic silver recovery, elimination of two HW generating activities, and good segregation practices in the used oil program.

c. Potential future HAZMIN opportunities include the upgrading of HM storage, the upgrading of spent solvent management at the AAFES gas station and the NWSC, and the upgrading of photographic waste management at the Graphic Aids Branch.

**Recommendations:**

a. Upgrade HM storage.

b. Upgrade solvent management.

c. Investigate alternative management options for photographic waste generated at the Graphic Aids Branch.

21. Installation: Fort McPherson  
Consultation Conducted By: U.S. Army Environmental Hygiene  
Agency, Waste Disposal Engineering Division  
Project Number: 37-26-J931-90  
Dates of Consultation: 2-14 April 1990  
Date of Transmittal Letter: 31 October 1990  
Project Costs: \$3,577.57  
Conclusions:  
Recommendations:

22. **Installation:** Walter Reed Army Medical Center  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Waste Disposal Engineering Division  
**Project Number:** 37-26-J934-91  
**Dates of Consultation:** 20-28 August 1990  
**Date of Transmittal Letter:** 14 January 1991  
**Project Costs:** \$3,577.57  
**Conclusions:**

a. The WRAMC HAZMIN Plan has been prepared and some of the HAZMIN projects/actions have been carried out successfully. Although the HAZMIN program has room for improvement, and the HAZMIN Plan should be revised to include some other items, the certification can be made on the WRAMC manifests that an HAZMIN program is in place at that installation.

b. Several presently feasible future HAZMIN efforts have been identified. Several potential future HAZMIN opportunities which require either coordination, R&D efforts or funds have also been discussed.

**Recommendations:**

a. Analyze the potential HW's for their HW characteristics or constituents, at least once, so that HW's and non-HW's will be managed accordingly. These wastes include--

(1) Used oil: The used oil specification levels should be analyzed if it is burned for energy recovery.

(2) Photographic Waste: The toxicity characteristic-silver of waste fixer should be analyzed at least once before discharging into the sewer system.

(3) Miscellaneous Wastes: The maintenance shops floor absorbent and solvent rags used for machine part cleaning should be analyzed for their HW characteristics at least once so that they can be handled and disposed of properly.

b. Collect the used ethanol for recovery or dispose of as HW. Used ethanol generated from various laboratories has a flash point of less than 100 °F as tested by USAEHA. Diluting used ethanol with water and then discharging into the sewer system is not an acceptable practice.

c. Initiate the following HAZMIN efforts:

(1) Emphasize the HAZMIN-related suggestions in the existing employee suggestion system.

(2) Continue the HAZMIN training in followup to the HAZMIN seminar "What Is HAZMIN?" given by the USAEHA project officer in order to provide more specific knowledge in HAZMIN technologies to the HM/HW handling and managing personnel at WRAMC.

(3) Expedite the modification of the xylene distillation room (Room 221, Bldg T-2) to meet the fire code, so that xylene recovery can be resumed.

(4) Construct spill containment structures at HM/HW storage areas, such as the DOL warehouse in Bldg 178 and DEH Mobile Equipment Shop yard in Forest Glenn Annex.

(5) Control HM purchases so that HM will not be overstocked, or the size of HM container is small enough so that each container could be used up prior to the expiration date.

d. Evaluate the feasibility of the following potential HAZMIN opportunities:

(1) Continue the investigation of the used xylene distillation system at AFIP. The USAEHA's preliminary studies indicate that a distillation system with vacuum could economically recover both used xylene and used ethanol with acceptable quality.

(2) Recovery of used methanol generated by CD&I, WRAIR with distillation is not feasible as evaluated by USAEHA. However, the AFIP personnel had expressed interests to reuse the used methanol generated. The CD&I personnel should coordinate with the AFIP personnel for a reuse trial.

(3) The DEH Mobile Equipment Shop and the Paint Shop should consider to join the solvent service contract at the DOL Transportation Motor Pool or the PX Service Station so that the used solvent can be recycled.

(4) The PX Service Station should evaluate the substitution of Stoddard Type I solvent (which is an HW when spent) with Type II solvent (which is not an HW when spent).

(5) Evaluate the substitution of halogenated "Varsol" solvent with a less toxic or non-hazardous solvent used at the DOL Transportation Motor Pool, the DEH Mobile Equipment Shop and the Paint Shop.

23. **Installation:** Carlisle Barrack  
**Consultation Conducted By:** U.S. Army Environmental Hygiene Agency, Direct Support Activity - North  
**Project Number:** 37-61-J941-90  
**Dates of Consultation:** 26-29 March 1990  
**Date of Transmittal Letter:** 4 May 1990  
**Project Costs:** \$3,577.57  
**Conclusions:**

a. Carlisle Barracks did not have an adequate HW Management Plan nor has it formed a HW Management Board.

b. No HAZMIN Plan or HAZMIN Committee existed.

c. Some wastes were being handled as HW without a clear determination that they were HW.

d. Lead-acid batteries which may be renewable or recyclable were being disposed of as HW.

e. The Golf Cart Maintenance Shop was not segregating wastes.

f. Reprographics may be able to reduce or eliminate HW disposal of developer and fixer by purchasing a closed system developer.

g. The x-ray section of the DUSAHC was discharging photographic developer into the sanitary sewer system. This may be an inappropriate disposal method.

h. The Dental Clinic x-ray section was containerizing and disposing its waste fixer as a HW. Silver recovery units at the Skill Development Center and at the Root Hall Photo Lab had the capability of treating this waste so that it may be discharged into the sanitary sewer.

**Recommendations:**

a. Revise the installation HW Management Plan and establish a HW management Board.

b. Prepare a HAZMIN Plan and form a HAZMIN Committee.

c. Ensure that items turned in a HW are actually HW.

d. Investigate the possibility of renewing or recycling all lead-acid batteries.

e. Segregate HW from non-hazardous waste at the Golf Cart Maintenance Shop.

f. Investigate the purchase of a closed developing system for the Reprographics Shop.

g. Containerize waste developer fluid from the DUSAHC x-ray clinic until a determination can be made on the legality of disposal to the sanitary sewer system.

h. Discharge waste fixer from the Dental Clinic x-ray section into the sanitary sewer after processing it through the silver recovery unit at the Root Hall Photo Lab or at the Skill Development Center.