RCRA Part B Post-Closure Permit Application

Book 3 of 3

Submitted to:

U.S. Environmental Protection Agency Region I
and
Connecticut Department of Environmental Protection

Submitted by:

TEXTRON Lycoming
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Stratford, Connecticut 06497

December 13, 1991

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Section F
Procedures to Prevent Hazards

This section is not applicable to this Post-Closure Permit Application for the former surface impoundments. All waste disposal activities associated with the former surface impoundments for which procedures to prevent hazards would be required ceased in 1986. RCRA closure was certified on May 22, 1990 for the surface impoundments, in accordance with the Closure Plan approved by DEP and EPA on April 5, 1988.

Section G
Contingency Plan

This section is not applicable to this Post-Closure Permit Application for the former surface impoundments. All waste disposal activities associated with the former surface impoundments for which a Contingency Plan would be required ceased in 1986. RCRA closure was certified on May 22, 1990 for the surface impoundments, in accordance with the Closure Plan approved by DEP and EPA on April 5, 1988.

Section H
Personnel Training

This section is not applicable to this Post-Closure Permit Application for the former surface impoundments. All waste disposal activities associated with the former surface impoundments for which personnel training would be required ceased in 1986. RCRA closure was certified on May 22, 1990 for the surface impoundments, in accordance with the Closure Plan approved by DEP and EPA on April 5, 1988.

Section I

Closure Plan, Post-Closure Plan, and Financial Requirement

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Section I

Closure Plan, Post-Closure Plan and Financial Requirements

This section describes the Closure Plan implemented to close the AVCO Corporation, Textron Lycoming Division (Textron Lycoming) surface impoundments in 1987 - 1989, and presents the Post-Closure Plan proposed for the post-closure care period. A description of the post-closure notices that were made and documentation of the post-closure cost estimate and exemption from financial assurance mechanism for post-closure are also presented.

I-1 Closure Plan [40 CFR 270.14(b)(13); 265.112]

A Surface Impoundment Closure Plan for the Textron Lycoming facility was submitted to the DEP and EPA in September 1987. The Closure Plan is provided in Appendix I-1. Amendments to the Surface Impoundment Closure Plan were submitted to DEP and EPA on September 30, 1987 (see Appendix I-2); January 5, 1988 (see Appendix I-3); and February 24, 1988 (see Appendix I-4).

This section presents the following background information:

- the submittal of the Closure Plan and its amendments
- DEP/EPA approval of the Closure Plan
- Closure Plan implementation
- closure certification

The Closure Plan was submitted in accordance with 40 CFR 265.112, and the Regulations of Connecticut State Agencies [Section 22a-449(c)-29(c)]. A description of the closed surface impoundments is included in Section B-1a. A description of the waste material placed in the surface impoundments is included in Section C.

Textron Lycoming's Closure Plan and closure implementation for the surface impoundments included the following activities:

- Removal of standing liquid from the equalization lagoon and processing this material through the treatment system contained in Building 18 for the removal of cyanide, chromium, and other heavy metals;
- Removal of settled solids and sludges from the four surface impoundments, pumping the materials to a holding tank, and dewatering the materials using filter presses;
- Removal of the bentonite liner beneath the equalization lagoon and soils underlying all four lagoons by excavating these materials vertically to at least the seasonal low water table elevation (generally to 1.5′ below the water table) and horizontally, as required, to remove any contaminated soils;
- Transportation of contaminated soils and dewatered sludges to a RCRA permitted hazardous waste treatment or disposal facility;
- Sampling and analyses of soils remaining after excavation to confirm that all contaminated soils had been removed from the surface impoundments;
- Removal of a pump station and associated piping and transportation to a RCRA approved facility for disposal;
- Providing site restoration, including backfilling and sloping to establish surface drainage patterns away from the locations of the closed surface impoundments;

- Designing and installing a final cover, including an impermeable bottom layer (synthetic geomembrane), middle drainage layer and vegetated top cover to minimize erosion;
- Preparation of a certificate of closure, including a survey plat and notification to the property deed; and
- Continuance of the Groundwater Assessment Monitoring Program for the waste management area during closure, as described in Section E-2.

DEP/EPA Review And Approval of the Closure Plan

Appendix I-5 contains the letter that documents the review and approval of the amended Closure/Post-Closure Plan by the DEP and EPA Region I.

Textron Lycoming's Certification of Closure

On May 22, 1990, VFL Technology Corporation certified the Textron Lycoming surface impoundments had been closed in accordance with all federal, state and local regulations. A copy of this certification is presented in Appendix I-6.

I-1a Closure Performance Standard [40 CFR 265.111]

In accordance with 40 CFR 265.111, closure activities for the surface impoundments were required to accomplish the following objectives:

- minimize the need for further maintenance;
- control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and
- comply with the closure requirements for surface impoundments [40 CFR 265.228]

To achieve the above objectives, the following Closure Performance Standards were established:

- Remove all wastes and contaminated subsoils, including liner, from the surface impoundments as described in Section I-1, in accordance with the DEP/EPA approved Closure Plan;
- Remove contaminated soil until the remaining soils, using analysis described in Table I-1, had levels that conformed to health and environmental based standards or background for all exposure pathways (the leachate extraction procedure was to be used for the groundwater pathway and mass analysis for the direct ingestion pathway);
- Provide closure as a landfill in accordance with 40 CFR 265.310 for any contaminated soil left in place;

Table I-1

Analytical Methods for Closure Soil Sampling

Analysis	Method
Aromatic Volatile Organics	Method 5030/8020[1]
Halogenated Volatile Organics	Method 5030/8010[1]
Cyanide	Method 9010[1]
Arsenic	Extraction Method 1310[1]
Barium	Extraction Method 1310[1]
Cadmium	Extraction Method 1310[1]
Chromium	Extraction Method 1310[1]
Lead	Extraction Method 1310[1]
Mercury	Extraction Method 1310[1]
Nickel	Extraction Method 1310[1]
Selenium	Extraction Method 1310[1]
Silver	Extraction Method 1310[1]
Hexavalent-Chromium	Extraction Method 1310[2]

[1] Test Methods for Evaluating Solid Waste, USEPA, DSW, SW-846, third edition, September 1986.

[2] Using EP toxicity test without acetic acid adjustment.

- Provide post-closure care for a landfill under 40 CFR 265.310 and 40 CFR 265 Subpart G, including a final cover that:
  - provides long-term minimization of migration of liquids through the closed landfill;
  - functions with minimum maintenance;
  - promotes drainage and minimizes erosion or abrasion of the cover;
  - accommodates settling and subsidence so that the cover's integrity is maintained; and
  - has a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.
- Provide additional post-closure care for the surface impoundments by:
  - maintaining the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events;
  - maintaining and monitoring the groundwater monitoring system and complying with all other applicable requirements of 40 CFR 265 Subpart F, including procedures outlined in the Groundwater Monitoring Assessment Program, March, 1987; and
  - preventing run-on and run-off from eroding or otherwise damaging the final cover.

I-1b Maximum Waste Inventory [40 CFR 265.112(b)(3)]

The maximum waste inventory was determined using base maps and surveys completed in 1985 and 1986. To estimate the material depths, a low groundwater elevation of 1.85 feet MSL, June 27, 1986, was used. As shown in Table I-2, the total estimated quantity of waste

Table I-2

Waste Inventory

Surface Impoundment	Component	Area (sq.ft.)	Depth (ft.)	Volume
Equalization (Lagoon 1)	Liquid	25,600	2	384,000 gal.
	Sludge	25,600	3	2,800 yd^3
Sludge Settling (Lagoon 2)	Sludge	9,140	3	1,020 yd^3
Sludge Settling (Lagoon 3)	Sludge	7,920	3	880 yd^3
Sludge Settling (Lagoon 4)	Sludge	12,600	4	1,870 yd^3
		Totals	Liquid	384,000 gal.
			Sludge	6,570 yd^3

inventory in the surface impoundments at the time of closure was 384,000 gallons of liquid (contained in Lagoon 1, the equalization lagoon), and 6,570 yd^3 of sludge (total for all four surface impoundments).

I-1c Inventory Removal, Disposal, and Decontamination of Equipment [40 CFR 265.114]

Waste materials and contaminated soils and liner were removed from the closed surface impoundments in accordance with the DEP/EPA approved Closure Plan and amendments contained in Appendices I-1 through I-4. Activities conducted during the closure implementation are summarized in Section I-1. Excavated contaminated soils and dewatered sludge were transported to Stablex, Quebec, Canada for disposal.

All equipment used during the closure process was decontaminated in accordance with the approved Closure Plan prior to removing the equipment from the site. This equipment included pumps, piping, dewatering equipment, backhoes, loaders, trucks, and personnel protective equipment.

I-c(1) Deviations from the Approved Closure Plan

Minor departures from the approved Closure Plan are described in a VFL Technology Corporation letter contained in Appendix I-7. This work included in-situ stabilization of the underlying soils to improve the subsurface conditions at the base of Lagoons 2, 3, and 4. This stabilization consisted of mixing on-site soils with a cement mixture that was delivered to the Textron Lycoming facility by truck. This procedure was required to provide sufficient strength to the remaining soils to adequately support the weight of the final fill material and cover, and prevent subsidence.

I-1c(2) Achievement of Closure Performance Standards

In accordance with 40 CFR 265.111, closure activities for the surface impoundments achieved the following objectives:

- the final cover was designed and installed to minimize the need for further maintenance;
- waste materials were removed from the surface impoundments and the final cover (including an impermeable liner) that was designed and installed to control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere;
- wastes and contaminated subsoils, including liner, were removed from the surface impoundments as described in Section I-1;

- closure as a landfill was accomplished in accordance with 40 CFR 265.310 and 40 CFR 265 Subpart G, including a cover that:
    - provides long-term minimization of migration of liquids through the closed surface impoundments;
    - functions with minimum maintenance;
    - promotes drainage and minimizes erosion or abrasion of the cover;
    - accommodates settling and subsidence so that the cover's integrity is maintained; and
    - has a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.
- post-closure care is continuing to be provided for the closed surface impoundments by:
    - maintaining the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct any effects of settling, subsidence, erosion, or other events (the area is currently graded, sloped and covered by vegetation, to comply with the approved Closure Plan);
    - maintaining and monitoring the groundwater monitoring system and complying with all other applicable requirements of 40 CFR 265 Subpart F, including procedures outlined in the Groundwater Assessment Monitoring Program, March, 1987; and
    - preventing run-on and run-off from eroding or otherwise damaging the final cover.

Section E-2 presents details of the Groundwater Assessment Monitoring Program and presentation of the groundwater analytical data.

I-2 Post-Closure Plan [40 CFR 270.14(b)(13)]

This Post-Closure Plan covers the closed surface impoundment area for which closure was certified in accordance with 40 CFR 265.115 on May 22, 1990. Closure activities were completed for the surface impoundments in accordance with the approved Closure Plan and are described in Section I-1. The post-closure activities proposed for the closed surface impoundment area are presented below in Sections I-2a through I-2h. All post-closure activities undertaken during the permitted portion of the post-closure care period (heretofore "post-closure care period") will be in accordance with this Post-Closure Plan. Upon receipt of a final RCRA Post-Closure Permit, this Post-Closure Plan (Section I-2) will supercede the Post-Closure Plan submitted with the original Closure Plan (see Appendix I-1).

The post-closure care period began on May 22, 1990 when Textron Lycoming certified closure of the four surface impoundments. In accordance with 40 CFR 264.117(a)(1), the 30-year post-closure care period will terminate on May 22, 2020. However, in accordance with 40 CFR 264.117(a)(2), Textron will submit an application for a permit modification to shorten the post-closure care period if it can be established that further post-closure care of the former waste management unit is not required to protect human health and the environment.

I-2a Post-Closure Care of Property [40 CFR 264.117]

The post-closure maintenance and monitoring activities specified in Sections I-2b through I-2h are proposed for the post-closure care period required by 40 CFR 264.117(a)(1). These post-closure maintenance and monitoring activities will be continued throughout the post-closure care period.

Use of the closed surface impoundment area will be restricted during the post-closure care period to protect the final cover and the monitoring system, in accordance with 40 CFR 264.117(c). Activities which may disturb the integrity of the final cover or the function of the facility's monitoring system will not be permitted. The appropriate post-closure notices have been made in accordance with 40 CFR 264.119, as described in Section I-2g.

I-2b Post-Closure Inspection and Maintenance Plan [40 CFR 264.118(b)(2)]

This section describes the elements of the Post-Closure Inspection and Maintenance Plan. In accordance with 40 CFR 264.118(b)(2), the proposed Post-Closure Inspection and Maintenance Plan describes the planned inspection and maintenance activities to be followed, and the frequencies at which these activities will be performed throughout the permitted portion of the post-closure care period to ensure the integrity of the final cover, and the proper function of the monitoring equipment. Implementation of this plan will ensure facility compliance with 40 CFR 264.117 throughout the post-closure care period.

I-2b(1) Post-Closure Inspection Plan [40 CFR 264.118(b)(1)]

Post-closure inspections will constitute an integral part of the post-closure monitoring and maintenance programs. Post-closure inspections will be performed to provide a mechanism for preventing and detecting equipment deterioration, malfunctions, erosion, vandalism, or mis-use of the property during the post-closure care period. When implemented, the post-closure inspections will prevent, or provide early detection for, any of the above events which, if allowed to continue, could result in a release of hazardous constituents, or constitute a threat to human health or the environment. Post-closure inspections will be conducted to give early warning of potential problems so that timely preventative or corrective actions can be taken.

Inspections will focus on verifying the integrity of the following items:

- site security
- final cover
- groundwater monitoring system

The Post-Closure Contact for Textron Lycoming (identified in Section I-2e) will be responsible for implementation of the inspection program. The Post-Closure Contact will have a thorough knowledge of the Post-Closure Inspection and Maintenance Plan. The Post-Closure Contact will have the responsibility to:

- implement the required inspections
- select and promptly implement appropriate maintenance or other required measures

Post-closure inspections will be conducted in accordance with the proposed schedule in Section I-2b(4). Inspections will be carried out only by personnel with a thorough knowledge of the Post-Closure Inspection and Maintenance Plan. Inspectors will work under the direction of the Post-Closure Contact and will prepare written inspection reports consisting of completed Post-Closure Inspection Checklist Report Forms. A typical Post-Closure Inspection Checklist Report Form is presented in Figure I-1. A brief description of each post-closure inspection item included in Figure I-1 is presented in Sections I-2b(1)(i) through I-2b(1)(iii).

As indicated in Figure I-1, the condition of each post-closure inspection checklist item will be assessed at the time of each post-closure inspection. For any item not found to be in acceptable condition, the inspector will indicate that maintenance is required and describe the specific type of maintenance or other measures that are necessary. After receiving each inspection report, the Post-Closure Contact will be responsible for taking prompt action to provide any maintenance or other care that may be required.

Figure I-1

Typical Post-Closure Inspection Report Form

Textron Lycoming

Post-Closure Inspection Checklist

Date of Inspection (month/day/year)

Time of inspection (hrs)

	Inspection Element	Status Acceptable (Y/N)	If Status Not Acceptable, Action Required
SECURITY	Fence line integrity		
	Gates entrances		
	Evidence of persons trespassing		
	Evidence of vandalism		
	Warning signs in place		
	Other:		
FINAL COVER	Evidence of soil erosion		
	Adequate vegetation cover		
	Stressed vegetation		
	Evidence of burrowing animals		
	Settling/Subsidence		
	Ditches/Drainage structures		
	Other:		
MONITORING	Monitoring wells locked		
	Outer casing integrity		
	Inner casing integrity		
	Concrete apron integrity		
	Other:		

Post-Closure Contact Notified: ☐ Yes ☐ No	Inspected by: *Signature*
Maintenance or Action Required: ☐ Yes ☐ No	Name and Title:
Response Timing: ☐ Urgent ☐ Routine ☐ No response required	Company:

I-2b(1)(i) Inspection of Post-Closure Security Systems

The post-closure security systems in place during the post-closure care period will include the following items:

- access to the Textron Lycoming site is limited to controlled gates, which are manned 24-hours/day by Textron Lycoming security guards; all visitors and contractors must receive authorization before entering any part of the facility
- a 6 - 10-foot high chain link fence is installed around the perimeter of the entire Textron Lycoming site except for the portion secured by Buildings #1 and #2 along Main Street
- a dedicated chain link fence with a locked gate that encloses the area of the closed surface impoundments
- signs with the legend "Danger — Unauthorized Personnel Keep Out" posted at the access gate to the enclosed location of the closed surface impoundments
- full time 24 hour/day security guards patrolling the facility on a daily basis
- outside lighting used to illuminate the facility at night

In accordance with the Post-Closure Inspection Report Form presented in Figure I-1, inspections to establish the condition of the post-closure security systems during the post-closure care period will include:

Fence Line Integrity — Establish condition of fences restricting access to the closed surface impoundment area to ensure they are sufficient to prevent unauthorized personnel and livestock from entering the area.

Gate Entrances — Establish that all gate entrances are being regularly monitored by security personnel, or are locked and secured.

Evidence of Trespassing and Vandalism — Identify any evidence of such intrusions, and evaluate the means of entry and possible measures to be taken to prevent entry.

Warning Signs in Place — Verify that warning signs reading "Danger — Unauthorized Personnel Keep Out" are posted and maintained at the entrance to the closed surface impoundment area.

Other Security Items — Any other concerns identified during inspections related to security of the closed surface impoundment area.

Inspection will be conducted at the frequencies presented in the Post-Closure Inspection and Maintenance Schedule in Section I-2b(4). Any need for maintenance to the security system will be established via these inspections and appropriate post-closure maintenance measures will be selected and implemented as described in Section I-2b(2)(i).

I-2b(1)(ii) Inspection of Final Cover

In accordance with the Post-Closure Inspection Form presented in Figure I-1, inspections to establish the condition of the final cover during the post-closure care period will include:

Evidence of Soil Erosion — Inspect earthen cover and surrounding area to identify any evidence of soil erosion.

Adequate Vegetation Cover — Inspect vegetation over final cover to ensure that it adequately covers the closed surface impoundment area.

Stressed Vegetation — Identify any evidence of stressed vegetation.

Evidence of Burrowing Animals — Inspect cover for holes, tunneling, or other evidence of burrowing animals that could damage the impermeable cover layer or channel rain water and accelerate the migration of liquids through the final cover.

Settling/Subsidence — Identify any areas where depressions or other evidence of settling or subsidence of the final cover have developed.

Ditches/Drainage Structures — Inspect perimeter ditches and drainage structures to ensure they are in good condition.

Other Final Cover Items — Any other concerns identified during inspections related to the final cover for the closed surface impoundment area.

If any need for maintenance to the final cover that is established via the inspections, appropriate post-closure maintenance measures will be selected and implemented as described in Section I-2b(2)(ii).

I-2b(1)(iii) Inspection of Groundwater Monitoring System

The post-closure groundwater monitoring system consists of 22 groundwater monitoring wells at 13 locations and are identified in Figure E-1. In accordance with the Post-Closure Inspection Form presented in Figure I-1, inspections to establish the condition of the groundwater monitoring system during the post-closure care period will include:

Monitoring Wells Locked — Ensure that monitoring well outer casing tops are closed and locked.

Outer Casing Integrity — Inspect outer casing to identify any corrosion or deterioration that may compromise monitoring well integrity.

Inner Casing Integrity — Inspect inner casing to identify any deterioration or other evidence of malfunction that may compromise monitoring well integrity.

Concrete Apron Integrity — Inspect concrete apron around outer casing to identify any evidence of cracks or deterioration that would compromise monitoring well integrity by accelerating the migration of surface water run-off to the monitored zone.

Other Monitoring System Items — Any other concerns identified during inspections related to the groundwater monitoring system for the closed surface impoundment area.

Additional inspection and assessment of monitoring well system, particularly for the inner casing and well screen of each well, will be conducted as a routine part of the post-closure groundwater monitoring program described in Section I-2c. Any need for maintenance identified during implementation of the post-closure monitoring program will be immediately brought to the attention of the Post-Closure Contact for prompt action. A description of inspections to be conducted as a part of the post-closure monitoring program is presented in Section E-3b(1).

Any need for maintenance to the groundwater monitoring system will be identified via the routine post-closure inspection program or post-closure monitoring program and appropriate post-closure maintenance measures will be selected and implemented as described in Section I-2b(2)(iii).

I-2b(2) Post-Closure Maintenance Plan [40 CFR 264.118(b)(2)]

The closed surface impoundment area should not require any routine scheduled post-closure maintenance during the post-closure care period. Post-closure maintenance will be performed for the final cover, groundwater monitoring system, and security systems throughout the post-closure care period on an as-needed basis, as determined through the post-closure inspections described in Section I-2b(1). Typical maintenance activities to be performed based on these inspections are described in Sections I-2b(2)(i) through I-2b(2)(iii).

The Post-Closure Contact will be responsible for promptly implementing any required maintenance activities during the post-closure care period. The Post-Closure Contact will review each Post-Closure Inspection Report to determine whether any maintenance activities are required. If maintenance activities are required, the Post-Closure Contact will ensure that all necessary arrangements are made with plant personnel or subcontractors, as appropriate. The Post-Closure Contact will be responsible for following through with implementation of all maintenance activities, including ensuring the work is properly completed in a timely fashion.

The Post-Closure Contact will be responsible for completing Post-Closure Maintenance Reports for each maintenance activity completed during the post-closure care period. A Typical Post-Closure Maintenance Report Form is presented in Figure I-2. Completed Post-Closure Maintenance Reports and other supporting documentation will be maintained on file throughout the post-closure care period in the Post-Closure Inspection and Maintenance Log described in Section I-2b(3).

Figure I-2

Typical Post-Closure Maintenance Report Form

Textron Lycoming **Post-Closure Maintenance Report Form**	Date Maintenance Activity Begun: Date Maintenance Activity Completed:

Maintenance Activity

Total Cost for Maintenance

Maintenance Initiated in Response to:

☐ Post-Closure Inspection date: ______________________

☐ Security Guard Patrol date: ______________________

☐ Groundwater Sampling Inspection date: ______________________

☐ Other (specify) ______________________

Approved by:

Date:

I-2b(2)(i) Maintenance of Security

As indicated in Section I-2b(1)(i), the security system will be inspected to ensure that it is maintained in good condition throughout the post-closure care period. Based on the results of post-closure inspections, the following maintenance activities may be required for the security system during the post-closure period:

- repair to fence lines
- repair to gates, locks, or chains restricting access at entrances to the facility
- repair or replacement of warning signs
- other maintenance measures to site security systems as required

I-2b(2)(ii) Maintenence of Final Cover [40 CFR 264.118(c)(2)(i)]

The final earthen cover over the closed surface impoundment area has been stabilized with adequate vegetation (grasses and other non-woody plants) and has remained stable since certification of closure on May 22, 1990. There is no evidence that this area has been subject to settling, subsidence, or significant soil erosion during this time period. The current vegetative covering over the closed surface impoundment area is healthy, and there is no evidence of stressed vegetation.

As indicated in Section I-2b(1), the final cover will be inspected to ensure that it is maintained in good condition throughout the post-closure care period. Based on the results of post-closure inspections, the following maintenance activities may be required for the final cover during the post-closure period:

- mowing to prevent intrusion by woody plants, and minimize the incidence of burrowing animals
- addition of topsoil and re-seeding to stabilize soil and vegetative cover to prevent erosion
- re-seeding to restore adequate density and coverage of grassy vegetation
- plugging and filling any holes or tunnels caused by burrowing animals
- addition of topsoil or other suitable fill materials where settling or subsidence has occurred, and compaction and regrading of these fill materials as required
- other maintenance measures to the final cover as required

I-2b(2)(iii) Maintenance of Groundwater Monitoring System [40 CFR 264.118(c)(2)(ii)]

The groundwater monitoring system is designed to function throughout the post-closure care period, if properly maintained. Any need for post-closure maintenance of the groundwater monitoring system will be identified by either the post-closure inspections, or by additional assessment and inspection of monitoring wells conducted regularly as a part of the post-closure groundwater monitoring program. Based on the results of these inspections, the following maintenance activities may be required for the groundwater monitoring system during the post-closure care period:

- repair or replacement of outer casing or locking cap necessary to maintain the integrity of the outer casing and adequately protect the inner casing and monitoring well integrity
- sealing of cracks or other repair of concrete apron and seal to prevent the infiltration of surface water into the monitoring well
- airlifting, overpumping, or other means as appropriate to clear any sedimentation from the screened interval of the monitoring well
- replacement of monitoring wells in cases where monitoring well integrity is permanently breached or the well is damaged beyond repair
- other maintenance measures to the groundwater monitoring system as required

I-2b(3) Post-Closure Inspection and Maintenance Log

An Inspection and Maintenance Log will be maintained to document completion of all maintenance and inspection procedures in accordance with the Post-Closure Maintenance and Monitoring Plan.

The following records will be maintained in the Post-Closure Maintenance and Inspection Log:

- copy of the Post-Closure Plan
- copies of all Post-Closure Inspection Reports

- copies of all Post-Closure Maintenance Reports
- copies of all records documenting maintenance activities, such as purchase orders and invoices for subcontractors or vendors

The Post-Closure Contact will be responsible for updating and maintaining the Post-Closure Inspection and Maintenance Log on file throughout the post-closure care period.

I-2b(4) Post-Closure Inspection and Maintenance Schedule

The closed surface impoundment area will not require any routine scheduled maintenance during the post-closure care period. Therefore, as stated in Section I-2b(2), there will not be any routine maintenance activities scheduled for the closed surface impoundment area during the post-closure care period. All post-closure maintenance activities will be initiated on an as-needed basis. The need for such maintenance will be identified during the routine post-closure inspections, and other inspection and monitoring activities described above in Section I-2(b)(1).

The post-closure inspections described in Section I-2(b)(1) will be completed on a routine scheduled basis. These inspections will be conducted and recorded quarterly throughout the post-closure care period, in accordance with the schedule presented in Table I-3. Inspections will be conducted more frequently during the post-closure care period it if is determined that maintenance is required more frequent than quarterly. Routine inspections by Textron

Lycoming security guards will be conducted on a daily basis as indicated in Section I-2b(1)(i).

Table I-3

Schedule for Conducting Post-Closure Inspections

Annual Inspection	Completed annually no latter than...
1st Quarter Inspection	March 31
2nd Quarter Inspection	June 30
3rd Quarter Inspection	September 30
4th Quarter Inspection	December 31

The additional inspection of the groundwater monitoring system described in Section I-2b(1)(iii) will be conducted at the time of each groundwater sampling event as described in Section E-3b(1).

I-2c Post-Closure Groundwater Monitoring Plan [264.118(b)(1)]

In accordance with 40 CFR 264.118(b)(1), the post-closure groundwater monitoring program will be implemented throughout the permitted portion of the post-closure care period to detect any releases to groundwater that could potentially occur from the closed surface impoundment area. The groundwater monitoring program proposed in accordance with 40 CFR 264 Subpart F for the post-closure care period is presented in Section E-3.

I-2d Updating/Amendment of Post-Closure Plan [40 CFR 264.118(d)]

Textron Lycoming will submit to the EPA Regional Administrator and the DEP Commissioner a written request for a Post-Closure Permit modification if and when any of the following circumstances occur:

- changes in operating plans or facility design affect the approved Post-Closure Plan
- events which occur during the active life of the facility, including partial and final closures, affect the approved Post-Closure Plan
- an unexpected event affects the Post-Closure Plan
- Textron Lycoming wishes to amend any provision of the Post-Closure Plan

Any written request for modification of Textron Lycoming's Post-Closure Permit will be accompanied with a copy of the amended Post-Closure Plan for approval by the EPA Regional Administrator and the DEP Commissioner. Any written request for permit modification will be submitted at least 60 days prior to the proposed change, or no later than 60 days after an unexpected event occurs that affects the Post-Closure Plan. The Post-Closure Contact will be responsible for preparing, submitting, and maintaining on file any written requests for permit modification, and amending the Post-Closure Plan accordingly.

I-2e Post-Closure Contact [40 CFR 264.118(b)(3)]

The Post-Closure Contact will be the person responsible for implementation of, and adherence to, the Post-Closure Plan during the post-closure care period. The Post-Closure Contact will have a thorough knowledge of the Post-Closure Plan. Throughout the post-closure care period, the Post-Closure Contact will have the responsibility and authority to:

- maintain post-closure records on file as described in Section I-2h
- implement the Post-Closure Inspection and Maintenance Plans as indicated in Section I-2b
- implement the post-closure groundwater monitoring activities as indicated in Section I-2c
- submit any necessary written requests to the EPA Regional Administrator and the DEP Commissioner requesting permit modifications in accordance with 40 CFR 264.118(d), as described in Section I-2d
- update the Post-Closure Cost Estimate annually in accordance with 40 CFR 264.144(b), as described in Section I-6
- prepare and submit to the EPA Regional Administrator and the DEP Commissioner the Post-Closure Certification, in accordance with 40 CFR 264.120, as described in Section I-2g
- serve as the main point of contact for Textron Lycoming on post-closure matters with the DEP and EPA Region I

In accordance with 40 CFR 118(b)(3), the designated Post-Closure Contact for Textron Lycoming will be:

Office of Legal Counsel
Textron Lycoming
Department 56
550 Main Street
Stratford, Connecticut 06497

The EPA Regional Administrator and the DEP Commissioner will be notified in writing of any change in the Post-Closure Contact during the post-closure care period.

I-2f Survey Plat [40 CFR 264.116]

The Survey Plat for the closed surface impoundment area has been prepared and submitted to the EPA Region I, the DEP, and the Town of Stratford (Stratford Zoning Commission and Stratford Environmental Conservation Office). The Survey Plat is included in Appendix I-9. The Survey Plat includes the boundaries of the closed surface impoundment area, referenced to permanent surveyed benchmarks, and was prepared and certified by a professional land surveyor. The following notes are prominently displayed on the Survey Plat:

- The closed surface impoundment area was used to manage hazardous wastes.
- The area's use is restricted under federal regulations [40 CFR 264, Subpart G] and regulations of Connecticut State Agencies [22a-449(c)-29(g)(3)].

I-2g Certification of Completion of Post-Closure Care [40 CFR 264.120]

In accordance with 40 CFR 264.120, within 60 days of completion of the post-closure care period for the closed surface impoundment area, Textron Lycoming will submit to the Regional Administrator and DEP Commissioner a certification that the post-closure care period was performed in accordance with the specifications in the approved Post-Closure Plan.

The Post-Closure Certification will be signed by a duly authorized representative of Textron Lycoming and an independent registered professional engineer. Typical Post-Closure Certifications to be submitted for the closed surface impoundments by a duly authorized representative of Textron Lycoming, and an independent registered professional engineer are presented in Figures I-3 and I-4.

The Post-Closure Contact will be responsible for contracting with the independent registered professional engineer and preparing the Post-Closure Certifications and will oversee the completion and submittal of the certifications to the EPA Regional Administrator and the DEP Commissioner.

Figure I-3

Textron Lycoming
Post-Closure Certification

The undersigned, ___(Name)___, an officer of the Textron Lycoming, Division of AVCO Corporation, incorporated under the laws in the State of Delaware and licensed to do business in Connecticut, which formerly owned or operated surface impoundments (herein-after "Facility") at the Textron Lycoming site located at 550 Main Street, Stratford, in Fairfield County, Connecticut, has completed post-closure activities for the facility and has fully implemented all measures relating to the post-closure of the facility as set forth in the Post-Closure Plan approved by (Region or State) for said facility.

NOW, THEREFORE, I (we)___(Name)___ hereby swear and affirm that the post-closure activities for the above-named hazardous waste facility have been conducted in accordance with the facility's Post-Closure Plan approved in writing by (name of EPA Regional Administrator or DEP Commissioner) on ____________, 19__, that all measures relating to post-closure of the facility required by the Post-Closure Plan and the rules and regulations of 40 CFR 264 Subpart G and RCSA 22a-449(c)-104 have been fully implemented, and that to the best of my knowledge, no violations exist.

____
(Signature)

____
(Name/Title)

____
(Address)

Taken, sworn and subscribed before me, this___ day of
___________ A.D. 19__ __________________________
____
____
(Notary)

Figure I-4

Typical Independent Registered Professional Engineer Post-Closure Certification

I, ______(name)________, a Professional Engineer registered in the State of Connecticut, hereby certify that I have reviewed the Post-Closure Plan for the Textron Lycoming surface impoundments located at 550 Main Street, Stratford, Connecticut, that I am familiar with the rules and regulations of 40 CFR 264 Subpart G and RCSA 22a-449(c)-104 pertaining to post-closure of such a facility, and that I personally have made visual inspection(s) of the former surface impoundment area, and that the post-closure activities for the surface impoundments have been performed in full and complete accordance with the facility's Post-Closure Plan approved in writing by (EPA Regional Administrator or DEP Commissioner) on ___________, 19__, and the rules and regulations of 40 CFR 264 Subpart G and RCSA 22a-449(c)-104.

________________________________ ________________

(Signature of Professional Engineer) (Date)

____

(Name of Professional Engineer)

________________________________ Professional

Engineer Seal

(Professional Engineering License Number)

____

(Business Address)

____

(Telephone Number)

I-2h Post-Closure Recordkeeping

The Post-Closure Contact will be responsible for updating and maintaining the following records on file throughout the post-closure care period:

- a copy of the Post-Closure Plan on file in accordance with 40 CFR 264.118(c)
- the Post-Closure Inspection and Maintenance Log as indicated in Section I-2(b)(3)
- the Post-Closure Monitoring records as indicated in Section E-3e
- any necessary written requests to the EPA Regional Administrator and DEP Commissioner requesting permit modifications in accordance with 40 CFR 264.118(d), as described in Sections I-2 and I-2d
- Post-Closure Certification and supporting documentation after the post-closure care period has been completed and certification prepared
- correspondence with the DEP and EPA Region I concerning post-closure

I-3 Documentation of Notice in Deed [40 CFR 264.119]

The following post-closure notices required by 40 CFR 264.119 have been made for the closed surface impoundments:

- In accordance with Connecticut law, a notation on the deed to the facility property has been recorded and will in perpetuity notify any potential purchaser of the property that:
  - The land has been used to manage hazardous wastes.
  - Its use is restricted under 40 CFR 264 Subpart G.
  - The survey plat and a record of the type, location, and quantity of waste disposed of within the closed surface impoundments required by 40 CFR 264.116 and 40 CFR 264.119(a) have been filed with EPA Region I, the DEP, and the Town of Stratford (Stratford Zoning Commission and Stratford Environmental Conservation Office).
- A certification to the EPA Regional Administrator and the DEP Commissioner has been signed by Textron Lycoming certifying that a deed notification has been submitted in accordance with 40 CFR 264.119(b)(1), including a copy of the document in which the notation has been placed. This certification is presented in Appendix I-10.

The deed notice submitted for the Textron Lycoming closed surface impoundments is presented in Appendix I-8. The survey plat that was submitted, as described in Section I-2f, is included in Appendix I-9.

The data from the closure soil sampling described in Section I-1a is presented in Appendix I-11. This information was submitted in accordance with 40 CFR 264.119(a) to document the type, location, and quantity of waste in the closed surface impoundment area.

I-4 Closure Cost Estimate [40 CFR 270.14(b)(15)]

Due to the fact that closure of the surface impoundments has been completed and certified closed on May 22, 1990, as described in Section I-1, a cost estimate for closure is no longer applicable for the closed surface impoundments.

I-5 Financial Assurance Mechanism for Closure [40 CFR 270.14(b)(15)

Due to the fact that closure of the surface impoundments has been completed and certified closed on May 22, 1990, as described in Section I-1, financial assurance for closure is no longer applicable for the closed surface impoundments.

I-6 Post-Closure Cost Estimate [40 CFR 270.14(b)(16)]

In accordance with 40 CFR 265.140(c), Textron Lycoming's Stratford facility is exempt from the requirements of 40 CFR 265 Subpart H. Therefore, Textron Lycoming is not required to maintain a post-closure cost estimate. This exemption is applicable because it is a government owned facility for which the U.S. Department of the Army has accepted the financial requirements of 40 CFR 265 Subpart H. The January 1988 letter submitted to EPA from Colonel Charles L. Brown of the U.S. Army documents the Army's acceptance of 40 CFR 265 Subpart H financial requirements. A copy of this letter is contained in Appendix I-12. Note that the required documentation in Appendix I-12 also exempts the facility from financial assurance requirements for post-closure care and liability requirements as described in Sections I-7 and I-8, respectively.

I-7 Financial Assurance Mechanism for Post-Closure [40 CFR 264.145(c)]

As stated in Section I-6, Textron Lycoming's Stratford facility is exempt from the requirements of 40 CFR 265 Subpart H. Therefore, Textron Lycoming is not required to maintain financial assurance for post-closure costs.

I-8 Liability Requirements [40 CFR 264.147]

As stated in Section I-6, Textron Lycoming's Stratford facility is exempt from the requirements of 40 CFR 265 Subpart H. Therefore, Textron Lycoming is not required to maintain financial assurance for both sudden and non-sudden accidental occurrences.

Appendix I-1

Textron Lycoming
Surface Impoundment Closure Plan

WehranEnviroTech

Surface Impoundment Closure

Project No. FY82/01B

Stratford Army Engine Plant, Stratford, Connecticut

Volume 2 - Surface Impoundment Closure Plan

Quality Assurance Project Plan

RECEIVED
MAR 01 1988
Plant Engineering
De[illegible]

February, 1988

APPENDIX B - SURFACE IMPOUNDMENT CLOSURE PLAN

Addendum to Surface Impoundment Closure Plan

AVCO-Lycoming TEXTRON

February 23, 1988

Amendment to Surface Impoundment Closure Plan dated September 1987.

The following changes shall be made to the plan:

1. Section 4-D, Page 4-7, Sampling and Analyses of Soils. Perimeter sampling and analyses of soils will be conducted at 35 foot intervals in order to achieve a 90 percent probability of detecting hazardous waste. For the two sides of the equalization lagoon that require sheeting, soil samples will be taken from test pits dug along the sheeting line. Sheeting will be installed only after confirmation sampling indicates that the sheeting is outside the range of hazardous material. Additional soil sampling shall be conducted according to the original plan.

2. Section 4-D, Page 4-8. The removal standards for metals, cyanide and chromium will be drinking water standards.

3. Create Appendix H and enclose the attached Hazardous Waste Substance List.

Textron Lycoming

HAZARDOUS WASTE
SUBSTANCE LIST

Page 1 of 6

Your sample ID See below
EML sample ID 71204-AVC

Date submitted 12-04-87
Date(s) analyzed 12-04 to 12-23-87

*** * * ALL VALUES REPORTED IN ug/gm (wet weight) * * ***

Method 8010/8020 via GC-PID/HECD. NOTE: not detected (nd) = <0.05 ppm

Compound:	Sample ID: 871204-1	871204-2	871204-3
Benzene	<0.05	<0.05	<0.05
Benzyl chloride	<0.05	<0.05	<0.05
Bis (2-chloroethoxy)methane	<0.05	<0.05	<0.05
Bis (2-chloroisopropyl)ether	<0.05	<0.05	<0.05
Bromobenzene	<0.05	<0.05	<0.05
Bromodichloromethane	<0.05	<0.05	<0.05
Bromoform	<0.05	<0.05	<0.05
Bromomethane	<0.05	<0.05	<0.05
Carbon tetrachloride	<0.05	<0.05	<0.05
Chloracetaldehyde	<0.05	<0.05	<0.05
Chloral	<0.05	<0.05	<0.05
Chlorobenzene	<0.05	<0.05	<0.05
Chloroethane	<0.05	<0.05	<0.05
Chloroform	<0.05	<0.05	<0.05
1-Chlorohexane	<0.05	<0.05	<0.05
2-Chloroethyl vinyl ether	<0.05	<0.05	<0.05
Chloromethane	<0.05	<0.05	<0.05
Chloromethyl methyl ether	<0.05	<0.05	<0.05
Chlorotoluene	<0.05	<0.05	<0.05
Dibromochloromethane	<0.05	<0.05	<0.05
Dibromomethane	<0.05	<0.05	<0.05
1,2-Dichlorobenzene	<0.05	<0.05	<0.05
1,3-Dichlorobenzene	<0.05	<0.05	<0.05
1,4-Dichlorobenzene	<0.05	<0.05	<0.05
Dichlorodifluoromethane	<0.05	<0.05	<0.05
1,1-Dichloroethane	<0.05	<0.05	<0.05
1,2-Dichloroethane	<0.05	<0.05	<0.05
1,1-Dichloroethylene	<0.05	<0.05	<0.05
trans-1,2-Dichloroethylene	<0.05	<0.05	<0.05
Dichloromethane	<0.05	<0.05	<0.05
1,2-Dichloropropane	<0.05	<0.05	<0.05
1,3-Dichloropropylene	<0.05	<0.05	<0.05
Ethylbenzene	<0.05	<0.05	<0.05
1,1,1,2-Tetrachloroethane	<0.05	<0.05	<0.05
1,1,2,2-Tetrachloroethane	<0.05	<0.05	<0.05
Tetrachloroethylene (PCE)	0.07	0.25	0.10
Toluene	<0.05	<0.05	<0.05
1,1,1-Trichloroethane	<0.05	<0.05	<0.05
1,1,2-Trichloroethane	<0.05	<0.05	<0.05
Trichloroethylene (TCE)	<0.05	<0.05	<0.05
Trichlorotrifluoromethane	<0.05	<0.05	<0.05
Trichloropropane	<0.05	<0.05	<0.05
Vinyl chloride	<0.05	<0.05	<0.05
Xylenes	<0.05	<0.05	<0.05
Dichloropropane	<0.05	<0.05	<0.05
Dichloropropylene	<0.05	<0.05	<0.05
Tetranitromethane	<5	<5	<5

CT DEPT HEALTH CERTIFICATION
ENVIRONMENTAL MONITORING LABORATORY, INC.
WALLINGFORD, CT

Analyst ____________

EML

REPORT OF RESULTS

Your sample ID See below Date submitted 12-04-87

EML sample ID 71204-AVC Date(s) analyzed 12-04 to 12-23-87

METHOD 625 GC/MS FRACTION-ACID COMPOUNDS (PHENOLS)

* * * ALL VALUES REPORTED IN ug/gm (ppm) * * *

Sample ID:	871204-1	871204-2	871204-3
Compound			
2-Chlorophenol	nd<0.5	nd<0.5	nd<0.5
2,4-Dichlorophenol	nd<0.5	nd<0.5	nd<0.5
2,4-Dimethylphenol	nd<0.5	nd<0.5	nd<0.5
4,6-Dinitro-o-cresol	nd<1	nd<1	nd<1
2,4-Dinitrophenol	nd<1	nd<1	nd<1
2-Nitrophenol	nd<0.5	nd<0.5	nd<0.5
4-Nitrophenol	nd<0.5	nd<0.5	nd<0.5
p-Chloro-m-cresol	nd<0.5	nd<0.5	nd<0.5
Pentachlorophenol	nd<0.5	nd<0.5	nd<0.5
Phenol	nd<0.5	nd<0.5	nd<0.5
2,4,6-Trichlorophenol	nd<0.5	nd<0.5	nd<0.5

PH-0608
ENVIRONMENTAL MONITORING LABORATORY, INC.
WALLINGFORD CT

Analyst

EML

Textron Lycoming

REPORT OF RESULTS

Your sample ID See below　　Date submitted 12-04-87

EML sample ID 71204-AVC　　Date(s) analyzed 12-04 to 12-23-87

METHOD 625: GC/MS FRACTION-BASE/NEUTRAL COMPOUNDS

* * * ALL RESULTS REPORTED IN ug/gm (ppm) * * *

Compound	871204-1	Compound	871204-1
Acenaphthene	nd<0.1	Diethylphthalate	nd<0.5
Acenaphthylene	nd<0.1	Dimethylphthalate	nd<0.5
Anthracene	nd<0.1	di-n-Butylphthalate	nd<0.5
Benzidine	nd<5	2,4-Dinitrotoluene	nd<0.5
Benzo(a)anthracene	nd<0.1	2,6-Dinitrotoluene	nd<0.5
Benzo(a)pyrene	nd<0.1	di-n-Octylphthalate	nd<0.5
Benzo(b)fluoranthene	nd<0.1	1,2-Diphenylhydrazine	nd<0.5
Benzo(ghi)perylene	nd<0.2	Fluoranthene	nd<0.1
Benzo(k)fluoranthene	nd<0.1	Fluorene	nd<0.1
bis(2-Chloroethoxy)methane	nd<0.5	Hexachlorobenzene	nd<0.5
bis(2-chloroethyl)ether	nd<0.5	Hexachlorobutadiene	nd<0.5
bis(2-ethylhexyl)phthalate	nd<0.5	Hexachlorocyclopentadiene	nd<0.5
4-Bromophenylphenylether	nd<0.5	Hexachloroethane	nd<0.5
Butylbenzylphthalate	nd<0.5	Indeno(1,2,3-cd)pyrene	nd<0.2
2-Chloronaphthalene	nd<0.5	Isophorone	nd<0.5
4-Chlorophenylphenylether	nd<0.5	Naphthalene	nd<0.1
Chrysene	nd<0.1	Nitrobenzene	nd<0.5
Dibenzo(ah)anthracene	nd<0.2	n-Nitrosodimethylamine	nd<5
1,2-Dichlorobenzene	nd<0.5	n-Nitrosodi-n-propylamine	nd<5
1,3-Dichlorobenzene	nd<0.5	n-Nitrosodiphenylamine	nd<5
1,4-Dichlorobenzene	nd<0.5	Phenanthrene	nd<0.1
3,3'-Dichlorobenzidine	nd<5	Pyrene	nd<0.1
bis(2-chloroisopropyl)ether	nd<0.5	1,2,4-Trichlorobenzene	nd<0.5

NOTE: nd = not detected

Analyst

EML

Textron Lycoming

REPORT OF RESULTS

Your sample ID See below
Date submitted 12-04-87
EML sample ID 71204-AVC
Date(s) analyzed 12-04 to 12-23-87

METHOD 625: GC/MS FRACTION-BASE/NEUTRAL COMPOUNDS

* * * ALL RESULTS REPORTED IN ug/gm (ppm) * * *

Compound	871204-2	Compound	871204-2
Acenaphthene	nd<0.1	Diethylphthalate	nd<0.5
Acenaphthylene	nd<0.1	Dimethylphthalate	nd<0.5
Anthracene	nd<0.1	di-n-Butylphthalate	nd<0.5
Benzidine	nd<5	2,4-Dinitrotoluene	nd<0.5
Benzo(a)anthracene	nd<0.1	2,6-Dinitrotoluene	nd<0.5
Benzo(a)pyrene	nd<0.1	di-n-Octylphthalate	nd<0.5
Benzo(b)fluoranthene	nd<0.1	1,2-Diphenylhydrazine	nd<0.5
Benzo(ghi)perylene	nd<0.2	Fluoranthene	nd<0.1
Benzo(k)fluoranthene	nd<0.1	Fluorene	nd<0.1
bis(2-Chloroethoxy)methane	nd<0.5	Hexachlorobenzene	nd<0.5
bis(2-chloroethyl)ether	nd<0.5	Hexachlorobutadiene	nd<0.5
bis(2-ethylhexyl)phthalate	nd<0.5	Hexachlorocyclopentadiene	nd<0.5
4-Bromophenylphenylether	nd<0.5	Hexachloroethane	nd<0.5
Butylbenzylphthalate	nd<0.5	Indeno(1,2,3-cd)pyrene	nd<0.2
2-Chloronaphthalene	nd<0.5	Isophorone	nd<0.5
4-Chlorophenylphenylether	nd<0.5	Naphthalene	nd<0.1
Chrysene	nd<0.1	Nitrobenzene	nd<0.5
Dibenzo(ah)anthracene	nd<0.2	n-Nitrosodimethylamine	nd<5
1,2-Dichlorobenzene	nd<0.5	n-Nitrosodi-n-propylamine	nd<5
1,3-Dichlorobenzene	nd<0.5	n-Nitrosodiphenylamine	nd<5
1,4-Dichlorobenzene	nd<0.5	Phenanthrene	nd<0.1
3,3'-Dichlorobenzidine	nd<5	Pyrene	nd<0.1
bis(2-chloroisopropyl)ether	nd<0.5	1,2,4-Trichlorobenzene	nd<0.5

JAN 04

NOTE: nd = not detected

Analyst

ENVIRONMENTAL MONITORING LABORATORY, INC. WALLINGFORD, CT

EML

Textron Lycoming

REPORT OF RESULTS

Your sample ID See below Date submitted 12-04-87

EML sample ID 71204-AVC Date(s) analyzed 12-04 to 12-23-87

METHOD 625: GC/MS FRACTION-BASE/NEUTRAL COMPOUNDS

* * * ALL RESULTS REPORTED IN ug/gm (ppm) * * *

Compound	871204-3	Compound	871204-3
Acenaphthene	nd<0.1	Diethylphthalate	nd<0.5
Acenaphthylene	nd<0.1	Dimethylphthalate	nd<0.5
Anthracene	nd<0.1	di-n-Butylphthalate	nd<0.5
Benzidine	nd<5	2,4-Dinitrotoluene	nd<0.5
Benzo(a)anthracene	nd<0.1	2,6-Dinitrotoluene	nd<0.5
Benzo(a)pyrene	nd<0.1	di-n-Octylphthalate	nd<0.5
Benzo(b)fluoranthene	nd<0.1	1,2-Diphenylhydrazine	nd<0.5
Benzo(ghi)perylene	nd<0.2	Fluoranthene	nd<0.1
Benzo(k)fluoranthene	nd<0.1	Fluorene	nd<0.1
bis(2-Chloroethoxy)methane	nd<0.5	Hexachlorobenzene	nd<0.5
bis(2-chloroethyl)ether	nd<0.5	Hexachlorobutadiene	nd<0.5
bis(2-ethylhexyl)phthalate	nd<0.5	Hexachlorocyclopentadiene	nd<0.5
4-Bromophenylphenylether	nd<0.5	Hexachloroethane	nd<0.5
Butylbenzylphthalate	nd<0.5	Indeno(1,2,3-cd)pyrene	nd<0.2
2-Chloronaphthalene	nd<0.5	Isophorone	nd<0.5
4-Chlorophenylphenylether	nd<0.5	Naphthalene	nd<0.1
Chrysene	nd<0.1	Nitrobenzene	nd<0.5
Dibenzo(ah)anthracene	nd<0.2	n-Nitrosodimethylamine	nd<5
1,2-Dichlorobenzene	nd<0.5	n-Nitrosodi-n-propylamine	nd<5
1,3-Dichlorobenzene	nd<0.5	n-Nitrosodiphenylamine	nd<5
1,4-Dichlorobenzene	nd<0.5	Phenanthrene	nd<0.1
3,3'-Dichlorobenzidine	nd<5	Pyrene	nd<0.1
bis(2-chloroisopropyl)ether	nd<0.5	1,2,4-Trichlorobenzene	nd<0.5

NOTE: nd = not detected

Analyst

PH-0508

ENVIRONMENTAL MONITORING LABORATORY, INC.

Addendum to Surface Impoundment Closure Plan

Avco - Lycoming TEXTRON

September 30, 1987

The following text contains responses to comments made by Mr. Robert Leger of EPA Region 1 and Mr. Kenneth Feathers of Connecticut DEP. All responses shall be incorporated into the report.

Section 2 - Closure Plan

Delete Figure 2.1, add attached Figure 2.1

Section 4 - Decontamination of Equipment/Personnel

Insert after the second paragraph:

"General equipment types to be decontaminated include:

*Pumps, piping, dewatering equipment
*Backhoes, Loaders
*HDP Lined Trucks
*Respirator cartridge, splash suits, deconsprayer, tyvek coveralls, decon. brush and basin, plastic sheets, trash barrel, plastic trash bags, decon. soap, disposable gloves, cotton gloves, hard hats, safety goggles, first aid kit, eye wash station, boots and duct tape.

This equipment shall be decontaminated according to US EPA Region IV, April 1986 Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, Environmental Services Division, Athens, Georgia, Appendix B. Methods to determine whether equipment is decontaminated are also listed in this manual.

Landfill Cap - General Comments

Design calculations for the drainage swale are not available at this time. They will be available during final design of the cap. (Note: this is a response to a comment and shall not be incorporated into the report).

Design calculations for the drainage swale will also not be provided at this time, however ASTM C33 and ASTM D1557 design standards will be added as Appendix H. (As per request of EPA). Therefore, insert attached Appendix H.

Section I - Paragraph 4

After paragraph 4 ("Figure 4.3 shows a typical section...) insert the following paragraphs.

"The final cover design will use the potential for soil erosion from side slopes. Application of this method is presented in the July 1982 Draft RCRA Guidance Document Landfill Designer, Liner System and Final Cover, US EPA, page 28.

Construction QA/QC for backfill control, membrane placement and slope verification will be conducted according to procedures outlined in the October 1986 Technical Guidance Document Construction Quality Assurance for Hazardous Waste Land Disposal Facilities, USEPA, OSWER Report No. EPA 1, 530-SW-86-031."

Section 7A-Groundwater Monitoring

Second paragraph, third sentence. "As part of the construction...". Delete last two sentences and replace with "As part of the construction of the final cap, these wells will be replaced outside the limit of the landfill cap with screens at the same elevations as the previous wells. The objective will be to make little or no changes in the well locations so that the time series of groundwater data remains comparable with past data."

Section 8 - Post Closure Cost Estimate

Delete section 8 and replace with the following:

C) The annual operating and Maintenance Costs for the post closure care period include:

1. Quarterly sampling and analyses -

pH	$ 5.
Specific Conductance	5.
Metals	145.
Cyanides (total & amenable)	60.
Hexvalent Chrom~~inim~~	25.
	$240.

Sampling eight wells plus 2
QA/QC samples
$240. x 10 samples x 4 per year = 9600/yr

Personnel: 2 engineers for 1 day
at $50/hr x 4 = $4000/yr

Subtotal $13,000/yr

2. Semi annual sampling and analyses -

TOC	$ 25.
TOX	85.
Methods 8010 & 8020	225.
	$335.

$335 x 10 samples x 2 per year =

Subtotal $6700/yr

3. Annual Inspections -

2 engineers for 2 days at
$50 per hour plus $400 per diem

Subtotal $2000/yr

4. Annual Reporting -

- analytic data: 1 engineer, 1 day at $50/hr
- inspection report: 1 engineer, 3 days at $50/hr

Subtotal $2100/yr

5. Annual Operation and Maintenance Costs -

Lawn mowing, erosion filling clear drainage, repair cap

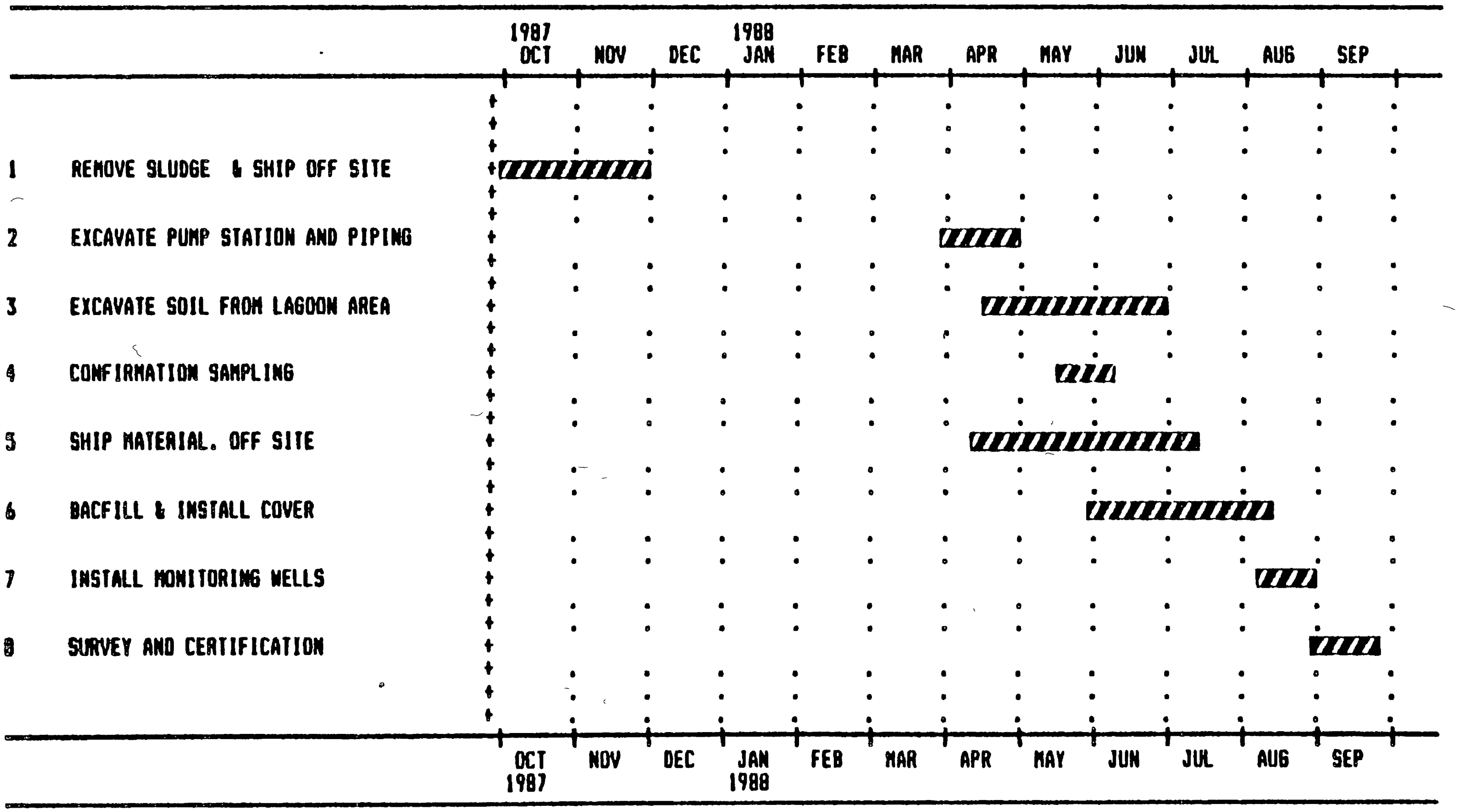
Subtotal $10,000/yr

The total annual cost for the above activities is approximately $35,000 (1987 dollars).

Landfill Design References

Remove references on last page of Appendix B and insert in Appendix G.

FIG. 2-1 SCHEDULE OF CLOSURE ACTIVITIES



Appendix H

ASTM C33 ASTM D1557 Standard Specifications

ie precautions give... 9.2.2.2 to guard against rying between time of removal from curing to sting.

0. Transportation of Specimens to Laboratory

10.1 Specimens shall not be transported from ie field to the laboratory before completion of ie initial curing. Specimens to be transported rior to an age of 48 h shall not be demolded rior to completion of transportation. Prior to ansporting, specimens shall be cured and protected as required in Section 9. During transportation, the specimens must be protected with suitable cushioning material to prevent damage from jarring and from damage by freezing temperatures, or moisture loss. Moisture loss may be prevented by wrapping the specimens in plastic or surrounding them with wet sand or wet saw dust. When specimens are received by the laboratory, they shall be removed from molds if not done before shipment and placed in the required standard curing at 73.4 ± 3°F (23 ± 1.7°C).

TABLE 1 Number of Layers Required for Specimens

Specimen Type and Size, as Depth, in (mm)	Mode of Compaction	Number of Layers	Approximate Depth of Layer, in (mm)
linders:			
12 (305)	rodding	3 equal	4 (100)
Over 12 (305)	rodding	as required	4 (100)
12 (305) to 18 (460)	vibration	2 equal	half depth of specimens
Over 18 (460)	vibration	3 or more	8 (200) as near as practicable
ams:			
6 (152) to 8 (200)	rodding	2 equal	half depth of specimen
Over 8 (200)	rodding	3 or more	4 (100)
6 (152) to 8 (200)	vibration	1	depth of specimen
Over 8 (200)	vibration	2 or more	8 (200) as near as practicable

TABLE 2 Number of Roddings to be Used in Molding Cylinder Specimens

Diameter of Cylinder, in (mm)	Number of Strokes/Layer
6 (152)	25
8 (200)	50
10 (250)	75

Standard Specification for
CONCRETE AGGREGATES[1]

This standard is issued under the fixed designation C 33; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision A number in parentheses indicates the year of last reapproval A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval

This specification has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards

1. Scope

1.1 This specification defines the requirements for grading and quality of fine and coarse aggregate (other than lightweight or heavyweight aggregate) for use in concrete.[2]

1.2 The information in this specification may be used by a specifier (designer, architect, engineer, etc.) to define the quality and grading of the aggregate to be used in the concrete in the structure. The specification may be also used by a contractor, concrete supplier, or other purchaser as a purchase document describing the material to be furnished by the aggregate producer.

NOTE 1—This specification is regarded as adequate to ensure satisfactory materials for most concrete. It is recognized that, for certain work or in certain regions, it may be either more or less restrictive than needed. The specifier should ascertain that aggregates specified are or can be made available in the area of the work, with regard to grading, physical, or chemical properties, or combination thereof.

1.3 *Units of Measurement:*

1.3.1 With regard to sieve sizes and the size of aggregate as determined by the use of testing sieves, the values in inch-pound units are shown for the convenience of the user; however, the standard sieve designation shown in parentheses is the standard value as stated in Specification E 11.

1.3.2 With regard to other units of measure, the values stated in inch-pound units are to be regarded as standard.

2. Applicable Documents

2.1 *ASTM Standards:*

C 29 Test Method for Unit Weight and Voids in Aggregate[3]

...st N... for... Ir...

Fine Aggregates for Concrete[3]

C 87 Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar[3]

C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate[3]

C 117 Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing[3]

C 123 Test Method for Lightweight Pieces in Aggregate[3]

C 125 Definitions of Terms Relating to Concrete and Concrete Aggregates[3]

C 131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine[3]

C 136 Method for Sieve Analysis of Fine and Coarse Aggregates[3]

C 142 Test Method for Clay Lumps and Friable Particles in Aggregates[3]

C 227 Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)[3]

C 289 Test Method for Potential Reactivity of Aggregates (Chemical Method)[3]

C 294 Descriptive Nomenclature of Constitu-

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[1] This specification is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09 03 05 on Methods of Testing and Specifications for Physical Characteristics of Concrete Aggregates

Current edition approved March 27, 1986. Published May 1986 Originally published as C 33 – 21 T Last previous edition C 33 – 85 Changes from the previous revision have included references to heavyweight aggregates in 1.1, 2 1, and footnote 2

[2] For lightweight aggregates, see Specifi... C 331, C 332, and C 330, for heavyweight aggregates s... ion C 637 ...d Des... Nomen [redacted] C 638 [redacted]

ents of Natural Mineral Aggregates[3]

C 295 Practice for Petrographic Examination of Aggregates for Concrete[3]

C 330 Specification for Lightweight Aggregates for Structural Concrete[3]

C 331 Specification for Lightweight Aggregates for Concrete Masonry Units[3]

C 332 Specification for Lightweight Aggregates for Insulating Concrete[3]

C 342 Test Method for Potential Volume Change of Cement-Aggregate Combinations[3]

C 535 Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine[3]

C 586 Test Method for Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)[3]

C 637 Specifications for Aggregates for Radiation-Shielding Concrete[3]

C 638 Descriptive Nomenclature of Constituents of Aggregates for Radiation Shielding Concrete[3]

C 666 Test Method for Resistance of Concrete to Rapid Freezing and Thawing[3]

D 75 Practice for Sampling Aggregates[3]

D 3665 Practice for Random Sampling of Construction Materials[4]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[3]

2.2 *Related Document:*

3. Ordering Information

3.1 The purchaser shall include the following information in the purchase order when applicable:

3.1.1 Reference to this specification, C 33, and date of issue,

3.1.2 Whether the order is for fine aggregate or for coarse aggregate,

3.1.3 Quantity, in tons or metric tons (Note 2),

3.1.4 When the order is for fine aggregate (Note 3):

3.1.4.1 Whether the optional grading in 5.2 applies,

3.1.4.2 Whether the restriction on reactive materials in 6.3 applies,

3.1.4.3 In the case of the sulfate soundness test (7.1) which salt is to be used. If none is stated, either salt may be used,

3.1.4.4 The appropriate limit for material finer than No. 200 sieve (Table 1). If not stated the 3.0 % limit shall apply,

3.1.4.5 The appropriate limit for coal and lignite (Table 1). If not stated, the 1.0 % limit shall apply.

3.1.5 When the order is for coarse aggregate (Note 3):

3.1.5.1 The grading (size number) (9.1 and Table 2),

3.1.5.2 The class designation (10.1 and Table 3),

3.1.5.3 Whether the restriction on reactive materials in 10.2 applies,

3.1.5.4 In the case of the sulfate soundness test (Table 3), which salt is to be used. If none is stated, either salt may be used.

3.1.6 Any exceptions or additions to this specification (see Notes 1 and 3).

NOTE 2—The weight should be determined as loaded in the hauling unit, including any natural moisture present. No water should be added at the time of loading.

NOTE 3—The specifier (architect, engineer, etc) should include in the contract documents his requirements as to the items listed in 3.1.4, 3.1.5, and 3.1.6 Otherwise, any grading or quality described in this specification which is furnished may be deemed to be acceptable, even though it may later prove to be unsatisfactory in service.

FINE AGGREGATE

4. General Characteristics

4.1 Fine aggregate shall consist of natural sand, manufactured sand, or a combination thereof.

5. Grading

5.1 *Sieve Analysis*—Fine aggregate, except as provided in 5.2, 5.3, and 5.4, shall be graded within the following limits:

Sieve (Specification E 11)	Percent Passing
⅜-in. (9.5 mm)	100
No. 4 (4.75-mm)	95 to 100
No. 8 (2.36-mm)	80 to 100
No. 16 (1.18-mm)	50 to 85
No. 30 (600-μm)	25 to 60
No. 50 (300-μm)	10 to 30
No. 100 (150-μm)	2 to 10

5.2 The minimum percent shown above f material passing the No. 50 (300-μm) and N 100 (150-μm) sieves may be reduced to 5 and respectively, if the aggregate is to be used in ai entrained concrete containing more than 400 of cement per cubic yard (237 kg/m³) or nonair-entrained concrete containing more tha of cement per cubic yard (297 kg/m³) or n approved mineral admixture is used to pply the deficiency in percent passing these sieves. Air-entrained concrete is here considered to be concrete containing air-entraining cement or an air-entraining agent and having an air content of more than 3 %.

5.3 The fine aggregate shall have not more than 45 % passing any sieve and retained on the next consecutive sieve of those shown in 5.1, and its fineness modulus shall be not less than 2.3 nor more than 3.1.

5.4 Fine aggregate failing to meet the sieve analysis and fineness modulus requirements of 5.1, 5.2, or 5.3, may be accepted provided that concrete made with similar fine aggregate from the same source has an acceptable performance record in similar concrete construction; or, in the absence of a demonstrable service record, provided that it is demonstrated that concrete of the class specified, made with the fine aggregate under consideration, will have relevant properties at least equal to those of concrete made with the same ingredients, with the exception that a reference fine aggregate be used which is selected from a source having an acceptable performance record in similar concrete construction.

NOTE 4—Fine aggregate that conforms to the grading requirements of a specification, prepared by another organization such as a state transportation agency, which is in general use in the area, should be considered as having a satisfactory service record with regard to those concrete properties affected by grading

NOTE 5—Relevant properties are those properties of the concrete which are important to the particular application being considered. STP 169B[5] provides a discussion of important concrete properties.

5.5 For continuing shipments of fine aggregate from a given source, the fineness modulus shall not vary more than 0.20 from the base fineness modulus. The base fineness modulus shall be that value that is typical of the source. If necessary, the base fineness modulus may be changed when approved by the purchaser.

NOTE 6—The base fineness modulus should be determined from previous tests, or if no previous tests exist, from the average of the fineness modulus values for the first ten samples (or all preceding samples if less than ten) on the order. The proportioning of a concrete mixture may be dependent on the base fineness modulus of the fine aggregate to be used Therefore, when it appears that the base fineness modulus is considerably different from the value used in the concrete mixture, a suitable adjustment in the mixture may be necessary

6. Deleterious Substances

6.1 The amount of deleterious substances in fine aggregate shall not exceed the limits prescribed in Table 1.

6.2 *Organic Impurities:*

6.2.1 Fine aggregate shall be free of injurious amounts of organic impurities. Except as herein provided, aggregates subjected to the test for organic impurities and producing a color darker than the standard shall be rejected.

6.2.2 A fine aggregate failing in the test may be used, provided that the discoloration is due principally to the presence of small quantities of coal, lignite, or similar discrete particles

6.2.3 A fine aggregate failing in the test may be used, provided that, when tested for the effect of organic impurities on strength of mortar, the relative strength at 7 days calculated in accordance with Test Method C 87, is not less than 95 %.

6.3 Fine aggregate for use in concrete that will be subject to wetting, extended exposure to humid atmosphere, or contact with moist ground shall not contain any materials that are deleteriously reactive with the alkalies in the cement in an amount sufficient to cause excessive expansion of mortar or concrete, except that if such materials are present in injurious amounts, the fine aggregate may be used with a cement containing less than 0.60 % alkalies calculated as sodium oxide equivalent ($Na_2O + 0.658K_2O$) or with the addition of a material that has been shown to prevent harmful expansion due to the alkali-aggregate reaction. (See Appendix X1)

7. Soundness

7.1 Except as provided in 7.2 and 7.3, fine aggregate subjected to five cycles of the soundness test shall have a weighted average loss not greater than 10 % when sodium sulfate is used or 15 % when magnesium sulfate is used.

7.2 Fine aggregate failing to meet the requirements of 7.1 may be accepted, provided that concrete of comparable properties, made from similar aggregate from the same source, has given satisfactory service when exposed to weathering similar to that to be encountered.

7.3 Fine aggregate not having a demonstrable service record and failing to meet the requirements of 7.1 may be accepted, provided it gives

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[4] *Annual Book of ASTM Standards*, Vol 04.03.

[5] *Significance of Tests and Properties of Concrete and Concrete Making Materials, STP 169B*, ASTM, 1978

[illegible] ing and thawing tests (see Test Method C 666).

COA[illegible] AGGREGATE

8. General Cha[illegible]istics

8.1 Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, air-cooled blast furnace slag, or crushed hydraulic-cement concrete, or a combination thereof, conforming to the requirements of this specification.

NOTE 7—Although crushed hydraulic-cement concrete has been used as an aggregate with reported satisfactory results, its use may require some additional precautions. Mixing water requirements may be increased because of the harshness of the aggregate. Partially deteriorated concrete, used as aggregate, may reduce freeze-thaw resistance, affect air void properties or degrade during handling, mixing, or placing. Crushed concrete may have constituents that would be susceptible to alkali-aggregate reactivity or sulfate attack in the new concrete or may bring sulfates, chlorides, or organic material to the new concrete in its pore structure.

9. Grading

9.1 Coarse aggregates shall conform to the requirements prescribed in Table 2 for the size number specified.

NOTE 8—The ranges shown in Table 2 are by necessity very wide in order to accommodate nationwide conditions. For quality control of any specific operation, a producer should develop an average gradation for the particular source and production facilities, and control the gradation within reasonable olerances from this average. Where coarse aggregate izes numbers 357 or 467 are used, the aggregate should be furnished in at least two separate sizes

10. Deleterious Substances

10.1 Except for the provisions of 10.3, the limits given in Table 3 shall apply for the class of coarse aggregate designated in the purchase order or other document (Notes 9 and 10). If he class is not specified, the requirements for Class 3S, 3M, or 1N shall apply in the severe, moderate, and negligible weathering regions, espectively (see Table 3 and Fig. 1).

NOTE 9—The specifier of the aggregate should designate the class of coarse aggregate to be used in he work, based on weathering severity, abrasion, and other factors of exposure. (See Table 3 and Fig 1.) The limits for coarse aggregate corresponding to each lass designation are expected to ensure satisfactory performance in concrete for the respective type and ocation of construction. Selecting a class with unduly estrictive limits may result in unnecessary cost if materials meeting those requirements are not locally available. Selecting a class with lenient limits may esult in unsatisfactory performance and premature deterioration of the concrete. While concrete in dif- [illegible] made with different classes of coarse aggregate, the specifier may wish to require the coarse aggregate for all concrete to conform to the same more restrictive class to reduce the chance of furnishing concrete with the wrong class of aggregate, especially on smaller projects.

NOTE 10—For coarse aggregate in concrete exposed to weathering, the map with the weathering regions shown in Fig. 1 is intended to serve only as a guide to probable weathering severity. Those undertaking construction, especially near the boundaries of weathering regions, should consult local weather bureau records for amount of winter precipitation and number of freeze-thaw cycles to be expected, for determining the weathering severity for establishing test requirements of the coarse aggregate. For construction at altitudes exceeding 5000 ft (1520 m) above sea level, the likelihood of more severe weathering than indicated by the map should be considered.

10.2 Coarse aggregate for use in concrete that will be subject to wetting, extended exposure to humid atmosphere, or contact with moist ground shall not contain any materials that are deleteriously reactive with the alkalies in the cement in an amount sufficient to cause excessive expansion of mortar or concrete except that if such materials are present in injurious amounts, the coarse aggregate may be used with a cement containing less than 0.60 % alkalies calculated as sodium oxide equivalent $(Na_2O + 0.658K_2O)$ or with the addition of a material that has been shown to prevent harmful expansion due to the alkali-aggregate reaction. (See Appendix X1.).

10.3 Coarse aggregate having test results exceeding the limits specified in Table 3 may be accepted provided that concrete made with similar aggregate from the same source has given satisfactory service when exposed in a similar manner to that to be encountered; or, in the absence of a demonstrable service record, provided that the aggregate produces concrete having satisfactory relevant properties (see Note 5).

METHODS OF SAMPLING AND TESTING

11. Methods of Sampling and Testing

11.1 Sample and test the aggregates in accordance with the following methods, except as otherwise provided in this specification. Make the required tests on test samples that comply with requirements of the designated test methods. The same test sample may be used for sieve analysis and for determination of material finer than the No. 200 (75-μm) sieve. Separated sizes from the sieve analysis may be used in paration of samples for soundness or abrasion ts. For determination of all other tests and for evaluation of potential alkali reactivity where required, use independent test samples.

11.1.1 *Sampling*—Practice D 75 and Practice D 3665.

11.1.2 *Grading and Fineness Modulus*—Method C 136.

11.1.3 *Amount of Material Finer than No. 200 (75-μm) Sieve*—Test Method C 117.

11.1.4 *Organic Impurities*—Test Method C 40.

11.1.5 *Effect of Organic Impurities on Strength*—Test Method C 87.

11.1.6 *Soundness*—Test Method C 88.

11.1.7 *Clay Lumps and Friable Particles*—Test Method C 142.

[illegible] using a liquid of 2.0 specific gravity to remove the particles of coal and lig[illegible] Only material that is brownish-black, or bla[illegible]all be considered coal or lignite. Coke shall not be classed as coal or lignite.

11.1.9 *Weight of Slag*—Test Method C 29.

11.1.10 *Abrasion of Coarse Aggregate*—Test Method C 131 or Test Method C 535.

11.1.11 *Reactive Aggregates*—See Appendix X1.

11.1.12 *Freezing and Thawing*—Procedures for making freezing and thawing tests of concrete are described in Test Method C 666.

11.1.13 *Chert*—Test Method C 123 is used to identify particles in a sample of coarse aggregate lighter than 2.40 specific gravity, and Practice C 295 to identify which of the particles in the light fraction are chert.

TABLE 1 Limits for Deleterious Substances in Fine Aggregate for Concrete

Item	Weight Percent of Total Sample, max
Clay lumps and friable particles	3.0
Material finer than No 200 (75-μm) sieve.	
Concrete subject to abrasion	3.0[A]
All other concrete	5.0[A]
Coal and lignite	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

[A] In the case of manufactured sand, if the material finer than the No 200 (75-μm) sieve consists of the dust of fracture, essentially free of clay or shale, these limits may be increased to 5 and 7 %, respectively.

TABLE 2 Grading Requirements for Coarse Aggregates

Size Number	Nominal Size (Sieves with Square Openings)	Amounts Finer than Each Laboratory Sieve (Square-Openings), Weight Percent												
		4 in. (100 mm)	3½ in. (90 mm)	3 in. (75 mm)	2½ in. (63 mm)	2 in. (50 mm)	1½ in. (37.5 mm)	1 in. (25.0 mm)	¾ in. (19.0 mm)	½ in. (12.5 mm)	⅜ in (9.5 mm)	No. 4 (4.75 mm)	No. 8 (2.36 mm)	No. 16 (1.18 mm)
1	3½ to 1½ in. (90 to 37.5 mm)	100	90 to 100	...	25 to 60	...	0 to 15	...	0 to 5	...	...	...	...	...
2	2½ to 1½ in. (63 to 37.5 mm)	...	...	100	90 to 100	35 to 70	0 to 15	...	0 to 5	...	...	...	...	...
3	2 to 1 in. (50 to 25.0 mm)	...	...	...	100	90 to 100	35 to 70	0 to 15	...	0 to 5	...	...	...	...
357	2 in. to No. 4 (50 to 4.75 mm)	...	...	...	100	95 to 100	...	35 to 70	...	10 to 30	...	0 to 5	...	...
4	1½ to ¾ in. (37.5 to 19.0 mm)	...	...	...	...	100	90 to 100	20 to 55	0 to 15	...	0 to 5	...	...	...
467	1½ in. to No. 4 (37.5 to 4.75 mm)	...	...	...	...	100	95 to 100	...	35 to 70	...	10 to 30	0 to 5	...	...
5	1 to ½ in. (25.0 to 12.5 mm)	...	...	...	...	...	100	90 to 100	20 to 55	0 to 10	0 to 5	...	...	...
56	1 to ⅜ in. (25.0 to 9.5 mm)	...	...	...	...	...	100	90 to 100	40 to 85	10 to 40	0 to 15	0 to 5	...	...
57	1 in. to No. 4 (25.0 to 4.75 mm)	...	...	...	...	...	100	95 to 100	...	25 to 60	...	0 to 10	0 to 5	...
6	¾ to ⅜ in. (19.0 to 9.5 mm)	...	...	...	...	...	...	100	90 to 100	20 to 55	0 to 15	0 to 5	...	...
67	¾ in. to No. 4 (19.0 to 4.75 mm)	...	...	...	...	...	...	100	90 to 100	...	20 to 55	0 to 10	0 to 5	...
7	½ in. to No. 4 (12.5 to 4.75 mm)	...	...	...	...	...	...	...	100	90 to 100	40 to 70	0 to 15	0 to 5	...
8	⅜ in. to No. 8 (9.5 to 2.36 mm)	...	...	...	...	...	...	...	...	100	85 to 100	10 to 30	0 to 10	0 to 5

TABLE 3 Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregate for Concrete

NOTE—See Fig. 1 for the location of the weathering regions and footnote E to this table for the computation of the weathering index. The weathering regions are defined as follows in terms of the weathering index:

(S) Severe Weathering Region—Weathering Index greater than 500 day-inches (1270 day-cm).
(M) Moderate Weathering Region—Weathering Index 100 to 500 day-inches (254 to 1270 day-cm).
(N) Negligible Weathering Region—Weathering Index less than 100 day-inches (254 day-cm).

Class Designation	Type or Location of Concrete Construction	Maximum Allowable, %						
		Clay Lumps and Friable Particles	Chert[C] (Less Than 2.40 sp gr SSD)	Sum of Clay Lumps, Friable Particles, and Chert (Less Than 2.40 sp gr SSD)[C]	Material Finer Than No. 200 (75-μm) Sieve	Coal and Lignite	Abrasion[A]	Magnesium Sulfate Soundness (5 cycles)[B]
		Severe Weathering Regions						
1S	Footings, foundations, columns and beams not exposed to the weather, interior floor slabs to be given coverings	10.0	...	...	1.0[D]	1.0	50	..
2S	Interior floors without coverings	5.0	...	..	1.0[D]	0.5	50	..
3S	Foundation walls above grade, retaining walls, abutments, piers, girders, and beams exposed to the weather	5.0	5.0	7.0	1.0[D]	0.5	50	18
4S	Pavements, bridge decks, driveways and curbs, walks, patios, garage floors, exposed floors and porches, or waterfront structures, subject to frequent wetting	3.0	5.0	5.0	1.0[D]	0.5	50	18
5S	Exposed architectural concrete	2.0	3.0	3.0	1.0[D]	0.5	50	18
		Moderate Weathering Regions						
1M	Footings, foundations, columns, and beams not exposed to the weather, interior floor slabs to be given coverings	10.0	...	..	1.0[D]	1.0	50	...
2M	Interior floors without coverings	5.0	...	...	1.0[D]	0.5	50	..
3M	Foundation walls above grade, retaining walls, abutments, piers, girders, and beams exposed to the weather	5.0	8.0	10.0	1.0[D]	0.5	50	18
4M	Pavements, bridge decks, driveways and curbs, walks, patios, garage floors, exposed floors and porches, or waterfront structures subject to frequent wetting	5.0	5.0	7.0	1.0[D]	0.5	50	18

TABLE 3 *Continued*

Class Designation	Type or Location of Concrete Construction	Maximum Allowable, %						
		Clay Lumps and Friable Particles	Chert[C] (Less Than 2.40 sp gr SSD)	Sum of Clay Lumps, Friable Particles, and Chert (Less Than 2.40 sp gr SSD)[C]	Material Finer Than No. 200 (75-µm) Sieve	Coal and Lignite	Abrasion[A]	Maximum Sulfate Soundness (5 cycles)[B]
5M	Exposed architectural concrete	3.0	3.0	5.0	1.0[D]	0.5	50	18
		Negligible Weathering Regions						
1N	Slabs subject to traffic abrasion, bridge decks, floors, sidewalks, pavements	5.0	...	...	1.0[D]	0.5	50	...
2N	All other classes of concrete	10.0	...	...	1.0[D]	1.0	50	...

[A] Crushed air-cooled blast-furnace slag is excluded from the abrasion requirements. The rodded or jigged unit weight of crushed air-cooled blast-furnace slag shall be not less than 70 lb/ft³ (1120 kg/m³). The grading of slag used in the unit weight test shall conform to the grading to be used in the concrete. Abrasion loss of gravel, crushed gravel, or crushed stone shall be determined on the test size or sizes most nearly corresponding to the grading or gradings to be used in the concrete. When more than one grading is to be used, the limit on abrasion loss shall apply to each.

[B] The allowable limits for soundness shall be 12 % if sodium sulfate is used.

[C] These limitations apply only to aggregates in which chert appears as an impurity. They are not applicable to gravels that are predominantly chert. Limitations on soundness of such aggregates must be based on service records in the environment in which they are used.

[D] This percentage may be increased under either of the following conditions: (*1*) if the material finer than the No. 200 (75-µm) sieve is essentially free of clay or shale the percentage may be increased to 1.5; or (*2*) if the source of the fine aggregate to be used in the concrete is known to contain less than the specified maximum amount passing the No. 200 (75-µm) sieve (Table 1) the percentage limit (L) on the amount in the coarse aggregate may be increased to $L = 1 + [(P)/(100 - P)]\,(T - A)$, where P = percentage of sand in the concrete as a percent of total aggregate, T = the Table 1 limit for the amount permitted in the fine aggregate, and A = the actual amount in the fine aggregate. (This provides a weighted calculation designed to limit the maximum mass of material passing the No. 200 (75-µm) sieve in the concrete to that which would be obtained if both the fine and coarse aggregate were supplied at the maximum tabulated percentage for each of these ingredients.)

[E] Weathering Index. The effect of weathering is related to the weathering index, which for any locality is the product of the average annual number of *freezing cycle days* and the average annual *winter rainfall* in inches (or centimetres), defined as follows: *A Freezing Cycle Day* is any day during which the air temperature passes either above or below 32°F (0°C). The average number of freezing cycle days in a year may be taken to equal the difference between the mean number of days during which the minimum temperature was 32°F (0°C) or below and the mean number of days during which the maximum temperature was 32°F (0°C) or below. *Winter Rainfall* is the sum, in inches (or centimetres) of the mean monthly corrected precipitation (rainfall) occurring during the period between and including the normal date of the first occurrence of freezing (32°F, 0°C) in the fall and the normal date of the last occurrence of freezing (32°F, 0°C) in the spring. The winter rainfall for any period is equal to the total precipitation less one tenth of the total fall of snow, sleet, and hail. Rainfall for a portion of a month is prorated.

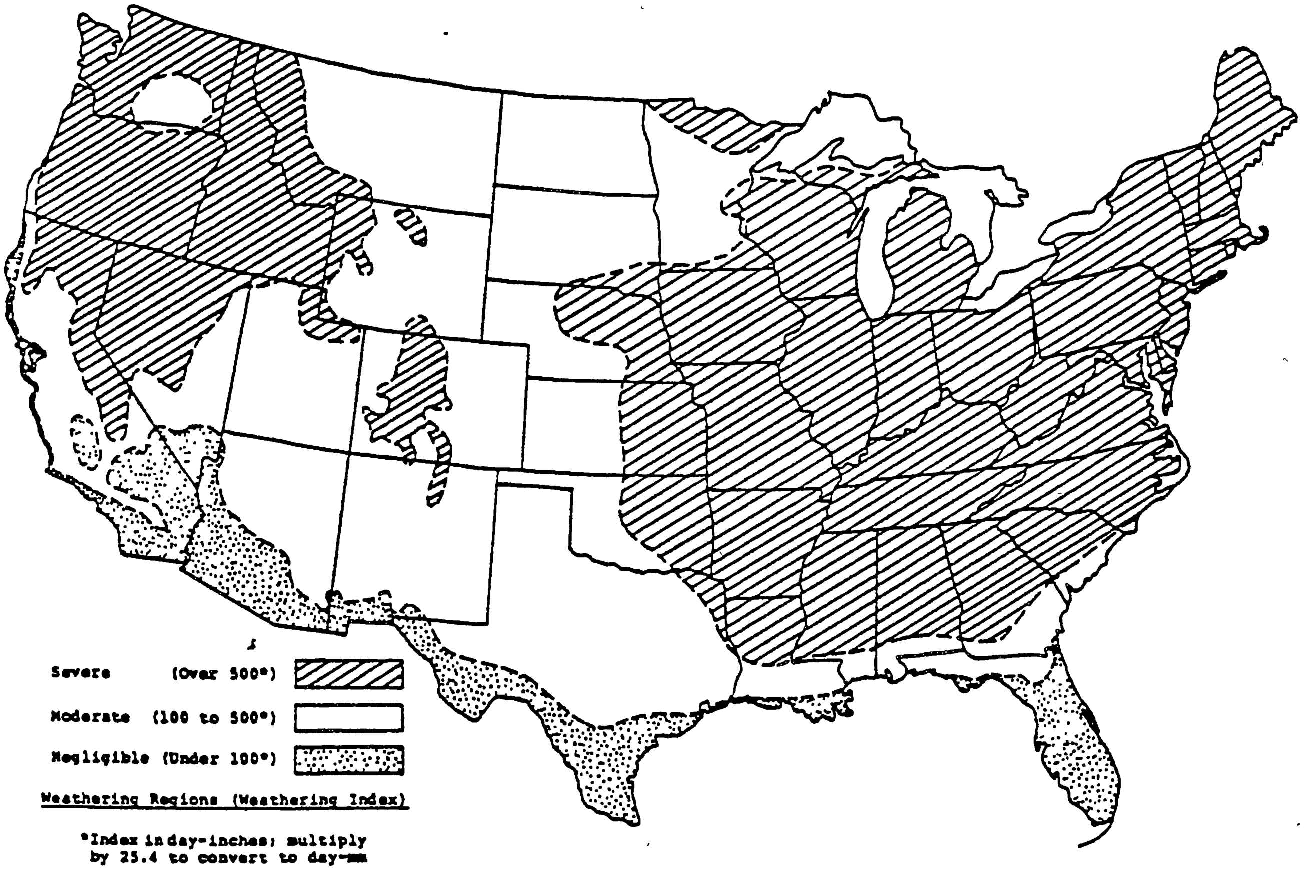

FIG. 1 Location of Weathering Regions

APPENDIX

(Nonmandatory Information)

XI. METHODS FOR EVALUATING POTENTIAL REACTIVITY OF AN AGGREGATE

X1.1 A number of methods for detecting potential reactivity have been proposed. However, they do not provide quantitative information on the degree of reactivity to be expected or tolerated in service. Therefore, evaluation of potential reactivity of an aggregate should be based upon judgment and on the interpretation of test data and examination of concrete structures containing a combination of fine and coarse aggregates and cements for use in the new work. Results of the following tests may assist in making the evaluation:

X1.1.1 *Practice C 295*—Certain materials are known to be reactive with the alkalies in cements. These include the following forms of silica: opal, chalcedony, tridymite, and cristobalite; intermediate to acid (silica-rich) volcanic glass such as is likely to occur in rhyolite, andesite, or dacite; certain zeolites such as heulandite; and certain constituents of some phyllites. Determination of the presence and quantities of these materials by petrographic examination is helpful in evaluating potential alkali reactivity. Some of these materials render an aggregate deleteriously reactive when present in quantities as little as 1.0 % or even less.

X1.1.2 *Test Method C 289*—In this test method, aggregates represented by points lying to the right of the solid line of Fig. 2 of Test Method C 289 usually should be considered potentially reactive.

X1.1.2.1 If R_c exceeds 70, the aggregate is considered potentially reactive if S_c is greater than R_c.

X1.1.2.2 If R_c is less than 70, the aggregate is considered potentially reactive if S_c is greater than 35 + $(R_c/2)$.

X1.1.2.3 These criteria conform to the solid line curve given in Fig. 2 of Test Method C 289. The test can be made quickly and, while not completely reliable in all cases, provides helpful information, especially where results of the more time-consuming tests are not available.

X1.1.3 *Test Method C 227*—The results of this test method when made with a high-alkali cement, furnish information on the likelihood of harmful reactions occurring. The alkali content of the cement should be substantially above 0.6 %, and preferably above 0.8 %, expressed as sodium oxide. Combinations of aggregate and cement that have produced excessive expansions in this test usually should be considered potentially reactive. While the line of demarcation between nonreactive and reactive combinations is not clearly defined, expansion is generally considered to be excessive if it exceeds 0.05 % at 3 months or 0.10 % at 6 months. Expansions greater than 0.05 % at 3 months should not be considered excessive where the 6-month expansion remains below 0.10 %. Data for the 3-month tests should be considered only when 6-month results are not available.

X1.1.4 *Test Method C 342*—This test method is intended primarily for research concerning the potential expansion of cement-aggregate combinations subjected to variations of temperature and water saturation during storage under prescribed conditions of test. Its use is mainly by those interested in research on aggregates that are found in parts of Kansas, Nebraska, Iowa and possibly other adjoining areas.

X1.1.4.1 In addition to its usefulness in research, this test method has been found useful in the selection of aggregates of the so-called "sand-gravel" type found mainly in some parts of Kansas, Nebraska and Iowa, which contain very little coarse material; generally 5 to 15 % retained on the No. 4 (4.75-mm) sieve. Much work has been done on the problems of using these aggregates successfully in concrete and is reported in summary in the "Final Report of Cooperative Tests of Proposed Tentative Method of Test for Potential Volume Change of Cement-Aggregate Combinations," Appendix to Committee C-9 Report, Proceedings, ASTM, Volume 54, 1954, p. 356. It indicates that cement-aggregate combinations tested by this procedure in which expansion equals or exceeds 0.200 % at an age of 1 year may be considered unsatisfactory for use in concrete exposed to wide variations of temperature and degree of saturation with water. In that geographical region, the problem has been reduced through the use of partial replacement of the "sand-gravel" with limestone coarse aggregate.

X1.1.5 *Potential Reactivity of Carbonate Aggregates*—The reaction of the dolomite in certain carbonate rocks with alkalies in portland cement paste has been found to be associated with deleterious expansion of concrete containing such rocks as coarse aggregate. Carbonate rocks capable of such reaction possess a characteristic texture and composition. The characteristic texture is that in which relatively large crystals of dolomite are scattered in a finer-grained matrix of calcite and clay. The characteristic composition is that in which the carbonate portion consists of substantial amounts of both dolomite and calcite, and the acid-insoluble residue contains a significant amount of clay. Except in certain areas, such rocks are of relatively infrequent occurrence and seldom make up a significant proportion of the material present in a deposit of rock being considered for use in making aggregate for concrete. Test Method C 586 has been successfully used in (*1*) research and (*2*) preliminary screening of aggregate sources to indicate the presence of material with a potential for deleterious expansions when used in concrete.

~~Standard Specification for~~
~~INORGANIC AGGREGATES FOR USE IN GYPSUM PLASTER~~[1]

~~This standard is issued under the fixed designation C 35; the number immediately following the designation indicates the year original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappro~~ ~~A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval~~

~~ε NOTE—Section 2 was added editorially and subsequent sections renumbered in May 1985.~~

~~1. Scope~~

~~1.1 This specification covers those aggregates most commonly used in gypsum plaster, which include perlite, sand (natural and manufactured), and vermiculite. Other aggregates may be employed, provided tests have demonstrated them to yield plaster of satisfactory quality.~~

~~2. Applicable Documents~~

~~2.1 *ASTM Standards:*~~

~~C 29 Test Method for Unit Weight and Voids in Aggregate~~[2]
~~C 40 Test Method for Organic Impurities in Fine Aggregates for Concrete~~[2]
~~C 136 Method for Sieve Analysis of Fine and Coarse Aggregates~~
~~D 75 Practice for Sampling Aggregates~~[2]

~~3. Definitions~~

~~3.1 *perlite aggregate*—a siliceous volcanic glass properly expanded by heat.~~

~~3.2 *sand aggregate.*~~

~~3.2.1 *natural sand*—the fine granular material resulting from the natural disintegration of rock or from the crushing of friable sandstone.~~

~~3.2.2 *manufactured sand*—the fine material resulting from the crushing and classification by screening, or otherwise, of rock, gravel or blast furnace slag.~~

~~3.3 *vermiculite aggregate*—a micaceous mineral properly expanded by heat.~~

~~4. Grading~~

~~4.1 *Sieve Analysis*—The aggregate, except as provided in 4.2, shall be graded within the limits specified in Table 1.~~

~~4.2 For natural or manufactured sand, n more than 50 % shall be retained between a two consecutive sieves shown in 4.1, nor mo than 25 % between the No. 50 (300-μm) and N 100 (150-μm) sieves.~~

~~4.3 For natural or manufactured sand, th amount of material finer than a No. 200 (75-μ sieve shall not exceed 5 %.~~

~~5. Weight of Lightweight Aggregates~~

~~5.1 The weight of perlite aggregate shall be n less than 6 nor more than 12 lb/ft³ (96 to 19 kg/m³).~~

~~5.2 The weight of vermiculite aggregate sh be not less than 6 more than 10 lb/ft³ (96 to 16 kg/m³).~~

~~6. Impurities~~

~~6.1 Water soluble impurities in sand shall no exceed 0.15 weight % and sodium ion conten shall not exceed 0.02 weight %.~~

~~6.2 Sand, when subjected to the colorimetri test for organic impurities, shall develop a colo no darker than the standard, unless it is esta lished by adequate tests that the impurities caus ing the color are not harmful in plaster.~~

~~[1] This specification is under the jurisdiction of ASTM Com mittee C-11 on Ceiling and Walls and is the direct responsibilit of Subcommittee C 11 02 on Specifications and Test Method for Accessories and Related Products~~

~~Current edition approved Sept 24, 1976. Published Novem ber 1976 Originally published as C 35 - 21 T. Last previou edition C 35 - 70 (1975)~~

~~[2] Annual Book of ASTM Standards, Vol 04 02~~

Standard Test Methods for
MOISTURE-DENSITY RELATIONS OF SOILS AND SOIL-AGGREGATE MIXTURES USING 10-lb (4.54-kg) RAMMER AND 18-in. (457-mm) DROP[1]

his standard is issued under the fixed designation D 1557; the number immediately following the designation indicates the ear of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

hese methods have been approved for use by agencies of the Department of Defense and for listing in the DoD Index of pecifications and Standards.

. Scope

1.1 These laboratory compaction methods over the determination of the relationship be-ween the moisture content and density of soils nd soil-aggregate mixtures (Note 1) when ompacted in a mold of a given size with a 10-b (4.54-kg) rammer dropped from a height of 8 in. (457 mm) (Note 2). Four alternative rocedures are provided as follows:

1.1.1 *Method A*—A 4-in. (101.6-mm) mold; material passing a No. 4 (4.75-mm) sieve;

1.1.2 *Method B*—A 6-in. (152.4-mm) mold; material passing a No. 4 (4.75-mm) sieve;

1.1.3 *Method C*—A 6-in. (152.4-mm) mold; material passing a ¾-in. (19.0-mm) sieve; and

1.1.4 *Method D*—A 6-in. (152.4-mm) mold; material passing a ¾-in. (19.0-mm) sieve, cor-ected by replacement for material retained on ¾-in. sieve.

NOTE 1—Soils and soil-aggregate mixtures should e regarded as natural occurring fine- or coarse-rained soils or composites or mixtures of natural oils, or mixtures of natural and processed soils or ggregates such as silt, gravel, or crushed rock.

NOTE 2—These laboratory compaction test meth-ds when used on soils and soil-aggregates which are ot free-draining will, in most cases, establish a well-efined optimum moisture content and maximum ensity (see Section 7). However, for free-draining oils and soil-aggregate mixtures, these methods will ot, in many cases, produce a well-defined moisture-ensity relationship and the maximum density ob-ained will generally be less than that obtained by ibratory methods.

1.2 The method to be used should be indi-cated in the specifications for the material being ested. If no method is specified, the provisions of Section 5 shall govern.

2. Applicable Documents

2.1 *ASTM Standards:*

C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate[2]

D 854 Test Method for Specific Gravity of Soils[3]

D 2168 Methods for Calibration of Laboratory Mechanical-Rammer Soil Compactors[3]

D 2216 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures[3]

D 2487 Test Method for Classification of Soils for Engineering Purposes[3]

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[3]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[4]

3. Apparatus

3.1 *Molds*—The molds shall be cylindrical in shape, made of rigid metal and be within the capacity and dimensions indicated in 3.1.1 or 3.1.2. The molds may be the "split" type, consisting either of two half-round sections, or a section of pipe split along one element, a cylinder meeting the requirements of this ion. The molds may also be the "taper" e, providing the internal diameter taper is uniform and is not more than 0.200 in./linear ft (16.7 mm/linear m) of mold height. Each mold shall have a base plate assembly and an extension collar assembly, both made of rigid metal and constructed so they can be securely attached to or detached from the mold. The **extension collar assembly shall have a height extending above the top of the mold of at least 2 in. (50 mm) which may include an upper section that flares out to form a funnel providing there is at least a ¾-in. (19-mm) straight cylindrical section beneath it.**

3.1.1 *Mold*, 4.0 in. (101.6 mm) in diameter, having a capacity of $^1/_{30}$ ± 0.0004 ft³ (944 ± 11 cm³) and conforming to Fig. 1.

3.1.2 *Mold*, 6.0 in. (152.4 mm) in diameter, having a capacity of $^1/_{13.333}$ ± 0.0009 ft³ (2124 ± 25 cm³) and conforming to Fig. 2.

3.1.3 The average internal diameter, height, and volume of each mold shall be determined before initial use and at intervals not exceeding 1000 times the mold is filled. The mold volume shall be calculated from the average of at least six internal diameter and three height measurements made to the nearest 0.001 in. (0.02 mm), or from the amount of water required to completely fill the mold, corrected for temperature variance in accordance with Table 1. If the average internal diameter and volume are not within the tolerances shown in Figs. 1 or 2, the mold shall not be used. The determined volume shall be used in computing the required densities.

3.2 *Rammer*—The rammer may be either manually operated (see 3.2.1) or mechanically operated (see 3.2.2). The rammer shall fall freely through a distance of 18.0 ± $^1/_{16}$ in. (457.2 ± 1.6 mm) from the surface of the specimen. The manufactured weight of the rammer shall be 10.00 ± 0.02 lb (4.54 ± 0.01 kg). The specimen contact face shall be flat.

3.2.1 *Manual Rammer*—The specimen contact face shall be circular with a diameter of 2.000 ± 0.005 in. (50.80 ± 0.13 mm). The rammer shall be equipped with a guide-sleeve which shall provide sufficient clearance so that the free fall of the rammer shaft and head will not be restricted. The guidesleeve holes total) located with centers ¾ ± $^1/_{16}$ in. (19.0 ± 1.6 mm) from eac and spaced 90 deg apart. The minimum neter of the vent holes shall be ⅜ in. (9.5 mm)

3.2.2 *Mechanical Rammer*—The rammer shall operate mechanically in such a manner as to provide uniform and complete coverage of the specimen surface. There shall be 0.10 ± 0.03 in. (2.5 ± 0.8 mm) clearance between the rammer and the inside surface of the mold at its smallest diameter. When used with the 4.0-in. (101.6-mm) mold, the specimen contact face shall be circular with a diameter of 2.000 ± 0.005 in. (50.80 ± 0.13 mm). When used with the 6.0-in. (152.4-mm) mold, the specimen contact face shall have the shape of a section of a circle of a radius equal to 2.90 ± 0.02 in. (73.7 ± 0.5 mm). The sector face rammer shall operate in such a manner that the vertex of the sector is positioned at the center of the specimen. The mechanical rammer shall be calibrated and adjusted, as necessary, in accordance with 3.2.3.

3.2.3 *Calibration and Adjustment*—The mechanical rammer shall be calibrated, and adjusted as necessary, before initial use, near the end of each period during which the mold was filled 1000 times; before reuse after anything, including repairs, which may affect the test results significantly; and whenever the test results are questionable. Each calibration and adjustment shall be in accordance with Methods D 2168.

3.3 *Sample Extruder* (optional)—A jack, frame, or other device adapted for the purpose of extruding compacted specimens from the mold.

3.4 *Balances*—A balance or scale of at least 20-kg capacity sensitive to ±1 g and a balance of at least 1000-g capacity sensitive to ±0.01 g.

3.5 *Drying Oven*, thermostatically-controlled, preferably of the forced-draft type, capable of maintaining a temperature of 230 ± 9°F (110 ± 5°C) for determining the moisture content of the compacted specimen.

3.6 *Straightedge*—A stiff metal straightedge of any convenient length but not less than 10 in. (254 mm). The scraping edge shall have a straightness tolerance of ±0.005 in. (±0.13 mm) and shall be beveled if it is thicker then ⅛ in. (3 mm).

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[1] These methods are under the jurisdiction of ASTM Committee D-18 on Soil and Rock.

Current edition approved April 27, 1978. Published July 1978. Originally published as D 1557 – 58 T. Last previous edition D 1557 – 70.

[2] *Annual Book of ASTM Standards*, Vol 04 02.

[3] *Annual Book of ASTM Standards*, Vol 04 08

[4] *Annual Book of ASTM Standards*, Vols 04 01, 04 02, 04 06, 05 05, and 14 02.

3.7 *Sieves*, [illegible]-mm), ¾-in. (19.0-mm), and No. 4 (4.7[illegible], conforming to the requirements of Specification E 11.

3.8 *Mixing Tools*—Miscellaneous tools such as mixing pan, spoon, trowel, spatula, etc., or a suitable mechanical device for thoroughly mixing the sample of soil with increments of water.

4. Procedure

4.1 *Specimen Preparation*—Select a representative portion of quantity adequate to provide, after sieving, an amount of material weighing as follows: Methods A—25 lb (11 kg); Methods B, C, and D—50 lb (23 kg). Prepare specimens in accordance with either 4.1.1 through 4.1.3 or 4.1.4.

4.1.1 *Dry Preparation Procedure*—If the sample is too damp to be friable, reduce the moisture content by drying until the material is friable; see 4.1.2. Drying may be in air or by the use of a drying apparatus such that the temperature of the sample does not exceed 140°F (60°C). After drying (if required), thoroughly break up the aggregations in such a manner as to avoid reducing the natural size of the particles. Pass the material through the specified sieve as follows: Methods A and B—No. 4 (4.75-mm); Methods C and D—¾-in. (19.0-mm). Correct for oversize material in accordance with Section 5, if Method D is specified.

4.1.2 Whenever practicable, soils classified as ML, CL, OL, GC, SC, MH, CH, OH and PT by Test Method D 2487 shall be prepared in accordance with 4.1.4.

4.1.3 Prepare a series of at least four specimens by adding increasing amounts of water to each sample so that the moisture contents vary by approximately 1½ %. The moisture contents selected shall bracket the optimum moisture content, thus providing specimens which, when compacted, will increase in mass to the maximum density and then decrease in density (see 7.2 and 7.3). Thoroughly mix each specimen to ensure even distribution of moisture throughout and then place in a separate covered container and allow to stand prior to compaction in accordance with Table 2. For the purpose of selecting a standing time, it is not required to perform the actual classification procedures described in Test Method D 2487 (except in the case of referee testing), if previous data exist which provide a basis for classifying the sample.

4.1.4 *Moist Preparation Method*—The following alternate procedure is recommended for soils classified as ML, CL, OL, GC, SC, MH, CH, OH and PT by Test Method D 2487. Without previously drying the sample, pass it through the ¾-in. (19.0-mm) and No. 4 (4.75-mm) sieves. Correct for oversize material in accordance with Section 5, if Method D is specified. Prepare a series of at least four specimens having moisture contents that vary by approximately 1½ %. The moisture contents selected shall bracket the optimum moisture content, thus providing specimens which, when compacted, will increase in mass to the maximum density and then decrease in density (see 7.2 and 7.3). To obtain the appropriate moisture content of each specimen, the addition of a predetermined amount of water (see 4.1.3) or the removal of a predetermined amount of moisture by drying may be necessary. Drying may be in air or by the use of a drying apparatus such that the temperature of the specimen does not exceed 140°F (60°C). The prepared specimens shall then be thoroughly mixed and stand, as specified in 4.1.3 and Table 2, prior to compaction.

NOTE 3—With practice, it is usually possible to visually judge the point of optimum moisture closely enough so that the prepared specimens will bracket the point of optimum moisture content.

4.2 *Specimen Compaction*—Select the proper compaction mold, in accordance with the method being used, and attach the mold extension collar. Compact each specimen in five layers of approximately equal height. Each layer shall receive 25 blows in the case of the 4-in. (101.6-mm) mold; each layer shall receive 56 blows in the case of the 6-in. (152.4-mm) mold. The total amount of material used shall be such that the fifth compacted layer is slightly above the top of the mold, but not exceeding ¼ in. (6 mm). During compaction the mold shall rest on a uniform rigid foundation, such as provided by a cylinder or cube of concrete weighing not less than 200 lb (91 kg).

4.2.1 In operating the manual rammer, care shall be taken to avoid rebound of the rammer from the top end of the guidesleeve. guide[illegible] be held steady [illegible]thin 5 deg of the vertical. The blows shall be applied at a uniform rate not exceeding approximately 1.4 s per blow and in such a manner as to provide complete and uniform coverage of the specimen surface.

4.2.2 *Mold Sizes*—The mold size used shall be as follows: Method A, 4-in. (101.6-mm); Methods B, C, and D 6-in. (152.4-mm).

4.2.3 Following compaction, remove the extension collar; carefully trim the compacted specimen even with the top of the mold by means of the straightedge and determine the mass of the specimen. Divide the mass of the compacted specimen and mold, minus the mass of the mold, by the volume of the mold (see 3.1.3). Record the result as the wet density, γ_m, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen.

4.2.4 Remove the material from the mold. Determine moisture content in accordance with Method D 2216, using either the whole compacted specimen or alternatively a representative specimen of the whole specimen. The whole specimen must be used when the permeability of the compacted specimen is high enough so that the moisture content is not distributed uniformly throughout. If the whole specimen is used, break it up to facilitate drying. Obtain the representative specimen by slicing the compacted specimen axially through the center and removing 100 to 500 g of material from one of the cut faces.

4.2.5 Repeat 4.2 through 4.2.4 for each specimen prepared.

5. Oversize Corrections

5.1 If 30 % or more of the sample is retained on a ¾-in. (19.0-mm) sieve, then none of the methods described under these methods shall be used for the determination of either maximum density or optimum moisture content.

5.2 *Methods A and B*—The material retained on the No. 4 (4.75-mm) sieve is discarded and no oversize correction is made. However, it is recommended that if the amount of material retained is 7 % or greater, Method C be used instead.

5.3 *Method C*—The material retained on the ¾-in. (19.0-mm) sieve is discarded and no oversize correction is made. However, if [illegible] material [illegible] 0 % or greater, it is recommende[illegible] Method D be used instead.

5.4 *Method D:*

5.4.1 This method shall not be used unless the amount of material retained on the ¾-in (19.0-mm) sieve is 10 % or greater. When the amount of material retained on the ¾-in. sieve is less than 10 %, use Method C.

5.4.2 Pass the material retained on the ¾-in. (19.0-mm) sieve through a 3-in. or 75-mm sieve. Discard the material retained on the 3-in. sieve. The material passing the 3-in sieve and retained on the ¾-in. sieve shall be replaced with an equal amount of material passing a ¾-in. sieve and retained on a No. 4 (4.75-mm) sieve. The material for replacement shall be taken from an unused portion of the sample.

6. Calculations

6.1 Calculate the moisture content and the dry density of each compacted specimen as follows:

$$w = [(A - B)/(B - C)] \times 100$$

and

$$\gamma_d = [\gamma_m/(w + 100)] \times 100$$

where:

w = moisture content in percent of the compacted specimens,
A = mass of contained and moist specimen,
B = mass of container and oven-dried specimen,
C = mass of container,
γ_d = dry density, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen, and
γ_m = wet density, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen.

7. Moisture-Density Relationship

7.1 From the data obtained in 6.1, plot the dry density values as ordinates with corresponding moisture contents as abscissas. Draw a smooth curve connecting the plotted points. Also draw a curve termed the "curve of complete saturation" or "zero air voids curve" on this plot. This curve represents the relationship between dry density and corresponding moisture contents when the voids are completely filled with water. Values of dry density and corresponding [illegible]ure contents for plotting the curve of co[illegible]e saturation can be computed using the following equation:

$$w_{sat} = [(62.4/\gamma_d) - (1/G_s)] \times 100$$

where:

w_{sat} = moisture content in percent for complete saturation,
γ_d = dry density in pounds per cubic foot (or kilograms per cubic metre),
G_s = specific gravity of the material being tested (see Note 4), and
62.4 = density of water in pounds per cubic foot (or kilograms per cubic metre).

NOTE 4—The specific gravity of the material can either be assumed or based on the weighted average values of: (*a*) the specific gravity of the material passing the No. 4 (4.75-mm) sieve in accordance with Test Method D 854; and (*b*) the apparent specific gravity of the material retained on the No. 4 (4.75-mm) sieve in accordance with Test Method C 127.

7.2 *Optimum Moisture Content*, w_o—The moisture content corresponding to the peak of the curve drawn as directed in 7.1 shall be termed the "optimum moisture content."

7.3 *Maximum Density*, γ_{max}—The dry density in pounds per cubic foot (or kilograms per cubic metre) of the sample at "optimum moisture content" shall be termed "maximum density."

8. Report

8.1 The report shall include the following:

8.1.1 Method used (Method A, B, C, or D).

8.1.2 Optimum moisture content.

8.1.3 Maximum density.

8.1.4 Description of rammer (whether manual or mechanical).

8.1.5 Description of appearance of material used in test, based on Practice D 2488 (Test Method D 2487 may be used as an alternative).

8.1.6 Origin of material used in test.

8.1.7 Preparation procedure used (moist or dry).

9. Precision

9.1 Criteria for judging the acceptability of the maximum density and optimum moisture content test results are given in Table 3. The standard deviation s is calculated from the equation:

$$s^2 = \frac{1}{n-1}\sum_{1}^{n}(x - \bar{x})^2$$

where:

n = number of determinations;
x = individual value of each determination; and
$\bar{x}$ = numerical average of the determinations.

9.2 Criteria for assigning standard deviation values for single-operator precision are not available at the present time.

TABLE 1 Volume of Water per Gram based on Temperature[A]

Temperature, °C (°F)	Volume of Water, ml/g
12 (53.6)	1.00048
14 (57.2)	1.00073
16 (60.8)	1.00103
18 (64.4)	1.00138
20 (68.0)	1.00177
22 (71.6)	1.00221
24 (75.2)	1.00268
26 (78.8)	1.00320
28 (82.4)	1.00375
30 (86.0)	1.00435
32 (89.6)	1.00497

[A] Values other than shown may be obtained by referring to the *Handbook of Chemistry and Physics*, Chemical Rubber Publishing Co., Cleveland, OH

TABLE 2 Dry Preparation Method—Standing Times

Classification D 2487	Minimum Standing Time, h
GW, GP, SW, SP	no requirement
GM, SM	3
ML, CL, OL, GC, SC	18
MH, CH, OH, PT	36

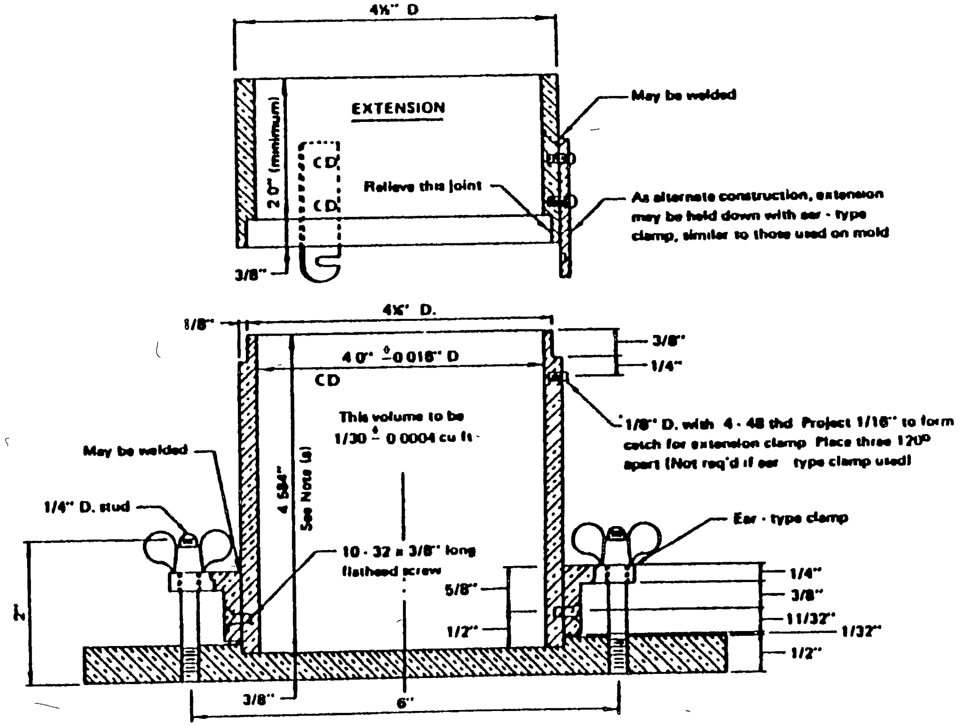
TABLE 3 Precision

	Standard Deviation, s	Acceptable Range of Two Results, Expressed as Percent of Mean Value[A]
Single-operator precision:		
Maximum density	...	1.9
Optimum moisture content	...	9.5
Multilaboratory precision:		
Maximum density	±1.66	4.0
Optimum moisture content	±0.86	15.0

[A] This column indicates a limiting range of values which should not be exceeded by the difference between any two results, expressed as a percentage of the average value. In cooperative test programs it has been determined that 95 % of the tests do not exceed the limiting acceptable ranges shown below. All values shown in this table are based on average test results from a variety of different soils and are subject to future revision

TABLE 4 Metric Equivalents for Figs. 1 and 2

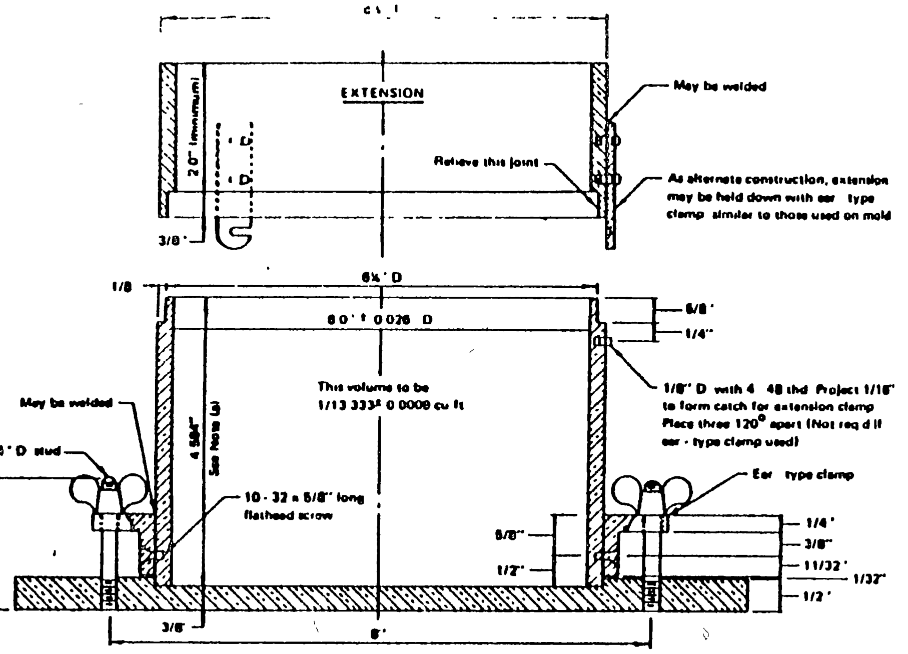
in.	mm
0.016	0.41
0.026	0.66
1/32	0.8
1/16	1.6
1/8	3.2
1/4	6.4
11/32	8.7
3/8	9.5
1/2	12.7
5/8	15.9
2	50.8
2 1/2	63.5
4	101.6
4 1/4	108.0
4 1/2	114.3
4.584	116.43
6	152.4
6 1/2	165.1
8	203.2
ft³	**cm³**
1/30	944
0.004	11
1/13.333	2124
0.0009	25



NOTE 1—The tolerance on the height is governed by the allowable volume and diameter tolerances

NOTE 2—The methods shown for attaching the extension collar to the mold and the mold to the base plate are recommended However, other methods are acceptable, providing the attachments are equally as rigid as those shown

FIG. 1 Cylindrical Mold, 4.0-in. for Soil Tests (see Table 4 for metric equivalents).



NOTE 1 – The tolerance on the height is governed by the allowable volume and diameter tolerances

NOTE 2 – The methods shown for attaching the extension collar to the mold and the mold to the base plate are recommended However, other methods are acceptable, providing the attachments are equally as rigid as those shown

FIG. 2 Cylindrical Mold, 6.0-in. for Soil Tests (see Table 4 for metric equivalents).

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~~Standard Test Method for~~
~~MOISTURE CONTENT PENETRATION RESISTANCE RELATIONSHIPS OF FINE-GRAINED SOILS[1]~~

~~This standard is issued under the fixed designation D 1558, the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.~~

~~1. Scope~~

~~1.1 This test method is for establishing the moisture-penetration resistance relationships of fine-grained soils as determined by the soil penetrometer.~~

~~1.2 The values stated in inch-pound units are to be regarded as the standard.~~

~~1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*~~

~~2. Applicable Documents~~

~~2.1 *ASTM Standards:*~~

~~D698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop[2]~~

~~D2216 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures[2]~~

~~E 380 Metric Practice[3]~~

~~3. Significance and Use~~

~~3.1 This test method is used with Methods A and B of Test Methods D 698 to develop relationships between moisture content, density, and penetration resistance. These relationships are used with a previously prepared family of moisture-penetration curves as a rapid field test to determine the approximate amount of moisture in the soil.~~

~~NOTE 1—When a penetration-resistance measurement of material in place is compared at a given moisture content with penetration-density curves prepared at a specified compactive effort, an approximate check of compaction (density) may be obtained.~~

~~3.2 Penetration resistance determinations are not reliable for very dry molded soil specimens or very granular soils.~~

~~4. Apparatus~~

~~4.1 *Moisture-Density Apparatus*, conforming to the requirements prescribed in Test Methods D 698.~~

~~4.2 *Soil Penetrometer*—A soil penetrometer (Fig. 1) consisting of a special spring dynamometer with pressure-indicating scale on the stem of the handle. The pressure scale shall be graduated to 90 lb in 2-lb divisions with a line encircling the stem at each 10-lb interval, or graduated to 40 kg in 1-kg divisions with a line encircling the stem at each 5-kg interval. A sliding ring on the stem shall indicate the maximum pressure obtained in the test.~~

~~4.3 *Set of Penetrometer Needles*—Each penetrometer needle (Fig. 1) shall consist of a shank with a head of known end area. The set of interchangeable needles shall include the sizes given in Table 1. The needle shank shall have graduations inscribed at intervals of ½ in. (10~~

~~[1] This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18 08 on Special and Construction Control Tests.~~

~~Current edition approved May 25, 1984 Published July 1984 Originally published as D 1558 – 58 Last previous edition D 1558 – 71 (1977)~~

~~[2] *Annual Book of ASTM Standards*, Vol 04 08~~

~~[3] *Annual Book of ASTM Standards*, Vol 14 02 Excerpts in all volumes~~

SURFACE IMPOUNDMENT CLOSURE PLAN

FOR

AVCO LYCOMING TEXTRON

STRATFORD ARMY ENGINEERING PLANT

STRATFORD, CONNECTICUT 06497

SEPTEMBER 1987

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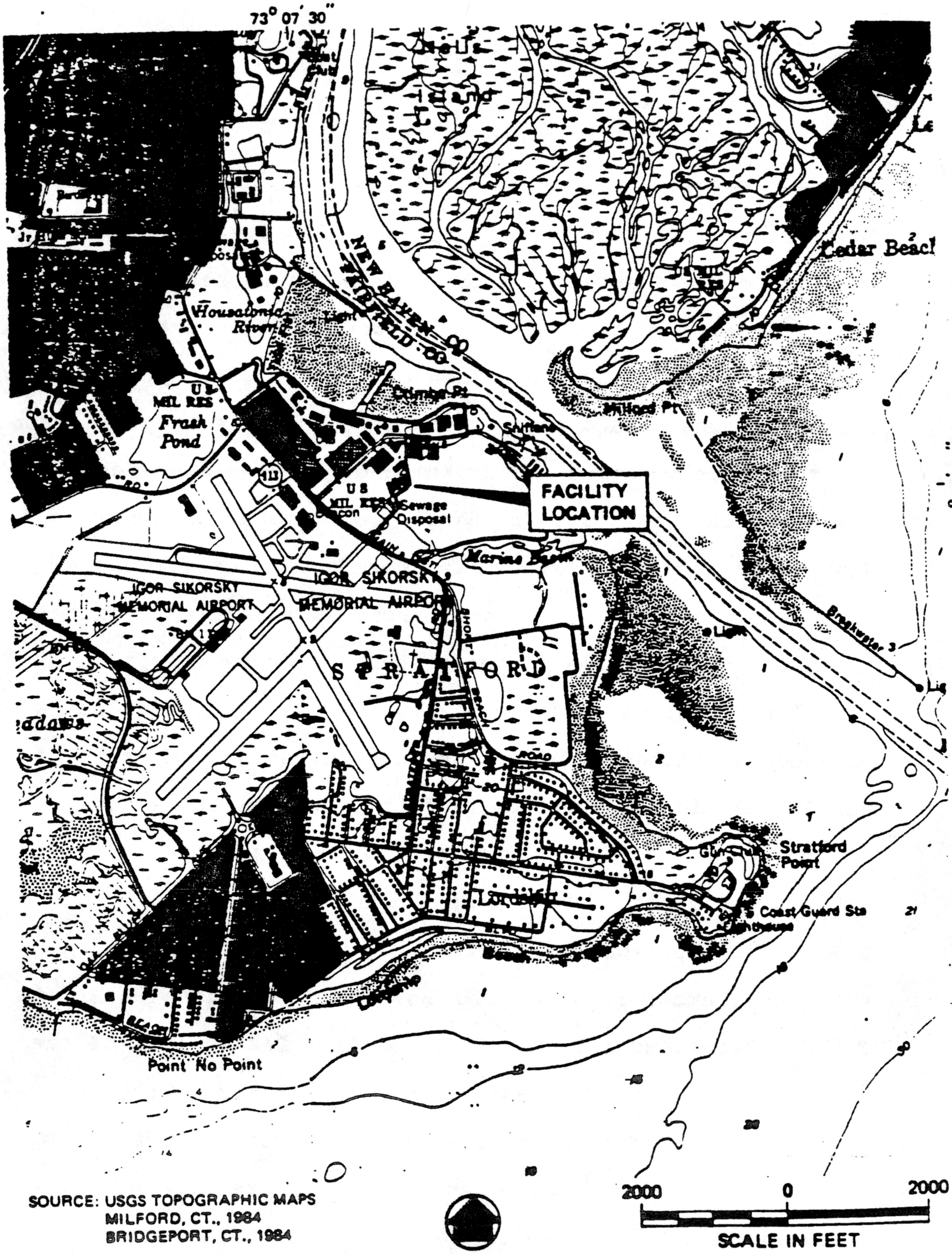
1.0. INTRODUCTION

The Avco facility, which is owned by the U.S. Army and operated by Avco Lycoming TEXTRON, is located in Stratford, Connecticut just west (approximately 1,000 feet) of where the Housatonic River enters the Long Island Sound see Figure 1.1. The activities at the facility include the manufacturing of gas turbine engines. The production of these engines includes the plating of engine and other miscellaneous parts in zinc, cadmium, chrome, copper, magnesium, nickel and black oxide baths. The spent plating baths are discharged to an equalization lagoon. Wastewater from this lagoon is pumped to a chemical waste treatment plant which, in turn, produces a metal hydroxide sludge which is pumped to one of three sludge storage lagoons.

The operation of these hazardous waste surface impoundments has been regulated under the Resource Conservation and Recovery Act (RCRA) since the effective date of these regulations on November 19, 1980. In compliance with the first requirement of RCRA, Avco submitted Part A of the RCRA permit application to the U.S. EPA on November 13, 1980.

On November 8, 1984, RCRA was amended by the "Hazardous and Solid Waste Amendments of 1984" (HSWA). Section 213 of the HSWA required that all land disposal facilities either cease operation or submit a complete Part B permit application by November 8, 1985. In compliance with this requirement, Avco submitted its Part B permit application to USEPA, Region I and the Connecticut Department of Environmental Protection (DEP) on



SOURCE: USGS TOPOGRAPHIC MAPS
MILFORD, CT., 1984
BRIDGEPORT, CT., 1984

FIGURE 1.1 LOCATION MAP - AVCO LYCOMING FACILITY

November 8, 1985. Until this permit application is reviewed and the final RCRA permit issued, Avco is considered to be operating under "interim status".

The chemical waste treatment plant at Avco has been modified to include an equalization tank to replace the equalization lagoon, and filtration with off-site disposal to replace the three sludge lagoons. Without the need for the four surface impoundments, Avco plans to close the impoundments. The planned start-up of the modified treatment plant is scheduled for July 1, 1987. As an interim status RCRA facility, Avco is re-submitting this partial closure plan under 40 CFR Part 265 subpart G and Connecticut Hazardous Waste Management Regulations 220-449 (c)-29. Partial closure refers to the four surface impoundments at Avco, which will be closed in a manner set forth in the interim status facility performance standards, 40 CFR 265.111. These performance standards require that Avco close its surface impoundments in a manner that:

1) Minimizes the need for further maintenance

2) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere, and

3) Complies with the closure requirements of Subpart G including, but not limited to, the requirements of 265.197, 265.228, 265.258, 265.280, 265,310, 265.351, 265.381 and 265.404.

In accordance with the above regulations and closure performance standards, the following is an outline of Avco's proposed closure steps:

1) Following the satisfactory start-up of the chemical waste treatment plant, Avco will remove the standing liquid from the surface impoundments. Currently only the equalization lagoon has standing liquid, which will be removed using existing pumps and piping and sent to the treatment plant in Building 18. Treatment of the standing liquid will consist of cyanide removal as well as the removal of chrome and other heavy metals. Discharge of the treated standing liquids will be to the tidal discharge ditch as required by Avco's National Pollution Discharge Effluent Standards (NPDES) permit. Should any standing liquids exist in either of the three sludge lagoons, the liquid will be removed as part of the sludge and handled according to Step 2 procedures.

2) Sludge will be removed from the four surface impoundments (see removal options in Section 4B and 4C of this document) and placed in a temporary holding tank for dewatering. Sludge dewatering will be done in contractor supplied filter presses. The filtrate will be pumped from the filter press using contractor supplied equipment, to the existing chemical waste treatment plant for cyanide, hexavalent chromium and heavy metal removal. The dewatered sludge or filter cake will be transferred from the filter press to a temporary onsite storage container prior to shipment to a RCRA permitted hazardous waste disposal facility.

3) Following the removal of all sludge from the four surface impoundments, soil will be removed from the remaining lagoon bottoms and laterally around each lagoon. The limit of soil removal from the lagoon bottoms will be at the seasonal low water table elevation (approximately 2.0 feet above mean sea level). The lateral extent of soil excavation will be determined by following an excavate and test cycle. Lateral excavation will proceed to a pre-determined limit, soil samples will be obtained from the walls of the excavation and analyzed for volatile organics (EPA Methods 8010 and 8020), EP Toxicity Test for metals and

hexavalent chromium and for total leachable cyanide by a sodium hydroxide leach test. Section 4D of this document presents the details of the soil sampling, analytic detection limits and the soil clean-up standards. If the results of the soils analyses indicate that the concentration in soil of any analyzed compound is above that compound standard, further excavation will be necessary. This excavate and sampling procedure will proceed until the analytic results indicate that the concentrations in soil of all analyzed compounds are below clean-up standards.

During excavation, soils will be transferred to a temporary onsite storage container or pad prior to shipment to a RCRA permitted hazardous waste disposal facility.

4) Transfer piping between the equalization and sludge lagoons as well as some of the abandoned effluent piping will be removed and placed in the onsite soils storage container or on a polyethylene liner and shipped for disposal at a RCRA permitted hazardous waste disposal facility. A sludge pump station must also be dismantled, stored and sent to the disposal facility.

5) Once dewatered sludge, and subsequently soils begin to be accumulated in the respective onsite storage containers, regular offsite shipment of the hazardous waste will begin. The goal of any on-site storage will be to limit storage time to less than 90 days. The sludge cake, soils, piping, and pump station will be transported to a RCRA permitted hazardous waste facility.

6) When the sludge and soils removal equipment is no longer required, an equipment decontamination will begin. The removal equipment, associated piping and transfer equipment will be transferred to an onsite decontamination pad (see Section 4H of this document). Other equipment which will be decontaminated include the onsite storage containers or pads, material handling equipment and the decontamination pad.

7) The open excavations remaining after sludge and soil removal will be backfilled with native soil and a landfill cap will be constructed (see Section 4I of this document).

8) Avco will prepare a certificate of closure specifying the four surface impoundments which have been closed in accordance with this document, a survey plat identifying

the locations and dimensions of the landfill cells, and a notification to the property deed which states Avco's obligation to restrict disturbance of the hazardous waste disposal unit.

The details and engineering options for this process, the groundwater monitoring and post-closure care are described further in Section 4 of this document.

2.0 CLOSURE SCHEDULE

An industrial waste treatment system has been installed and is scheduled to begin operation on July 1, 1987. The plant will have an equalization tank to replace the equalization lagoon, and filter presses to dewater the sludge. It is proposed to begin closure of the equalization and sludge storage lagoons in September 1987, following the start-up of the treatment plant. The schedule of the pertinent closure activities is shown in Figure 2.1.

Avco will close the hazardous waste surface impoundments as landfills in compliance with 40 CFR 265.228 (c) and 265.310. As noted in Figure 2.1, once the four surface impoundments stop receiving hazardous waste, the following actions will be performed. All pumpable wastewater in the equalization lagoon will be transferred to the treatment system. After these liquids have been pumped to the treatment system, the sludge in the equalization lagoon and the sludge storage lagoons will be transported to a filter press for dewatering. Sludge that contains soil will have to pass through either a grit screen or a grit chamber to settle out dirt.

Once the dewatering process is completed, filtrate from the filter press will be sent back through the treatment system. The cake produced by the filter press will be temporarily stored in roll off boxes or a covered storage pad where it will subsequently be loaded for off-site shipment.

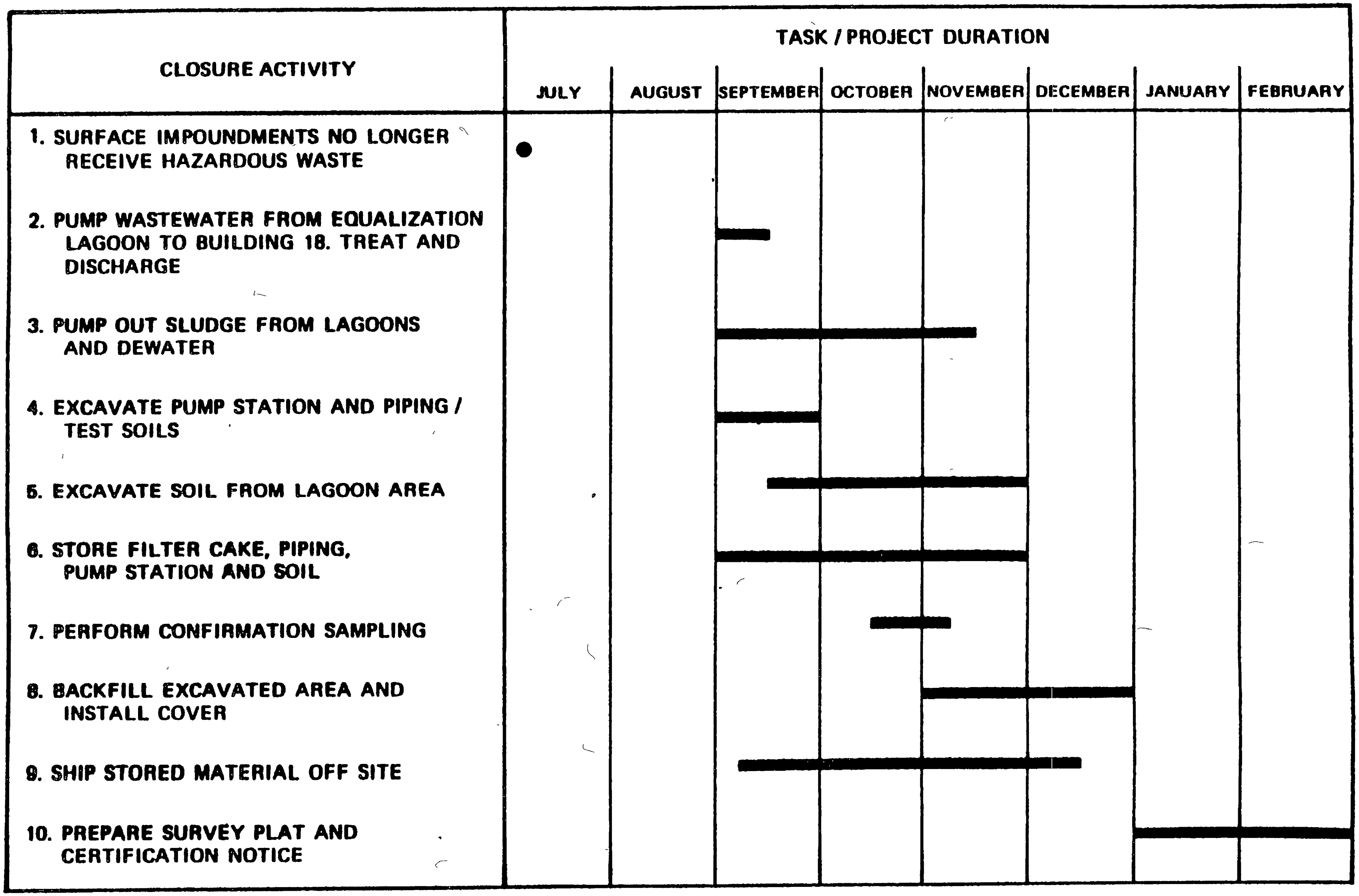


FIGURE 2-1. SCHEDULE OF CLOSURE ACTIVITIES

According to 40 CFR 265.113, closure must be completed within 180 days after approval of the closure plan. It is anticipated that closure of the Avco surface impoundments will take longer than 6 months, primarily because of the volume of material that must be managed and the fact that all of the excavated material will be dewatered prior to off-site shipment. It has been estimated that the volume of sludge is 6,570 cubic yards. If it is assumed that the sludge contains 20% solids and will be dewatered to 40-45% solids, the final volume of filter cake will be 3,250 cubic yards. Contractors who have dewatered metal hydroxide sludges have found that roughly 240 cubic yards of filter cake can be produced each week from each filter press. Based on a 10-week dewatering time, approximately 8 filter presses will be necessary, running 24-hour per day, six days per week.

Because of the volume of contaminated material and the number of activities necessary to assure proper closure, the closure process will take approximately 12 months. This time frame will allow Avco to close the surface impoundments in a regulatory and environmentally sound manner. Since it is anticipated that the closure will extend beyond 6 months, Avco is requesting a closure extension of 180 days.

After all of the contaminated material is removed, the excavated areas will be backfilled and a landfill cap will be constructed. A survey plat will be prepared to indicate the location and dimension of the landfill for future reference.

3.0. WASTE CHARACTERISTICS

The production of gas turbine engines at Avco includes plating operation in zinc, cadmium, chrome, copper, magnesium, nickel and black oxide baths. Other baths associated with plating include cleaning baths (such as acid and alkaline cleaners) and rinse water baths. The spent baths and rinse water are discharged to an equalization lagoon prior to being treated. In addition, wastewater from several other areas of the plant are sent to the equalization lagoon.

Avco Lycoming currently uses its surface impoundments in conjunction with a chemical waste treatment plant to treat its waste streams (see Figure 3.1 for location). Wastewater in the equalization lagoon is pumped to a chemical wastewater treatment system. This system first treats the cyanides by alkaline chlorination. Next, hexavalent chromium is reduced to the trivalent state with sulfuric acid and sodium metabisulfite. After the cyanide and chrome are treated, the free metals are precipitated as metal hydroxide with a lime treatment. The overflow from the treatment system settling tank is discharged to an outfall near the treatment plant in accordance with a NPDES permit under Section 402 of the Clean Water Act. The settled metal hydroxide sludge is pumped to one of three sludge storage lagoons.

The equalization lagoon is lined with a bentonite liner, while the three sludge lagoons are unlined. Wastes in the equalization and sludge lagoons are characterized in Table 3.1

TABLE 3.1. WASTE CHARACTERISTIC AND DAILY DISCHARGE VOLUMES

Impoundment	Waste Description	U.S. EPA Hazardos Waste	Daily Discharge to Impoundment
Equalization Lagoon	Spent cyanide plating bath solutions from electroplating operations	F007	1600 gal/day (F007 and F009)
	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used	F009	
	Waste streams that exhibit the EP Toxicity characteristics for cadmium and chromium	D006 & DO07	77,500 gal/day
Sludge Lagoons	Waste water treatment sludges from electroplating	F006	7,700 lbs/day (960 gal/day)

Table 3.2 presents estimates of the liquid, sludge, liner and soil volumes associated with the four Avco surface impoundments. Volume estimates are from M&E base maps and surveys completed in 1985 and 1986. To estimate the material depths, a low groundwater elevation of 1.85 feet MSL, June 27, 1986, was used. Soil volumes include an estimated 10 foot lateral contaminant migration around each lagoon. A conservative estimate of the percent solids of the existing lagoon sludge is 20 percent, or a total sludge solids volume of 1314 cubic yards.

The primary water constituents in the four surface impoundments include chromium, heavy metals and cyanide. Influent to the equalization lagoon is aqueous while sludge is contained in the sludge holding lagoons. Sampling of these lagoons was conducted as part of the preliminary design work for the new chemical waste treatment plant. Filtrate and filter cake samples were collected at each of the lagoons and results of analyses conducted on those samples are presented in Table 3.3.

TABLE 3.2. QUANTITY ESTIMATES OF CONTAMINATED MATERIAL

Surface Impoundment	Component	Area	Depth	Volume
Equalization (Lagoon 1)	Liquid	25,600	2	384,000 gals
	Sludge	25,600	3	2,800 yd^3
	Liner	25,600	1	950 yd^3
	Soil(1)	--	--	6,900 yd^3
Sludge Storage (Lagoon 2)	Liquid(2)	--	0	0 gals
	Sludge	9,140	3	1,020 yd^3
	Soil(1)	--	--	870 yd^3
Sludge Storage (Lagoon 3)	Liquid(2)	--	0	0 gals
	Sludge	7,920	3	880 yd^3
	Soil(1)	--	--	700 yd^3
Sludge Storage (Lagoon 4)	Liquid(2)	--	0	0 gals
	Sludge	12,600	4	1,870 yd^3
	Soil(1)	--	--	890 yd^3

---

1. Includes soils beneath and adjacent to the surface impoundment as well as perimeter berm soils.
2. Based on March, 1987 observations, no liquids exist in the sludge storage lagoons.

TABLE 3.3. SUMMARY OF SLUDGE SAMPLING RESULTS
SAMPLES OBTAINED 3/12/86

	Results			
	Filtrate Samples			
Test	East Lagoon	Middle Lagoon	West Lagoon	Equalization Lagoon
Amen. Cyanide	NDL.05	NDL.05	.05	.18 mg/l
Total Cyanide	NDL.05	.05	.08	.25 mg/l
Total Chrome	.20	.39	1.34	6.90 mg/l
Hex. Chrome	NDL.01	NDL.01	NDL.01	5.80 mg/l
	Filter Cake Samples			
Dried Solids	47.3	49.1	41.3	32.7%
Total Cyanide	188	128	190	252 ppm

4.0. SURFACE IMPOUNDMENTS

Introduction

This section presents general procedures for the closure of the four surface impoundments at Avco. In addition, the last sub-section describes specific closure procedures recently proposed by a closure contractor. It is anticipated that the specific closure procedures will be used during closure, and the general procedures will represent guidelines for any changes in the contractor's procedures.

A. Removal and Treatment of Standing Liquid

Of the four surface impoundments, the equalization lagoon is the only impoundment that contains a measurable amount of standing liquid. This lagoon will no longer receive liquid waste once operation of the new wastewater treatment system begins. This action, which is scheduled for July, 1, 1987, will initiate closure of the lagoon.

The first task with regard to closure activities is the removal and treatment of standing liquid from the equalization lagoon. This liquid shall be sent to Building 18 (the current cyanide treatment system) via existing pumps and piping for treatment. Treatment shall consist of cyanide removal, as well as the removal of chrome and other heavy metals. Discharge of the treated standing liquid will be to the tidal drainage ditch as required by Avco's NPDES permit. In the event that standing liquid is discovered on any of the other three impoundments, the liquid will be removed as part of the sludge and handled according to the following section.

Avco will obtain written permission from the Connecticut DEP Water Compliance Unit prior to changing the input quantities to the treatment plant. An estimated maximum increase in flow rate to the treatment plant is 135 gallons per minute, 24 hours per day, 6 days per week for 6 weeks.

B. Removal and Treatment of Sludge

Following the removal of the standing liquid, the next task with regard to closure activities is the removal and treatment of sludge. Settled solids, or sludge, have accumulated in the four surface impoundments: an aqueous sludge in the equalization lagoon, and a dryer, more dense sludge in the three storage lagoons. It is expected that the sludge removal and treatment will proceed as follows:

1. Pump (slurry) the sludge from the lagoons to a holding tank(s). Equipment that may be necessary to remove sediments includes an air jet or water jet to slurry the sludge. One of the more common techniques is to use a

high-speed rotary cutter mounted at the suction of a pump with the entire assembly hung from a floating platform. It is recommended that the sludge be slurried to 6 percent solids in order to avoid clogging of the pump and filter press.

2. Dewater the sludge using filter presses. The method of dewatering metal hydroxide sludges that has been most reliable in achieving high solid content in sludges is the "plate and frame" filter press. These filter presses have generated filter cakes at between 35 and 55 percent solids. Belt filter presses are also a viable option, but do not produce high solids yield.

It is the Contractor's responsibility to ensure that any soil inadvertently removed with the sludge does not damage the dewatering equipment (soil and rocks can tear the fabric on filter presses). One option is to install a screen before the holding tank(s). Another option is to use a system that will remove only material of a certain density (i.e. the sludge); and stop when the more dense material (soil) is reached.

Sludge samples from the equalization lagoon indicate a solids content of 10 percent; sludge in the three storage lagoons is estimated to have a solids content of 20 percent. The dewatering process should be able to increase the solids content to 40 or 50 percent, which will substantially reduce the amount of sludge to be transported to the RCRA permitted hazardous waste/disposal facility. For example, if there are 10,000 cu. yd. of sludge, the volume could be reduced to 2000 cu. yd. (assuming the initial material contains 10 percent solids and it is dewatered to 50 percent solids).

The desired total time for closure is 90 days, with time for sludge dewatering estimated to be 10 weeks. Therefore, the quantity and capacities of the filter press selected is dependent upon the Contractor meeting the schedule. The filter press selected must have a means of collecting filtrate and a piping system capable of transporting the filtrate to the new wastewater treatment plants equalization tank. Each filter press must also have some sort of hopper and/or conveyor arrangement to collect and transport the sludge cake to the onsite temporary storage area. The dewatering equipment and transport system must be protected from the weather at all times.

Contractor personnel will comply with 29 CFR 1910.120, OSHA Interim Final Standard to protect workers in Hazardous Waste Operations which is contained in Appendix D. Figure 4.1 shows a probable schematic of the sludge removal and dewatering equipment and processes.

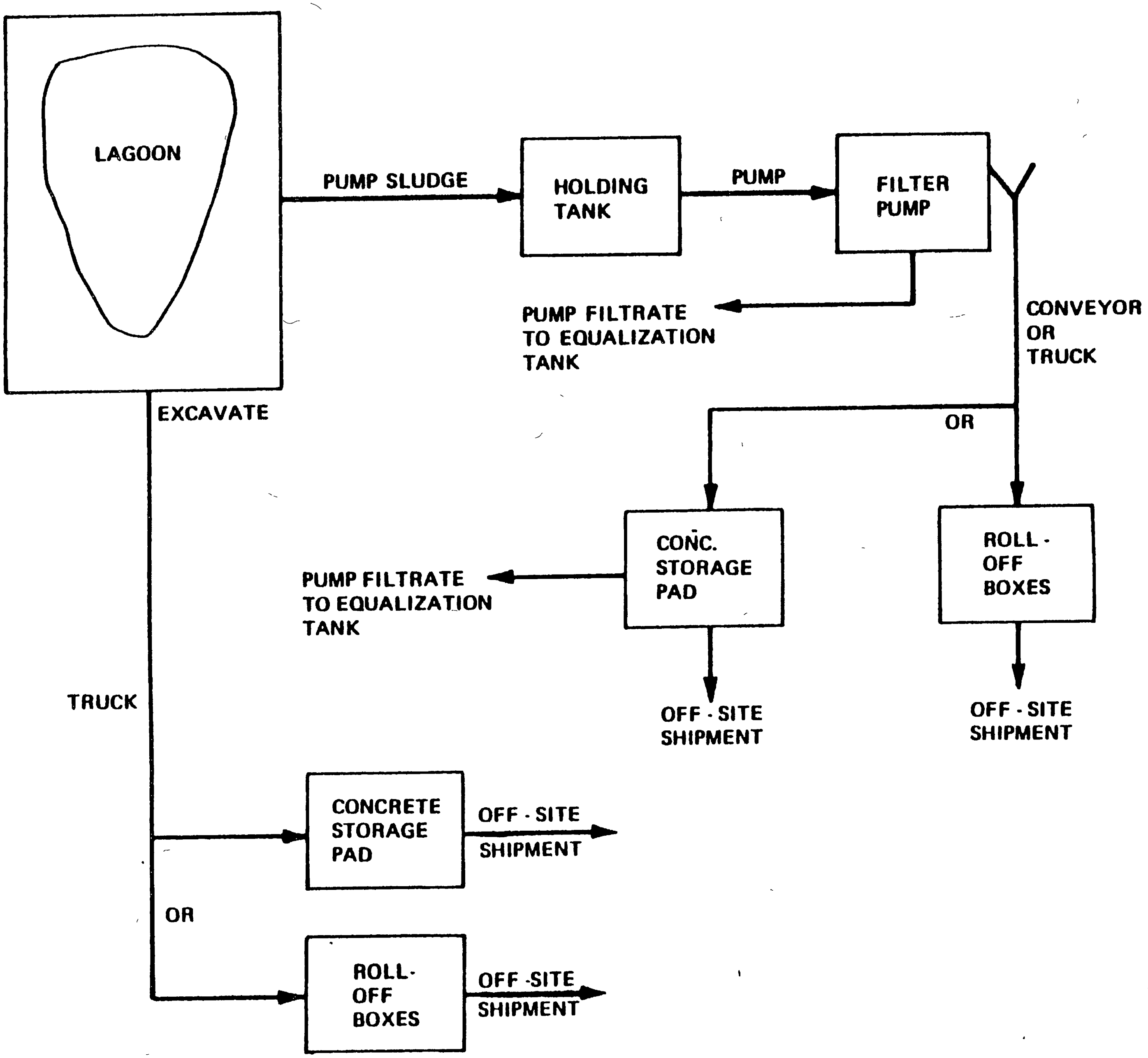


FIGURE 4 - 1. SCHEMATIC OF SLUDGE AND SOIL REMOVAL

C. Removal of Contaminated Soil and Liner

As discussed earlier, three of the four surface impoundments are unlined. The fourth, the equalization lagoon, has a bentonite liner. Due to the nature of the waste, it is assumed that there is substantial downward and lateral migration of contaminants through the soil. Therefore, soil below and adjacent to the existing lagoons will be removed also. The limits of soil excavated below the lagoons will be at the seasonal low water table elevation (approximately 2.0 feet above mean sea level). The lateral extent of soil excavation will be determined following an excavate and test cycle.

There are approximately 9400 cu. yd. of soil and 950 cu. yd. of bentonite to be excavated. In addition, an undetermined amount of areal soil will be excavated following confirmation sampling. The excavation procedure may consist of a bulldozer to push the dirt into piles, at which point a backhoe will transfer the soil to a dump truck. Another acceptable removal method is to use a truck loader with a bucket to load on a dump truck. Dump trucks will have 6 mil thick polyethylene liners to retain liquid.

The bentonite liner will be removed in the same fashion as the soil. The soil and liner shall not be dewatered, as the weight reduction and thus cost savings from drying would be minor. The Contractor must follow 29 CFR 1910.120 for the health and safety of all personnel.

D. Sampling and Analyses of Soils

The objective of the soil sampling at Avco is to confirm that all contaminated soils have been removed from the surface impoundments. During the excavation process, the walls of the excavations will be screened with a portable organic vapor analyzer to help direct the excavation process toward the more highly contaminated soils. Confirmation soil samples will be obtained from the walls of the excavation when the predetermined limits of the excavation have been reached.

Because the water table represents the vertical limit of excavation, all confirmation samples will be taken from the walls of the excavation. It is assumed that because of downward and lateral contaminant migration in the unsaturated zone, more contamination will be present in lower portions of the excavation. As a result, confirmation soil sampling will take place along an imaginary horizontal line located at one-third of the total excavation depth as measured from the bottom of the excavation. In each excavation, samples will be obtained at ~~50-~~ foot intervals along that horizontal line. It has been assumed that the distribution of wastes within all the surface impoundments is fairly uniform over the long period of disposal,

See

but to address the possibility of some waste segregation the 50-foot sampling interval was selected. This interval will produce a minimum of 14 confirmation samples from the 3 sludge lagoons and a minimum of 12 confirmation samples from the equalization lagoon. Considering a hazardous waste occupying only approximately 10 percent of the total area, the proposed sampling density could have a ~~80~~ percent probability of detecting a randomly located hazardous waste (Benson et. al., 1982). Although differing rates of contaminant migration will affect the depth of penetration, the uniform distribution of waste in these surface impoundments is considered the controlling factor. Additional soil sampling will take place at "hot spot" locations identified by either visual inspection or OVA screening. The soil sampling and decontamination procedures are outlined in Appendix B of this document.

Analyses of the soil samples will be conducted by a USEPA and Connecticut DEP approved laboratory. All soil samples will be analyzed according to the methods presented in Table 4.D.1. Detection limits for all analyses of soil samples will be less than the Connecticut removal standard. For metals, cyanide and chromium, the removal standard will be ten times the Drinking Water Standards, and for volatile organics ~~ten~~ times the Connecticut Action Levels, see Appendix C. As an example, the

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Benson, R.C., G.loccum, R.A. and Noel, M.R., 1982, Geophysical Techniques for Sensing Buried Waste and Waste Migration, U.S. EPA Contract No. 68-03-3050, p. 25.

TABLE 4.1. ANALYTIC METHODS FOR CONFIRMATION SOIL SAMPLING

Analysis	Method
Aromatic Volatile Organics	Method 5030/8020(1)
Halogenated Volatile Organics	Method 5030/8010(1)
Total Leachate Cyanide	Insoluble organic extraction(2) Cyanide distillation Method 9019(1)
EP Toxicity Test (including hexavalent chromium)	Extraction Method 1310(1)

1. Test Methods for Evaluating Solid Waste, USEPA, DSW, SW-846, July 1982.
2. Standard Methods for the Evaluation of Water and Wastewater, 16th Edition, p. 329, Cyanide in Solid Waste, b. Insoluble Cyanide.

Action Level for benzene is one microgram per liter, which means that all soils demonstrating benzene concentrations greater than 10 micrograms per kilogram must be removed. The detection limit for benzene must then be 5 micrograms per kilogram or less.

E. Removal of Pump Station and Piping

In addition to the sludge, soil, and liner, there is one pump station and several hundred feet of piping that must be removed and sent to a RCRA approved hazardous waste disposal facility (see Figure 4.2 for locations). The piping must be removed in a way which retards the leaching of contaminated material into the soil. The recommended method of removal is as follows: 1) flush pipes at least once with water; 2) verify that there are no combustible gases in the pipe, and if gases are detected, the pipeline should be force-aerated or made inert with carbon dioxide or dry ice; 3) cut the pipe into sections similar to the length of transfer trucks, and 4) store on a 6 mil thick polyethylene ground cover. At night, the pipes should be covered with a polyethylene cover. Most of the piping lies under dirt and thus the surface will not require any special rehabilitation. The 10 inch effluent force main, however, lies under a parking lot which will require patching of the pavement after removal.

The pump station is approximately 70 square feet, 15 feet deep, and constructed of concrete block. The pump station, pump and other appurtenances will be removed and stored on a polyethylene ground cover (covered at night). To address the possibility for contamination in the pipe trench, confirmation soil samples will be taken from the bottom of the trench at 50-foot intervals along the entire length of the trench. The soil sampling and decontamination procedures are outlined in Appendix B of this document.

Analyses of the soil samples and removal standards will be the same as for the surface impoundments, outlined under subpart D of this chapter.

F. Temporary Storage of Sludge, Soil, Piping, and Pump Station

The filtered sludge cake generated by the filter press will be placed in either portable roll off boxes or on a concrete storage pad prior to off-site shipment. This action will be taken for the following reasons. First, the off-site shipment of the filter cake will proceed smoothly if the trucks that come onto the site can be completely loaded when they first arrive. The trucks that will be used for off-site shipment should have an approximate capacity of 18 cubic yards. Since it is likely that a fleet of trucks will be used, there will need to be a stockpile of filter cake so that these trucks are not standing idle.

Based on the closure schedule (see Section 2 of this document), the dewatering procedure should be capable of handling approximately 440,000 gallons of slurried sludge a week. Contractors who have performed similar work have found that approximately 200 cu. yd. of filter cake can be produced each week (24 hours a day, 5 days a week) by one filter press. This would be equivalent to about seven truck loads of material each week. It will be necessary to operate eight filter presses to meet the time schedule. The rate of generation of this volume of filter cake should be similar to the ability of the trucks to transport this material off-site. Therefore, if transportation is initiated one week after dewatering is begun, there should always be roughly 400 cu. yd. of stored filter cake.

If roll-off boxes are selected for temporary storage of the filter cake, they should have a total capacity of 600 cu. yd. This will allow for ample storage space should logistical problems develop while removing and dewatering the contaminated material. Roll off boxes are available in a variety of sizes and capacities. Typical roll off box dimensions adequate for filter cake storage would be 90 inches in height, 22 feet in length, 90 inches in width, with a capacity of 45.6 cu. yd. Tops for the roll off boxes are also necessary. Therefore the contractor should make arrangements to have an adequate number of roll off boxes on site for the temporary storage.

If a concrete storage pad is used as a temporary storage location for the filter cake, it must have a surface area large enough to store the dewatered material. The pad will be equipped with drains and a blind sump pump to collect and pump leachate. As well, the pad will have slopes sidewalls and a one foot curb to inhibit the migration of leachate from the pad. All leachate collected will be pumped to the industrial wastewater treatment plant's equalization tank. The material stored on the concrete storage pad must be shielded from rainfall and excessive wind (greater than 50 mph) with an adequate cover.

All piping and pump station materials which require temporary storage will be placed upon a 6 mil thick ground cover composed of polyethylene. Any contaminated debris or leachate associated with the piping and pump station material will be collected and disposed of as described above.

After all contaminated materials have been shipped off-site, the roll off boxes, concrete pad and cover, and polyethylene ground cover will be decontaminated in accordance with sections 4H of this document.

G. Off-Site Disposal of Sludge, Soil, Piping and Pump Station

The off-site shipment of the contaminated material will be a routine exercise. The contractor involved in the removal and dewatering of the lagoon material will be responsible for loading the contaminated material into the trucks. As previously mentioned, the trucks should have an approximate capacity of 18 cu. yd. and must be covered during transport.

It is proposed to send the contaminated material to the Stablex Canada facility in Blainville, Quebec, Canada. The facility is located approximately 20 miles north of Montreal. Because this material is being shipped out of the United States, Avco will notify the EPA as required by 40 CFR 262.50 (b). This includes notifying the EPA Administrator in writing 30 days before the initial shipment of the waste and notifying Transport Canada and Environment Canada in writing 60 days prior to the initial shipment. Appendix E contains the proposal submitted by

Stablex Canada which describes the procedures involved in the off-site disposal process. In addition, Appendix E contains a form notification letter for the EPA, Transport Canada, and Environment Canada.

The waste will be identified by its EPA hazardous waste identification number and its DOT shipping description, which for the Avco waste would be:

EPA ID#:	F006
Dot ID#:	NA 9189
Proper Shipping Name:	Hazardous waste, solid, n.o.s.
Hazard Class:	ORM-E

Additional information that will be submitted includes the name and address of the foreign consignee. All of the above information will be submitted to the following:

Office of International Activities (A-106)
U.S. EPA
Washington, DC 20460

Avco will also request that Stablex Canada sign each manifest and return a copy of the signed manifest to Avco. The transporter of the material will also be asked to submit a copy of the manifest stating the date and place of entry into Canada.

Avco will comply with other manifest requirements under 262.20 (a) except that:

- The name, address, and EPA identification number of the foreign consignee will be used instead of the designate facility;

- The departure point from the U.S. into Canada will be identified.

Avco will submit an exception report to the Regional I Administrator and the EPA Administrator, and the previously mentioned address, if either of the following occurs:

1. A copy of the manifest signed by the transporter stating the date and place of departure from the U.S. has not been received by Avco within 45 days from the date it was accepted by the initial transporter; or

2. A copy of the manifest signed by Stablex Canada has not been received by Avco within 90 days from the date it was accepted by the initial transporter.

H. Decontamination of Equipment/Personnel

All equipment and Avco facilities used during the closure process will be decontaminated prior to the equipment being removed from the site and prior to Avco facilities being used for another purpose. Appendix D contains the Occupational Safety and Health Standards (OSHA) interim final standard to protect workers in hazardous waste operations, 29 CFR 1910.120. All personnel who work on the site must be familiar with the OSHA regulations and the site health and safety plan. In order to assure that personnel or off-site contamination does not occur, the following decontamination procedures are set forth.

An area around the perimeter of the lagoons will be declared the hot zone (see Figure 4-4). It will be large enough to allow the excavation equipment room to operate, and to accommodate all temporary storage of apparatus and contaminated material identified in section 4.F. A corner of the hot zone, located closest to the nearest fire hydrant (a clean water source) will be zoned as the area for entering and leaving the contaminated area. All decontamination will occur in this area.

< [illegible]

In order to limit the amount of contaminated water produced during decontamination wash down procedures, the following practices should be followed: 1) all packed-on dirt and grit will be removed from the excavation equipment using wire brushes, 2) the equipment will then be steam cleaned, 3) the equipment will then be washed down using an alkonox and water wash, 4) a final rinse of water will be applied. After wash down, all equipment will be air dried before leaving the hot zone.

All rinsate will be collected and pumped to the new industrial wastewater treatment system. Collection of the contaminated rinsate will be possible through use of a contoured concrete pad, equipped with drains and drainage channels, upon which all washing and rinsing will occur. Soil and dirt removed from all equipment will be collected from the concrete pad and shipped with other contaminated material to the RCRA approved waste storage facility.

Personnel decontamination will also take place in the area of the hot zone considered for decontamination. All personnel who enter the hot zone will be required to remove any personal protective equipment, deemed necessary for the project, in such a manner so as to protect clean areas from contamination. Wire and soft bristle brushes and water rinses will be available for cleaning of boots, clothing and accessory equipment brought or worn into the hot zone.

I. Design and Installation of Final Cover/Restoration of Excavated Areas.

The four surface impoundments at AVCO will be closed in a manner set forth in the interim status facility performance standards 40 CFR 265.111 (as discussed in Section 1.0), and closure and post-closure care, 40 CFR 265.310. The closure and post-closure care criteria state that at final closure of the landfill, the owner or operator must cover the landfill with a final cover designed and constructed to:

1. Provide long-term minimization of migration of liquids through the closed landfill;
2. Function with minimum maintenance;
3. Promote drainage and minimize erosion or abrasion of the cover;
4. Accommodate settling and subsidence so that the cover's integrity is maintained; and
5. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils presents.

In accordance with the above regulations and closure performance standards, Avco proposes the following final cover design and site restoration:

After all contaminated materials have been removed from the lagoon area, backfilling and capping of the surface impoundments will commence. Figure 4.2, a plan view of the site, depicts the estimated limits of the final cover and tne proposed final contours. The three sludge storage impoundments will be capped as one unit. Drainage patterns for the equalization lagoon area and the sludge storage impoundment area are also shown on Figure 4.2.

< insert 11A

Figure 4.3 shows a typical section of the final cover. It has been designed using the RCRA Guidance Document for Landfill Design in conjunction with RCRA regulations. The final cover's impermeable bottom layer, middle drainage layer and vegetated top cover are designed with the intent to adhere to the criteria presented above.

< [illegible] 11A, [illegible]

Figure 4.3 shows the limits of excavation and the subsequent area to be backfilled and capped. Uncontaminated soils which were not removed during excavation will be evenly graded over the lagoon areas forming the base strata for backfilling. In preparation for construction of the final cover the lagoon areas will be backfilled with a granular fill to the elevations

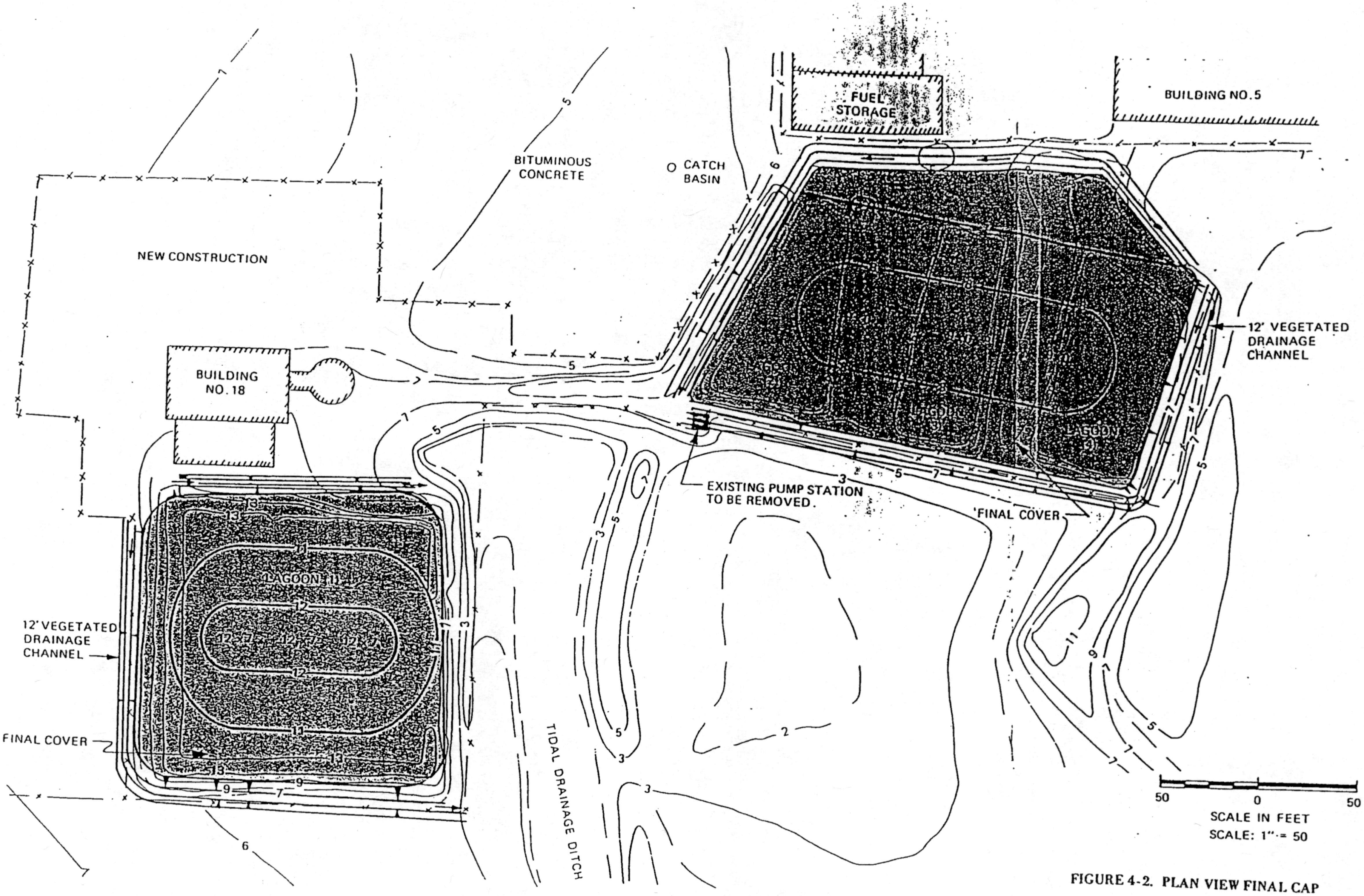
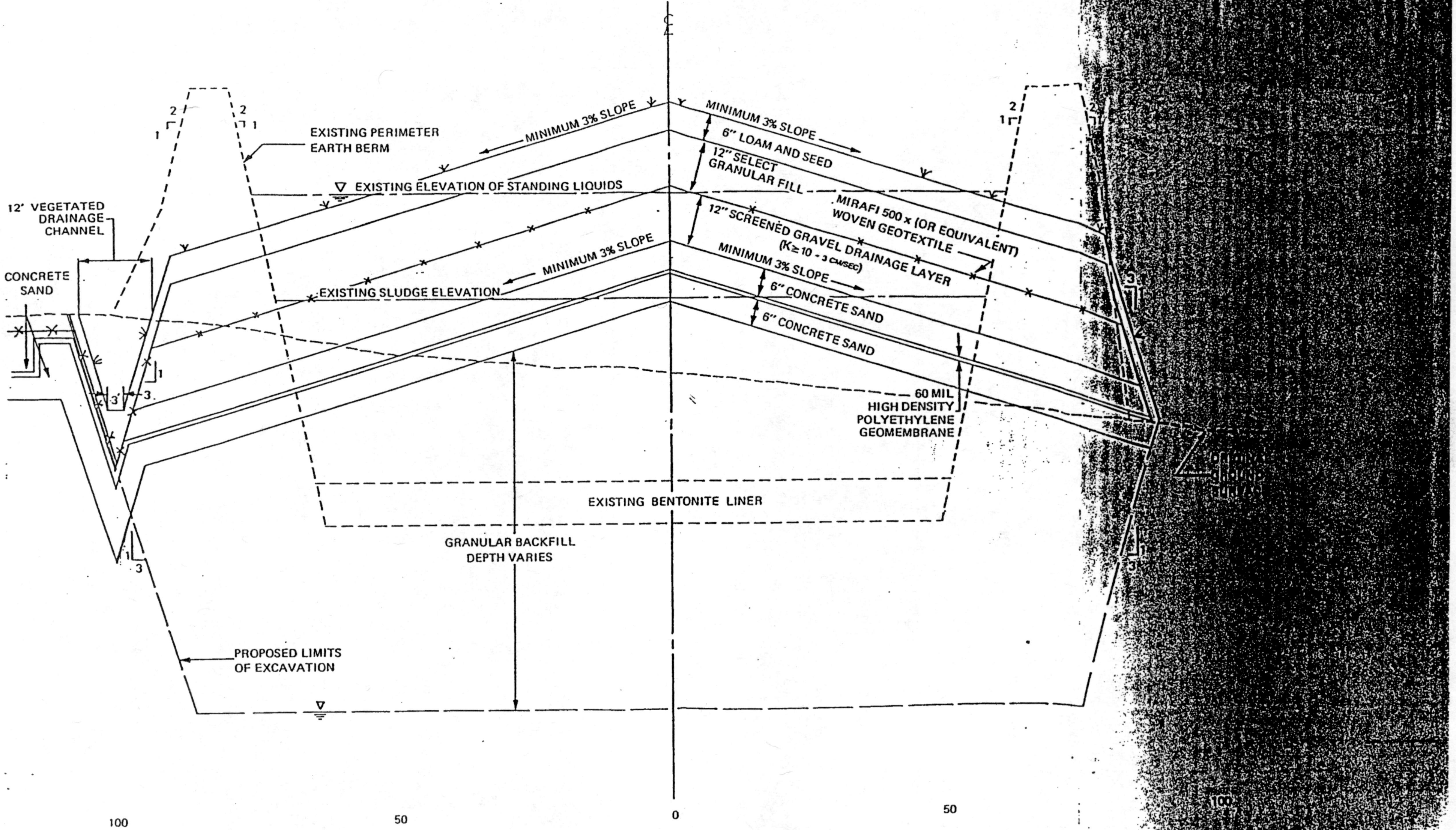


FIGURE 4-2. PLAN VIEW FINAL CAP

Note: Final cover elevations, direction of slope, and locations of drainage channels are conceptual only and may be changed in final design.



Note: This is a conceptual depiction illustrating the general design of the cover which could change during final design.

FIGURE 4-3. TYPICAL SECTION FINAL COVER

depicted in figure 4.3. Uncontaminated soils and backfill material must adhere to the gradation requirements set forth by ASTM C33. It will be placed in lifts no thicker than 12-inch and be compacted to 90 percent of maximum dry density in accordance with ASTM D1557.

A 60 mil thick High Density Polyethylene (HDP) Geomembrane will serve as an impermeable barrier prohibiting any migration of liquids through the closed landfill. As shown on figure 4.3 the HDP geomembrane will be laid on a bed of concrete sand, and covered with a 6 in. layer of the same concrete sand, graded as specified in ASTM C33. The concrete sand will serve as bedding for the HDP geomembrane and protect it from damage. Therefore, the concrete sand must be free of rock, fractured stone, debris, cobbles, rubbish, roots, and sudden changes in gradation.

The middle drainage layer will consist of a 12 in. thick layer of screened gravel with a permeability no less than 1×10^{-3} cm/sec. The material will meet the gradation requirements of ASTM C33, No. 67 coarse aggregate, and will be placed in one 12-inch thick loose lift and compacted to 90 percent of maximum dry density in accordance with ASTM D1557. The final bottom slope of the drainage layer will be at least 3 percent, after allowance for settling and subsidence. To prevent clogging of the drainage layer with fines, a synthetic geotextile such as Mirafi 500X, or equivalent, will be placed above the screened gravel. The geotextile will also serve to stabilize the soil in the event Avco chooses to use the capped surface impoundments as a parking area in the future. Finally, the drainage layer has been designed to minimize head on and flow to the impermeable layer. Some suggested design methods for computing landfill runoff and slope stability analyses are presented in Appendix G, along with example manufacturer's specifications for 60 mil HDP and Mirafi 500 woven geotextile.

The vegetated top cover (figure 4.3) shown consists of a 12 in. thick layer of select granular fill and 6 in. thick layer of loam and seed. The 12. in layer of granular fill will meet the following gradation:

U.S. Standard Sieve Size	Percent Passing by Weight
6"	100
No. 4	30-100
No. 20	10-80
No. 200	0-20

It will be laid in one loose lift such that final thickness after compaction is a minimum of 12 in. It will be compacted to 90 percent of maximum dry density according to ASTM D1557. The 6 in. layer of loam will be placed in one 6 in. loose lift over the top of the landfill, side slopes, and drainage channels. It will be seeded with a mixture of Creeping Red Fescue, Domestic Rye, and Kentucky Bluegrass in a ratio of 2:1:1, respectively.

The vegetation chosen will effectively minimize erosion without the need for continuing application of fertilizers, irrigation, or other non-applied materials to ensure viability and persistence. The seeding will produce a strain of vegetation that will effectively minimize erosion without developing a root system that will penetrate below the vegetative and drainage layers. A top slope of 3-5 percent, and a surface drainage system consisting of 12 ft. vegetated drainage channels (figure 4.2), with side slopes of 3 horizontal to 1 vertical, will conduct runoff across the cap and direct it towards the tidal drainage ditch.

J. Closure Certification

Within 60 days of completion of closure of each hazardous waste surface impoundment, and within 60 days of completion of final closure, Avco will submit to the Regional Administrator certification that the surface impoundments have been closed in accordance with the specifications in the approved Closure Plan. The certification will be signed by Avco and by an independently registered professional engineer. Closure documentation shall include:

1. Topographic surveys of final excavation,
2. As-build plans of final cap,
3. Resident engineer's daily activity logs, with estimates of the type and quantity of wastes removed,

4. Boring logs and as-built diagrams of any replacement monitoring wells,
5. Analytic results of all confirmation soils analyses along with sample locations, and
6. Technical specifications of cap materials and soils used.

K. Survey Plat

Avco will submit to the local zoning authority and to the Regional Administrator a survey plat indicating the location and dimensions of the landfill with respect to permanently surveyed benchmarks. This plat will be submitted no later than the submission of the certification of closure of each surface impoundment. The survey plat will be prepared and certified by a professional land surveyor, and will contain a note which states Avco's obligation to restrict disturbance of the landfill in accordance with 40 CFR 265.117.

L. Contractor Proposed Closure Procedure

Closure of the four surface impoundments at Avco will involve several different types of materials handling. A primary objective of all materials handling and equipment decontamination will be to prevent the migration of materials and/or rinse waters. To achieve this objective, the contractor will conduct all materials handling, and equipment decontamination in the immediate vicinity of either the sludge lagoons or the equalization lagoon.

One of the first on-site activities will be to control runoff within the working area. The area will be graded to direct runoff toward lagoons, paved to prevent infiltration in the work area and bermed to prevent runoff from both entering or leaving the work area (see Figure 4-4).

All liquids, primarily from the equalization lagoon, will be pumped directly to the on-site treatment plant in Building 18. Sludges from the surface impoundments will be slurried in the respective lagoon and pumped directly to the filter presses located between Sludge Lagoons 2 and 3. Soils in the equalization lagoon will be dragged to a waiting backhoe in the equalization lagoon for transfer to a dumptruck on the paved work area. The dumptruck will transfer soils from the equalization lagoon to sludge lagoon #1 for storage. Soils excavation and transfer to dumptrucks will be done using only a backhoe in the three sludge lagoons. All equipment will be decontaminated at the end of each work day and prior to leaving the work area in the decontamination area near Lagoon #1.

Upon completion of the materials handling, the pavement and berms will be excavated and transported off-site to Stablex, Canada. The final extent of the landfill cap will encompass almost the entire work area except for the transport road between the equalization lagoons and the sludge lagoons.

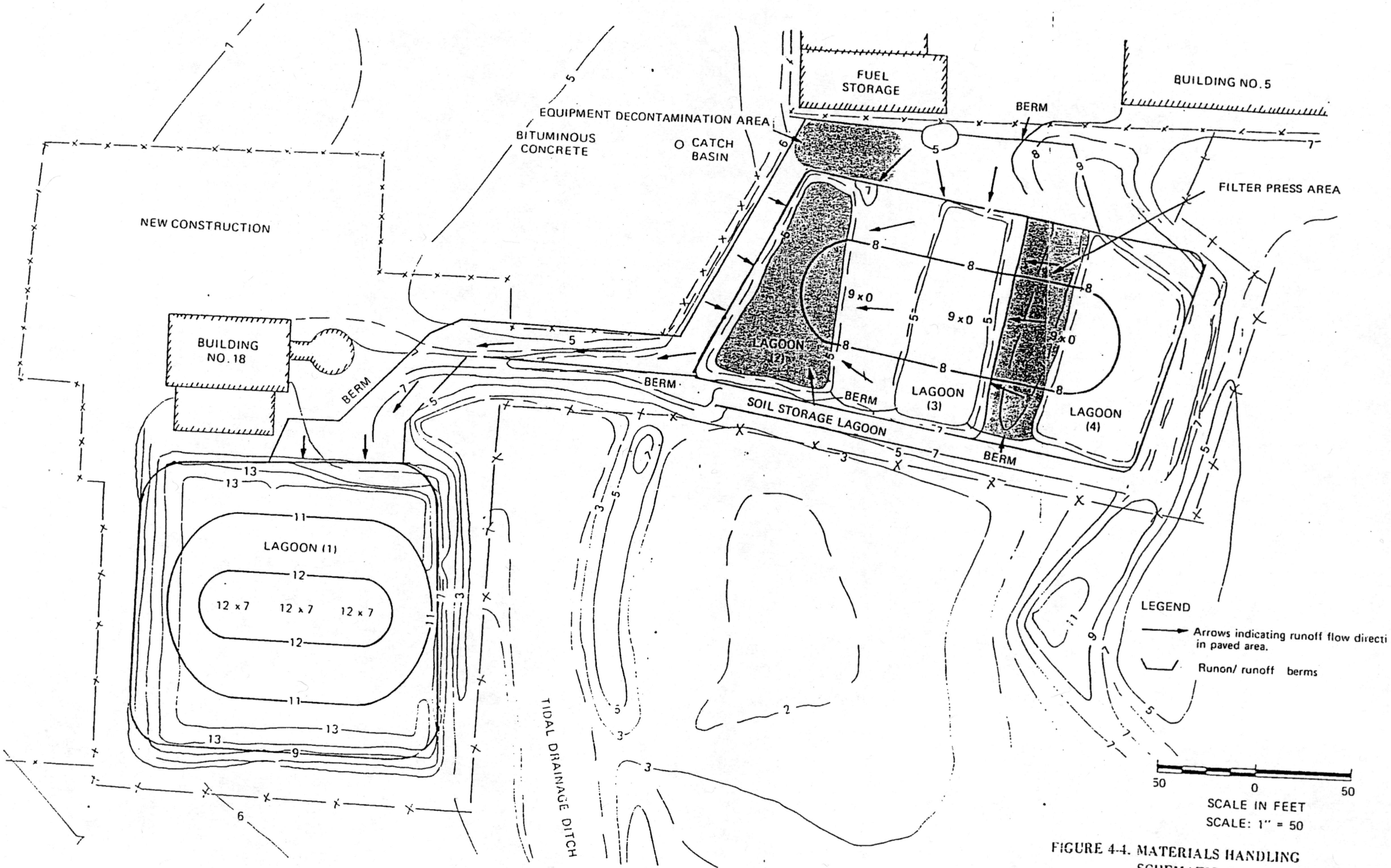


FIGURE 4-4. MATERIALS HANDLING SCHEMATIC

5.0 GROUNDWATER MONITORING DURING CLOSURE

Groundwater monitoring at the Avco Lycoming facility will continue during the surface impoundment closures. As stated in the Groundwater Monitoring Assessment Program (GMAP), March 1987 and Addendum, May 1987, the objective of the monitoring program is to provide a systematic, well-defined method for determining the rate of migration, extent, and composition of any contaminant releases from the surface impoundments.

Thirteen groundwater observation wells make up the groundwater monitoring network (See Figure 5.1). These wells are sampled quarterly and analyzed for the following dissolved chemicals or constituents:

pH
specific conductance
total cyanide
amenable cyanide
cadmium
chromium (total)
chromium (hexavalent)
copper
mercury
zinc
nickel

+ TOC
TOX
[illegible]

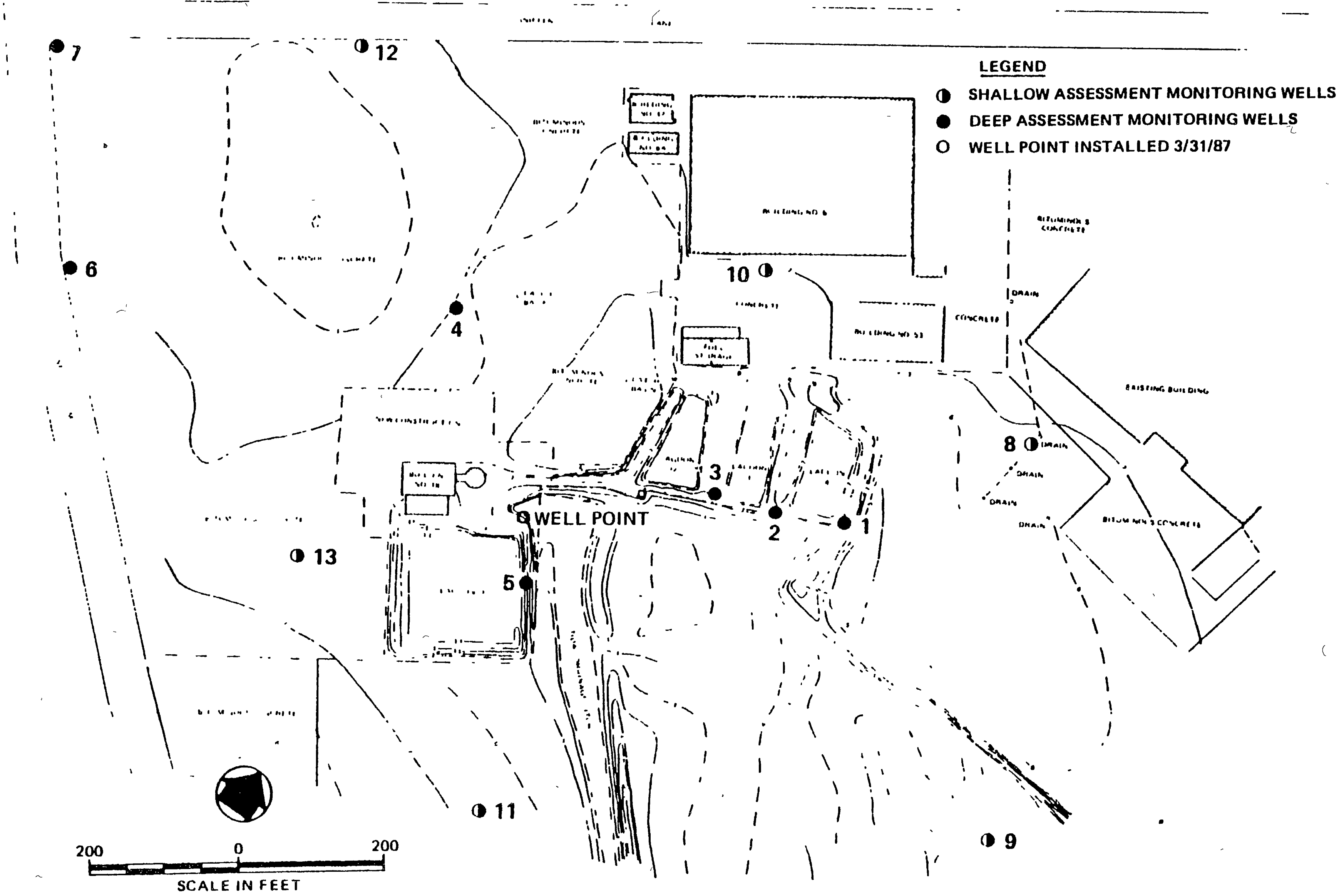
[illegible]

On a semi-annual basis, groundwater samples are also analyzed for total organic carbon, total organic halides, halogenated (EPA Method 8010) and aromatic (EPA Method 8020) volatile organics.

All groundwater sampling and analyses will be performed according to procedures and methods described in the Groundwater Monitoring Assessment Program, Section VII, Sampling and Analyses Procedures.

NOTES

1. BASE MAP FROM METCALF & EDDY SURVEYS 1985 & 1986
2. ALL ELEVATIONS REFERENCED TO MEAN SEA LEVEL.



[illegible]GU[illegible] 1. [illegible] S[illegible] AC[illegible] OU[illegible] EN[illegible] ND [illegible] ITO[illegible] WELLS

6.0 CLOSURE COST ESTIMATES

Closure costs have been prepared to provide an estimate of those costs associated with equipment, labor and materials. The costs are approximate and are based primarily on estimates of sludge and soil volumes to be removed. Actual excavated volumes may differ based on the extent of contaminant migration in the soil.

The grand total for closure is estimated to be $2,400,000. Appendix F presents a summary cost sheet and a breakdown of those costs by individual items.

7.0 POST CLOSURE CARE

Following the closure of the four (4) surface impoundments at Avco the post closure care period will begin and continue for 30 years from the date of closure certification. Post closure of the Avco surface impoundments will be carried out according to the requirements of 40 CFR Parts 265.117 thru 265.120 and Part 265.310. The planned post closure monitoring activities include: groundwater monitoring, cover inspection and maintenance, and will be managed by an onsite Avco Coordinator. As per 40 CFR 265, 119, no later than 60 days after certification of closure, Avco will submit to the local zoning authority and the Regional Administrator records of the type, location and quantities of the hazardous wastes removed from the four surface impoundments. Avco will also submit estimates of the type, location and quantities of hazardous wastes disposed of in the four surface impoundments over the life of the impoundments.

Within 60 days of closure certification, a notation on the facility deed will be prepared noting:

1) The land has been used to manage hazardous wastes,
2) The land use is restricted under 40 CFR Subpart G regulations,
3) The survey plat and record of the type, location and quantify of hazardous wastes disposed in each surface impoundment have been filed with the local zoning authority.

In addition, Avco will submit to the Regional Administrator a signed copy of the notation to the facility deed specified above.

A. Groundwater Monitoring

Groundwater monitoring following the closure of the Avco surface impoundments will comply with all applicable requirements of 40 CFR Part 265 Subpart F and follow the procedure outlined in the Groundwater Monitoring Assessment Program, March, 1987. This monitoring activity will include: the quarterly sampling and analyses of existing groundwater monitoring wells, monitoring well inspection and maintenance, recordkeeping of analytic results and groundwater elevations and the annual reporting of the groundwater data to the Regional Administrator.

The existing groundwater monitoring system at Avco is made up of 13 monitoring wells, see Figure 5.1. It is likely that during the soils excavation, monitoring wells 1, 2, 3, 5 and the well point may be damaged or destroyed. As part of the construction of the final cap, these wells will be replaced, and with screens at the same elevations. The objective will be to make no changes in well locations so that the time series of groundwater data remains comparable with past data.

Insert
III A

B. Cover Inspection and Maintenance

Closure of the surface impoundment at Avco as a landfill requires that the post closure care under 40 CFR Parts 265.117 thru 265.120 and Part 265.310 be followed. The objectives of c over inspection is to maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct any effects of settling, subsidence or erosion.

This will be accomplished through regular monthly inspections of the cover and associated drainage facilities. Inspection of the facilities will identify:

1) Erosion sills which may lead to infiltration of rainwater through the cap,
2) Gullying adjacent to the covered areas which could progressively erode the cap,
3 The quality of the vegetative cover which stabilized the cover soils,
4) Ponding the cap due to differential settlement,
5) The stability of runoff ditches and their ability to freely transport water away from the capped waste area.
6) The growth of trees which may cause a breach in the cap,
7) The stability of on-site benchmarks, and
8) The condition of all monitoring wells.

Inspection results and any deficiencies, along with proposed remedial measures, will be reported in the annual report to the Regional Administrator.

Maintenance activities may be required during the post-closure period to ensure that the landfill closure functions as intended. The range of maintenance measures which respond to specific inspection deficiencies are described below:

1) Maintenance of the landfill's final cover will include repair of dessication cracks and areas of localized erosion that may develop, especially prior to establishment of uniform, healthy vegetation. The

18 inches of soil in the vegetative soil layer and the 12 inches of drainage material will protect the soil layer with low permeability from any damage. In the unlikely event that the low permeability layer is damaged at some time during the post-closure period, it will be repaired by the addition and compaction of material and replacement of the drainage media and vegetative soil. The soil layer with low permeability will not be excavated during any maintenance and repair operations.

2) Maintenance of the landfill's vegetative cover during the post-closure period is important for minimizing erosion and infiltration of precipitation. Healthy vegetation will reduce the potential for cracking of the soil cover and will increase evapotranspiration. Avco will rework the surface soil in any areas where vegetation dies, treat the soil, and reseed as necessary to restore the vegetative cover. The vegetation will be checked and mowed as necessary to prevent development of large, deep-rooted plants that could damage the integrity of the final cover.

3) Significant settlement of the landfill's final cover is not expected because of the nature of the backfill. However, small areas of minor differential settlement

could develop during the post-closure period, leading to localized ponding on the surface of the landfill. These areas will be identified during the post-closure inspections and will be filled or regraded to ensure proper drainage. Avco will reseed any areas so repaired to re-establish uniform, healthy vegetation.

4) Maintenance of the surface drainage channels during the post-closure period will include re-establishment of vegetation as needed and repair of any areas of erosion damage. The channels will also be checked and mowed as necessary to prevent development of large plants that could damage the channels or reduce flow capacity. The drainage pipes and appurtenances will be routinely inspected for damage and repaired as necessary.

5) Post-closure maintenance activities for the monitoring wells will include measures to ensure that access to the wells is provided, and that the protective and security features of the wells are adequate.

C. Identification of Post Closure Coordinator

Coordination of all post closure monitoring and inspection activities will be the responsibility of John S. Fleming, Ph.D., Chief, Environmental Compliance. Dr. Fleming will insure that all monitoring, inspection and reporting is conducted according to the procedures set forth in this plan.

No later than 60 days after the completion of the post-closure care period, Avco will submit to the Regional Administrator a certification that the post-closure area period has been performed according to the specifications herein. The certification shall be signed by the post-closure coordinator and a registered professional engineer. Documentation supporting the engineers certification will include:

1. Analytic results of the quarterly groundwater monitoring with groundwater contour maps, and
2. Records of the monthly inspections of the landfill cover and drainage facilities.

D. Post-Closure Security

Following the capping of the four surface impoundments at AVCO, a fence will be constructed around the capped areas to prevent unauthorized entry onto the capped areas. All fence gates will be locked to prevent entry, and the keys will be in the possession of the post closure coordinator. Signs will be placed near the entrance to the capped areas and at fifty foot intervals along the fence, with the legend "Danger - Unauthorized Personnel Keep Out."

REFERENCES

1. Landfill Runoff:
   Schroeder, Paul R., August 1983. Hydrologic Evaluation of Landfill Performance, HELP Version 1. USAE Waterways Experiment Station, Vicksburg, MS 39180.

2. Slope Stability Analyses:
   GEOCOMP Corp., 1984. GEOSCOPE, Version 2.0. GEOCOMP Corp., Concord, MA 01742

8.0 POST CLOSURE COST ESTIMATES

The annual operating and maintenance activities for the post closure care period include:

1) Quarterly sampling and analyses,

2) Semi-annual sampling and analyses;

3) Monthly inspection of cover and drainage facilities,

4 Annual reporting of groundwater analytic results and elevations as well as inspection results, and

5) Annual operations and maintenance of the cap which could include grass mowing, filling in of any erosion, clearing drainage ditches, or cap repair.

The total annual costs for these activities is approximately $35,000 (1987 dollars).

See III A
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9.0 POST CLOSURE FINANCIAL ASSURANCE

As noted in Appendix A, the Avco facility is owned by the U.S. Government as the Stratford Army Engineer Plant, CTD 001181502. According to 40 CFR, Part 265.140(c), States and the Federal government are exempt from Subpart H - Financial Requirements.

APPENDIX A

Exemption From Financial Requirements

HEADQUARTERS, US ARMY AVIATION SYSTEMS COMMAND
4300 GOODFELLOW BOULEVARD, ST. LOUIS, MO 63120-1798

JAN - 6

Office of Deputy Director, Administrative
and Installation Support Activity

SUBJECT: Stratford Army Engine Plant Groundwater Monitoring and
Financial Assurance Certification

Mr. Richard Boynton
Chief of CT/RI Waste Program Section
U.S. Environmental Protection Agency
Region I, HSC-CAUS
John F. Kennedy Federal Building
Boston, Massachusetts 02203

Dear Mr. Boynton:

I, Colonel Charles L. Brown, Jr., Deputy Commander for Installation and Resource Management, acting as Agent for the U.S. Government who owns the Stratford Army Engine Plant, CTD 001181502, located at Stratford, Connecticut, certify that the equalization lagoon and sludge storage lagoons at this facility are in compliance with all applicable groundwater monitoring requirements in 40 CFR, Part 265, Subpart F.

This facility does not need to comply with 40 CFR, Subpart H as noted in 40 CFR, Part 265.140(c) as it is government-owned.

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the persons who manage the system, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

Charles L. Brown, Jr.
Colonel, General Staff
Deputy Commander for Installation
and Resource Management

Copies Furnished:

Mr. Barry Cirox (DEP)
Mr. John Fleming (AVCO)
Mr. Ron Matteuzzi (AMSAV-PEC)
Mr. Robert Garfield (AMSAV-JR)

APPENDIX B

Soil Sampling and Decontamination Procedures

Chain of Custody, Shipping
and Field QA/QC Recommendations

Confirmation soil samples at/or near the surface will be taken. Single grab samples will be collected from each area and submitted for laboratory analysis as specified in Section 4.D.

Materials Required

Stainless steel trowel

Tile spade

Procedure for Collecting Surface Soil Samples

1. Use tile spade to excavate to six inches.
2. Decontaminate tile spade as specified below.
3. Collect representative sample using decontaminated stainless steel trowel.
4. Place sample in appropriate sample container (see Table below) filling container as completely as possible to minimize air space.
5. Log-in each sample and fill our chain-of-custody forms.
6. Place sample container into cooler and pack with ice.

Equipment Decontamination

The procedure for decontamination of sampling equipment is as follows:

1. Wash with lab-grade detergent
2. Rinse with clean tap water
3. Rinse with deionized water
4. Rinse with reagent-grade isopropanol
5. Air dry on aluminum foil
6. Wrap in aluminum foil until next use

REQUIREMENTS FOR SAMPLE CONTAINERS, PRESERVATION AND HOLDING TIME

Parameter	Container	Preservation	Maximum Holding Time
Aromatic and Halogenated Volatile Organics	2x120 ml wide mouth w/teflon caps	ice, 4°C	7 days
Cyanides	1 quart amber jar	ice, 4°C	14 days
EP Toxicity Metals and Hexavalent Chromium	1 quart amber jars	none	six months

Chain of Custody, Shipping and Field QA/QC

An overriding consideration for environmental measurement data is the ability to demonstrate that samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collections, shipment, laboratory receipt and laboratory custody until disposal must be documented to accomplish this. Documentation is accomplished through a chain of custody record that records each sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is:

- In a person's actual possession.
- In view after being in physical possession.
- Locked so that no one can tamper with it after having been in physical custody.
- In a secured area, restricted to authorized personnel.

Sample custody will be initiated by field personnel upon collection of samples. Documents specifically prepared for such purposes will be used for recording pertinent information about the types and numbers of samples collected and shipped for analysis. An example chain of custody form is included as Figure B-1. The samples collected will first be brought to an on-site location for batching and paperwork checks. Labels and log information are checked to be sure there is no error in identification. Samples are packaged to prevent breakage or leakage, and labeled according to DOT regulations for transport by air as laboratory samples. Copies of forms will be maintained for the project record. Storage of samples by the laboratory will be under conditions specified for the analyses to be performed. Samples partially used for analysis will be held for 60 days following report of the data before disposal. Archived samples will be stored until the end of the project, or shipped to another lab (for reanalysis if necessary).

Chain of Custody Record Form

Figure B-1 is an example of the chain of custody form to be used while collecting and shipping samples from the AVCO site.

The chain of custody form shall be signed by each individual who has had the samples in their possession. Preparation of the chain of custody form shall be as follows:

- The chain of custody record shall be initiated for every sample by the person collecting the sample. Every sample shall be assigned a unique identification number that is entered on the chain of custody form. Samples can be grouped for shipment using a single form.
- The record shall be completed in the field to indicate project, sampling team, etc.
- The person transporting the samples for shipment shall sign the record form as Transported By ______________.
- Because the samples are to be shipped to the laboratory by commercial carrier, the chain of custody form shall be sealed in a watertight envelope, placed in the shipping container, and the shipping container sealed prior to being given to the carrier.
- The commercial carrier's airbill shall serve as an extension of the chain of custody record between the final field custodian and receipt in the laboratory.
- Upon receipt in the laboratory, the Quality Control Coordinator, or representative, shall open the chain of

custody record, and sign and date the record. Any discrepancies shall be noted on the chain of custody form.

- If discrepancies occur, the samples in question shall be segregated from normal sample storage and the field personnel immediately notified.
- Chain of custody records shall be maintained with the specific project files, becoming part of the permanent closure documentation.

FIGURE B-1

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
SAMPLERS: (Signature)	

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS							REMARKS

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	

Distribution: Original Accompanies Shipment, Copy to Field Files

Field Collection and Shipment

In addition to initiating the chain of custody form, field personnel are responsible for uniquely identifying (required for the chain of custody form) and labeling samples, providing proper filtration and preservation, and packaging samples to preclude breakage during shipment.

Every sample should be labeled so as to include:

- Project number.
- Unique sample number.
- Sample description (such as well number and depth).
- Sampling data and time.
- Person obtaining the sample.
- Method of sample preservation/filtration, if any.

Samples must be placed in containers compatible with the intended analysis and properly preserved. Requirements for various analytical parameters with respect to the type of container, preservation method, and maximum holding time between collection and analysis have been presented in other sections.

Shipping containers are to be sealed prior to shipment, both during direct transport via field personnel as well as when commercial carrier is used. The only exception to this is if sufficient holding time exists so that the samples can be held in the field and it is necessary to re-ice the containers prior to or during transport.

As soon as field personnel are ready to transport samples from the field to the laboratory, they shall notify the laboratory by telephone of the shipment. The estimated time of arrival at the laboratory should be given.

Sample Packaging and Shipping

In order to ensure safe, secure delivery of all collected samples to the analytical laboratory involved, the following packaging, labeling and shipping procedures have been prepared for this project. All procedures presented below are written to comply with applicable DOT regulations for transportation by surface and air.

Packaging and Shipping - Field Procedure

1. Place a signed, dated, chain of custody seal on each of the bottles and vials in such a way that no bottles may be opened without breaking the seal.

2. Wrap properly labeled and secured glass sample bottles and purgeable vials with two thicknesses of plastic bubble wrap. Place the wrapped containers into a water-tight zip lock bag. Seal and label the outside of the bag with the sample number or other field assigned identifier.

3. Put a layer of cushioning material (e.g., styrofoam board) in the bottom of the watertight shipping containers.

4. Place sample bottles, tops up, in the shipper. Arrange bottles such that glass bottles are surrounded by plastic bottles.

Field QA/QC Reviews

			Responsible
1.	Sample and field monitoring information conforms to specified conditions and schedule	Review of labeled samples and in-process samples using daily sample inventory	Field Sampling team

Objective	Action	Person
2. Verify incoming field data and sample completeness	Daily count of incomplete items	Field Sampling team
3. Verify completeness of field log books	Review Daily	Field Team Leader
4. Field calibration criteria reviewed and test calibration acceptance recorded	With each measurement	Field Team Leader
5. All data forms are properly completed	Review and check off during each sample collection	Field Team Leader
6. All field generated QC samples collected as required	Review requirements and confirm	Field Team Leader
7. Assure comparability of units	Review units reported for consistency in calculations at each use and check off	Project Engineer
8. Examine engineering validity of data	Review parameter extremes and transients versus expected data trends. Document data excluded on this basis	Project Engineer & Quality Assurance Program Manager
9. Examination of statistical data	Apply tests to data groupings to be used. Record data and test results	Project Engineer & Quality Assurance Project Officer

APPENDIX C

Standards Developed by the Connecticut DEP

9/86

VARIOUS DRINKING WATER STANDARDS USED BY THE CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION HAZARDOUS WASTE MANAGEMENT UNIT

TABLE OF CONTENTS

CONNECTICUT STANDARDS FOR QUALITY OF PUBLIC DRINKING WATER AND EPA MAXIMUM CONCENTRATION OF CONTAMINANTS FOR CHARACTERISTIC OF OF E.P. TOXICITY

Limits for Inorganic Chemicals

Substance	Maximum Permissible Level (mg/l)	E.P. Toxic (mg/l)
Arsenic	0.05	5.0
Barium	1.00	100.0
Cadmium	.010	1.0
Chromium	.05	5.0
Cyanide	.20	2.0*
Fluoride	2.00	#
Lead	.05	5.0
Mercury	.002	0.2
Nitrite Nitrogen	1.0 (as N)	#
Nitrate Nitrogen Plus Nitrite Nitrogen	10.0 (as N)	#
Selenium	.01	1.0
Silver	.05	5.0
Sodium	20	#
Copper	1.0	100.0*
Chlorides	250	#

Limits for Pesticides and Organic Chemicals

Substance	Maximum Permissible Level (mg/l)	E.P. Toxic (mg/l)
Gross Hydrocarbons (oil base) (by gas chromatograph using appropriate standard)This test required only when the odor test shows oil to be present.	.001	
Chlorinated Hydrocarbons		
Endrin	.0002	.02
Lindane	.004	0.4
Methoxychlor	0.1	10.0
Toxaphene	.005	0.5
Chlorophenoxys		
2,4-D	0.1	10.0
2,4,5-TP Silvex	0.01	1.0

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* State Guideline

Radioactivity

Natural Radioactivity

Contaminant	Maximum Allowable Level Picocuries Per Liter
Combined radium-226 and radium-228	5
Gross alpha particle activity (including radium-226)	15

Man-Made Radioactivity

Contaminant	Annual Average Maximum Allowable Level
Dose equivalent of beta particles plus photon radioactivity	4 millirems
or	
Gross beta particle activity	50 pCi per liter
Tritium	20,000 pCi per liter
Strontium-90	2 pCi per liter
Dose equivalent of Tritium plus Strontium-90	4 millirems

CONNECTICUT DEPARTMENT OF HEALTH SERVICES
ACTION LEVELS

PARAMETER	ACTION LEVEL
Acrylonitrile	35 ug/l
Benzene	1 ug/l
1,2-Dibromoethane (EDB)	.10 ug/l
1,2-Dichloroethane	1 ug/l
1,2-Dichloropropane	10 ug/l
1,3-Dichloropropene	10 ug/l
2,3-Dichloropropene	87 ug/ l
1,4-Dioxane	20 ug/l
Ethanol	26,000 ug/l(short term spill)
Ethylene	100 ug/l
Isopropyl alchol	1000 ug/ l
Methanol	3600 ug/l(short term spill)
Methyl Ethyl Ketone	1000 ug/l
Methylene Chloride	25 ug/l
Polychlorinated Biphenyls (PCBs)	1 ug/l
2,3,7,8-TCDD	.05 ppt
Tetrahydrofurans	8100 ug/l
Tetrachloroethylene	20 ug/l
Toluene	1000 ug/l (10 days)
1,1,1,-Trichloroethane	300 ug/l
Trichloroethylene	25 ug/l
Total Trihalomethanes (THMs)*	100 ppb
Xylenes, mixed	100

*(ie. chloroform,bromoform,dibromochloromethane,bromo dichloromethane).

EPA PROPOSED MAXIMUM
CONTAMINANT LEVELS (PMCLS)

CONTAMINANT	PROPOSED MCL(mg/1)
Benzene	0.005
Carbon tetrachloride	0.005
1,4 - Dichlorobenzene	0.75
1,2 - Dichloroethene	0.005
1,1 - Dichloroethylene	0.007
1,1,1 - Trichloroethane	0.2
Trichloroethylene	0.005
Vinyl chloride	0.001

EPA RECOMMENDED MAXIMUM CONTAMINANT LEVELS (RMCLs)

CONTAMINANT	PROPOSED RMCL(mg/l)
Acrylamaide	zero
Alachlor	zero
Aldicarb, aldicarb sulfoxide and aldicarb sulfone	0.009
Carbofuran	0.036
Chloradane	zero
cis-1, 1-Dichlorothylene	0.07
DBCP	zero
1,2-Dichloropropane	0.006
o-Dichlorobenzene	0.62
2,4-D	0.07
EDB	zero
Epichlorohydrin	zero
Ethylbenzene	0.68
Heptachlor	zero
Heptachlor epoxide	zero
Lindane	0.0002
Methoxychlor	0.34
Monochlorobenzene	0.06
PCBs	zero
Pentachlorophenol	0.22
Styrene	0.14
Toluene	2.0
2,4,5-TP	0.052
Toxaphene	zero
trans-1,2-Dichlorolethylene	0.07
Xylene	0.44

RMCLs for the inorganic chemicals are proposed as follows:

CONTAMINANT	PROPOSED RMCL (mg/l)
Arsenic	0.050
Barium	1.5
Cadmium	0.005
Chromium	0.12
Copper	1.3
Lead	0.020
Mercury	0.003
Nitrate	10
Nitrite	1
Selenium	0.045
Asbestos	7.1 million long fibers per liter

SUGGESTED NO-ADVERSE RESPONSE LEVEL FOR ORGANIC PESTICIDES AND OTHER ORGANIC CONTAMINANTS IN DRINKING WATER

COMPOUNDS	SNARLS* (ug/l)
2,4,5-T	1000
TCDD	.001
MCPA	12.5
Amiben	2500
Dicamba	12.5
Alachlor	1000
Butachlor	100
Propachlor	1000
Propanil	200
Aldicarb	10
Bromacil	125
Paraquat	85
Trilfluralin (also for Nitralin and Benefin)	1000
Azinphosmethyl (Guthion)	125
Diazinon	20
Phorate (also for Disulfoton)	1
Carbaryl	820
Ziram (and Ferbam)	125
Captan	500
Folpet	1600
Hexachlorobenzene	10
Paradichlorobenzene (also Orthodichlorobenzene)	134
Parathion (and Methyl parathion)	43
Malathion	200
Maneb (and Zineb and Dithane)	50
Thiram	50
Atrazine	215
Propazine	464
Di-n-butyl phthalate	1100
Di-2-(ethyl hexyl) phthalate	6000
Hexachlorophene	10
Methyl methacrylate	1000
Pentachlorophenol	30
Styrene	1330

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*Suggested No Adverse Response Levels for chronic exposure. These values are derived from the Acceptable Daily Intake values computed by the National Academy of Sciences (Drinking Water and Health, Vol I, 1977). SNARLS assume total exposure from drinking water for 10 kilogram child consuming 1 liter of water per day.

EPA WATER QUALITY CRITERIA
Published pursuant to Section 304 (a)(1) of the CWA

PARAMETER	FRESHWATER AQUATIC LIFE (ug/l)		SALTWATER AQUATIC LIFE (ug/l)		HUMAN HEALTH^A (ug/l)
	acute	chronic	acute	chronic	
Acenaphthene	1700	ND	970	710	20^B
Acrolein	68	21	55	ND	320
Acrylonitrile	7550	2600	ND	ND	$.058^C$
Dieldrin	$.0019^D$		$.0019^D$		.071ng/l^C
Aldrin	3.0	ND	1.3	ND	.074ng/l^C
Antimony	9000	1600	ND	ND	146
Arsenic	400^E		508	ND	2.2ng/l^C
Asbestos	ND	ND	ND	ND	30,000 fibers/l^C
Benzene	5300	ND	5100	700^F	$.66^C$
Benzidene	2500	ND	ND	ND	.12ng/l^C
Beryllium	130	5.3	ND	ND	3.7ng/l^C
Cadmium	Q^D,	X^E	4.5^D		10
Carbon Tetrachloride	35,200	ND	50,000	ND	$.4^C$
Chlordane	$.0043^D$ 2.4^E		$.09^E$ $.0040^D$		.46ng/l^C
Chlorinated Benzenes	250	50^F	160	129	
hexachlorobenzene					.72ng/l^C
1,2,4,5-tetrachlorobenzene					38
pentachlorobenzene					74
monochlorobenzene					$488,20^B$
Chlorinated Ethanes					
1,2-dichloroethane	118,000	20,000	113,000	ND	.94
two trichloroethanes	18,000	ND	ND	ND	ND
two tetrachloroethanes	9320	ND	ND	ND	ND

PARAMETER	FRESHWATER AQUATIC LIFE LIFE (ug/l)		SALTWATER AQUATIC (ug/l) (ug/l)		HUMAN HEALTH[A]
	acute	chronic	acute	chronic	
Chlorinated Ethanes cont'd					
pentachloroethane	7240	1100	390	281	ND
hexachloroethane	980	540	940	ND	1.9
1,1,2-trichloroethane	ND	9400	ND	ND	.6
1,1,2,2-tetrachloroethane	ND	2400	9020	ND	.17
1,1,1-trichloroethane	ND	ND	31,200	ND	18.4 mg/l
Chlorinated Napthalenes	1600	ND	7.5	ND	ND
Chlorinated Phenols	30[G]	970[H]	440[I]	ND	
3-monochlorophenol					0.1[B]
4-monochlorophenol					0.1[B]
2,3-dichlorophenol					0.04[B]
2,5-dichlorophenol					0.5[B]
2,6-dichlorophenol					0.2[B]
3,4-dichlorophenol					0.3[B]
2,3,4,6-tetrachlorophenol					1.0[B]
2,4,5-trichlorophenol					1.0[B], 2.6mg/l[J]
2,4,6-trichlorophenol					1.2[C]
2 methyl-4-chlorophenol					1800[B]
3 methyl-4-chlorophenol					3000[B]
3 methyl-6-chlorophenol					20[B]
Chloroalkyl Ethers	238,000	ND	ND	ND	ND
bis(chloromethyl)-ether		ND	ND	ND	.0038ng/l[C]

PARAMETER	FRESHWATER AQUATIC LIFE (ug/l) acute	FRESHWATER AQUATIC LIFE (ug/l) chronic	SALTWATER AQUATIC LIFE (ug/l) acute	SALTWATER AQUATIC LIFE (ug/l) chronic	HUMAN HEALTH^A (ug/l)
Chloroalkyl Ethers cont'd					
bis(2-chloroethyl) ether		ND	ND	ND	$.03^C$
bis(2-chloroisopropyl) ether		ND	ND	ND	34.7
Chloroform	28,900	1240^K	ND	ND	.19
2-Chlorophenol	4380	2000^L	ND	ND	0.1^B
Chromium					
total recoverable hexavalent chromium	$.29^D,21^E$		$18^D,1260^E$		50
total recoverable trivalent chromium	M	44	10300	ND	170 mg/l
Copper	5.6^D	N^E	$4.0^D,23^E$		1 mg/l
Cyanide (free)^P	$3.5^D,52^E$		30	2.0	200
DDT and Metabolites					
DDT	$.001^D$ 1.1^E		0.13^E	$.001^D$	.024 ng/l
TDE	0.6	ND	3.6	ND	ND
DDE	1050	ND	14	ND	ND
Dichlorobenzenes	1120	763	1970	ND	400
Dichlorobenzidenes	ND	ND	ND	ND	.0103
Dichloroethylenes	11,600	ND	224,000	ND	.033
2,4-Dichlorophenol	2,020	365	ND	ND	$3.09, .3^B$
Dichloropropanes	23,000	5700	10,300	3040	ND
Dichloropropenes	6,060	244	790	ND	87
2,4-Dimethylphenol	2,120	ND	ND	ND	400^B
2,4-Dinitrotoluene	330	230	590	370^F	$.11^C$
1,2-Diphenylhydrazine	270	ND	ND	ND	$42ng/1^C$

PARAMETER	FRESHWATER AQUATIC LIFE (ug/l) acute	FRESHWATER AQUATIC LIFE (ug/l) chronic	SALTWATER AQUATIC LIFE (ug/l) acute	SALTWATER AQUATIC LIFE (ug/l) chronic	HUMAN HEALTH^A (ug/l)
Endosulfan	$.056^D, .22^E$		$.0087^D, .34^E$		74
Endrin	$.0023^D, .18^E$		$.0023^D, .037^E$		1
Ethylbenzene	32,000	ND	430	ND	1.4 mg/l
Fluoranthene	3,980	ND	40	16	42
Haloethers	360	122	ND	ND	ND
Halomethanes	11,000	ND	12,000	6400	$.19^C$
(Chloromethane, bromomethane, dichloromethane, bromodichloromethane tribromethane, dichlorodifluoromethane, trichlorofluoromethane)					
Heptachlor	$.0038^D, .52^E$		$.0036^D, .053^E$		.28 ng/l
Hexachlorobutadiene	90	9.3	32	ND	$.45^C$
Hexachlorocyclohexane					
Lindane	$.080^D, 2.0^E$		ND	$.16^E$	
BHC	100	ND	.34	ND	
alpha-HCH					9.2 ng/l^C
beta-HCH					16.3 ng/l^C
tech-HCH					12.3 ng/l^C
gamma-HCH					18.6 ng/l^C
Hexachlorocyclopentadiene	7.0	5.2	7.0	ND	$206, 1.0^B$
Isophorone	117,000	0	12,900	ND	5.2 mg/l
Lead	R,S		668	25	50
Mercury	$.00057^D, .0017^E$		$.025^D$, 3.7		144 ng/l
Naphthalene	2300	620	2350	ND	ND
Nickel	T,U		$7.1^D, 140^E$		13.4
Nitrobenzene	27,000	ND	6680	ND	19.8 mg/l
Nitrophenols	230	150^F	4850	ND	
2,4-dinitro-o-cresol					13.4
dinitrophenol					70

PARAMETER	FRESHWATER AQUATIC LIFE (ug/l) acute	FRESHWATER AQUATIC LIFE (ug/l) chronic	SALTWATER AQUATIC LIFE (ug/l) acute	SALTWATER AQUATIC LIFE (ug/l) chronic	HUMAN HEALTH^{A} (ug/l)
Nitrosamines	5850	ND	3,300,000		ND
nitrosodimethylamine					1.4 ng/l^{C}
nitrosodiethylamine					0.8 ng/l^{C}
n-nitrosodi-n-butylamine					6.4 ng/l^{C}
n-nitrosodiphenylamine					4900 ng/l^{C}
n-nitrosopyrrolidine					16.0 ng/l^{C}
Pentachlorophenol	55	3.2	53	34 30^{B}	1.01 mg/l,
Phenol	10,200	2560	5800	ND 0.3mg/l^{B}	3.5 mg/l
Phthalate Esters	940	3	2944	ND	
dimethylphthalate					313 mg/l
diethylphthalate					350 mg/l
dibutylphthalate					34 mg/l
di-2-ethyl-hexyl-phthalate					15 mg/l
PCB's	2.0	.014^{D}	10	.030^{D}	.79 ng/l^{C}
Polynuclear Aromatic Hydrocarbons	ND	ND	300	ND	2.8ng/l^{C}
Selenium	760	35^{D},260^{E}	54^{D}	410^{E}	10
Silver	V	ND	2.3^{E}	50	
Tetrachloroethylene	5280	840	10,200	450	0.8^{C}
Thallium	1400	40	2130	ND	13
Toluene	17,500	ND	6300	5000	14.3 mg/l
Toxaphene	.013^{D}	1.6^{E}		.070^{E}	.71ng/l^{C}
Trichloroethylene	45000	ND	2000	ND	2.7^{C}
Vinyl Chloride	ND	ND	ND	ND	2.0^{C}
Zinc	47^{D}, W^{E}	58^{D}, 170^{E}	5 mg/l^{B}		

OTHER APPLICABLE STANDARDS USED IN CONNECTICUT

PARAMETER	CONCENTRATION (mg/l)	E.P. TOXIC (mg/l)[1]	ORIGIN OF STANDARD
Antimony	.01		EPA and World Health Organization
Boron	1.0		EPA and World Health Organization
Foaming Agents	0.5		EPA Secondary DWS[2]
Hydrogen Sulfide	.05		EPA Secondary DWS[2]
Iron	0.3		EPA Secondary DWS[2]
Manganese	.05		EPA Secondary DWS[2]
Nickel	1.0	100[3]	
Phenols	.001		
Sulfate	250		EPA Secondary DWS[2]
T.D.S.	500		EPA Secondary DWS[2]
Zinc	5.0	500[3]	EPA Secondary DWS[2]
Radium	5 pCi/l		EPA Primary DWS[2]
Gross Alpha	15 pCi/l		EPA Primary DWS[2]
Gross Beta	4 millirem/yr		EPA Primary DWS[2]
Turbidity	1/TU		EPA Primary DWS[2]
Coliform Bacteria	1/100ml		EPA Primary DWS[2]

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[1] E.P.Toxic levels recommended by CT DEP

[2] DWS is Drinking Water Standards

[3] State Guideline

FOOTNOTES FOR PAGES 6-10

A Ingestion of water.

B From organoleptic data (undesirable taste and odor).

C Value at an incremental increase of cancer risk estimated at 10^{-6}.

D 24- hour average.

E At any time.

F Preliminary data only.

G For 4-chloro-3-methylphenol, 500,000 ug/l for other compounds.

H For 2,4,6-trichlorophenol.

I For 2,3,5,6-tetrachlorophenol, and 29,700 ug/l for 4-chlorophenol.

J Derived level based on available toxicity data.

K LC_{50} (twentyseven-day).

L Based on flavor impairment.

M $e^{(1.08\ [\ln\ (\text{hardness})]+3.48)}$

N $e^{(0.94\ [\ln\ (\text{hardness})]-1.23)}$

P Free cyanide is the sum of cyanide present as HCN and CN^-.

Q $e^{(1.05\ [\ln(\text{hardness})]-3.73)}$

R $e^{(2.35\ [\ln(\text{hardness})]-9.48)}$,24-hour average

S $e^{(1.22\ [\ln(\text{hardness})]-0.47)}$, at anytime

T $e^{(0.76\ [\ln(\text{hardness})]+1.06)}$,24-hour average

U $e^{(0.76\ [\ln(\text{hardness})]+4.02)}$, at anytime

V $e^{(1.72\ [\ln(\text{hardness})]-6.52)}$

W $e^{(0.83\ [\ln\ (\text{hardness})]+1.95)}$

X $e^{(1.05\ [\ln(\text{hardness})]-3.73)}$

APPENDIX D

OSHA Standards

1970 (29 U.S.C. 655, 657). Sections 3 and 4 of the Administrative Procedures Act (5 U.S.C. 552(a), 553), and Secretary of Labor's Order 9–83 (48 FR 35736), 29 CFR Part 1910 is amended by adding a new § 1910.120, Hazardous Waste Operations, as set forth below, effective December 19, 1986.

Signed at Washington, DC this 16th day of December 1986.

John A. Pendergrass,
Assistant Secretary of Labor.

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1. The Authority citation for Subpart H of Part 1910 is amended by adding the following:

Authority: * * * Section 1910.120 issued under the authority of section 126(e) of the Superfund Amendments and Reauthorization Act of 1986 (Pub. L. 99–499). Sections 6 and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 655, 657), sections 3 and 4 of the Administrative Procedure Act (5 U.S.C. 552(a), 553) and Secretary of Labor's Order 9–83 (48 FR 35736).

2. Part 1910 of Title 29 of the Code of Federal Regulations is amended by adding a new § 1910.120 to read as follows:

§ 1910.120 Hazardous waste operations and emergency response.

(a) *Scope, application, and definitions.*—(1) *Scope.* This section covers employers and employees engaged in the following operations:

(i) Hazardous substance response operations under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended (42 U.S.C. 9601 *et seq*) (CERCLA), including initial investigations at CERCLA sites before the presence or absence of hazardous substances has been ascertained;

(ii) Major corrective actions taken in clean-up operations under the Resource Conservation and Recovery Act of 1976 as amended (42 U.S.C. 6901 *et seq*) (RCRA);

(iii) Operations involving hazardous waste storage, disposal and treatment facilities regulated under 40 CFR Parts 264 and 265 pursuant to RCRA, except for small quantity generators and those employers with less than 90 days accumulation of hazardous wastes as defined in 40 CFR 262.34;

(iv) Hazardous waste operations sites that have been designated for clean-up by state or local governmental authorities; and

(v) Emergency response operations for releases of or substantial threats of releases of hazardous substances and post-emergency response operations for such releases.

(2) *Application.* (i) All requirements of Part 1910 and Part 1926 of Title 29 of the Code of Federal Regulations apply pursuant to their terms to hazardous waste operations (whether covered by this section or not). In addition the provisions of this section apply to operations covered by this section. If there is a conflict or overlap, the provision more protective of employee safety and health shall apply. 29 CFR 1910.5(c)(1) is not applicable.

(ii) All paragraphs of this section except paragraph (o) apply to hazardous substance response operations under CERCLA, major corrective actions taken in clean-up operations under RCRA, post-emergency response operations, and hazardous waste operations that have been designated for clean-up by state or local governmental authorities.

(iii) Only the requirements of paragraph (o) of this section apply to those operations involving hazardous waste storage, disposal, and treatment facilities regulated under 40 CFR Parts 264 and 265, except for small quantity generators and those employers with less than 90 days accumulation of hazardous wastes as defined in 40 CFR 262.34.

(iv) Paragraph (l) of this section applies to emergency response operations for releases of or substantial threats of releases of hazardous substances.

(3) *Definitions*—*"Buddy system"* means a system of organizing employees into work groups in such a manner that each employee of the work group is designated to observe the activities of at least one other employee in the work group. The purpose of the buddy system is to provide quick assistance to those other employees in the event of an emergency.

"Decontamination" means the removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects.

"Emergency response" means response to any occurrence which results, or is likely to result, in a release of a hazardous substance due to an unforeseen event.

"Established permissible exposure limit" means the inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subpart Z, or if none is specified the exposure limits in "NIOSH Recommendations for Occupational Health Standards" dated September 1986 incorporated by reference, or if neither of the above is specified, the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1986–87" dated 1986 incorporated by reference, or if none of the above is specified, a limit based upon a published study or manufacturers' safety data sheet brought to the employer's attention. The two documents incorporated by reference are available for purchase from the following:

NIOSH, Publications Dissemination, Division of Standards Development and Technology Transfer, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 841–4287

American Conference of Governmental Industrial Hygienists, 6500 Glenway Ave., Building D-7, Cincinnati, OH, 45211–4438, (513) 661–7881

and are available for inspection and copying at the OSHA Docket Office, Docket No. S–760, Room N–3671, 200 Constitution Ave., NW., Washington, DC 20210.

"Hazardous substance" means any substance designated or listed under (i) through (iv) below, exposure to which results or may result in adverse effects on the health or safety of employees:

(i) any substance defined under section 101(14) of CERCLA,

(ii) any biological agent and other disease-causing agent as defined in section 104(a)(2) of CERCLA,

(iii) any substance listed by the U.S. Department of Transportation and regulated as hazardous materials under 49 CFR 172.101 and appendices, and

(iv) hazardous waste.

"Hazardous waste" means (i) a waste or combination of wastes as defined in 40 CFR 261.3, or (ii) those substances defined in 49 CFR 171.8.

Hazardous waste operation" means any operation involving employee exposure to hazardous wastes, hazardous substances, or any combination of hazardous wastes and hazardous substances that are conducted within the scope of this standard.

"Hazardous waste site" or *"site"* means any facility or location at which hazardous waste operations within the scope of this standard take place.

"Health hazard" means a chemical, mixture of chemicals or a pathogen for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the

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hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. Further definition of the terms used above can be found in Appendix A to 29 CFR 1910.1200.

"IDLH" or *"Immediately dangerous to life or health"* means any condition that poses an immediate threat to life, or which is likely to result in acute or immediate severe health effects. This includes oxygen deficiency conditions.

"Immediate severe health effects" means any acute clinical sign or symptom of a serious, exposure-related reaction manifested within 72 hours after exposure to a hazardous substance.

"Oxygen deficiency" means that concentration of oxygen by volume below which air supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

"Site safety and health officer" means the individual located on a hazardous waste site who is responsible to the employer and has the authority and knowledge necessary to implement the site safety and health plan and verify compliance with applicable safety and health requirements.

(b) *General requirements*—(1) *Safety and health program.* Each employer shall develop and implement a safety and health program for its employees involved in hazardous waste operations. The program, as a minimum, shall incorporate the requirements of this section and be provided, as appropriate, to any subcontractor or its representative who will be involved with the hazardous waste operation. The program shall be designed to identify, evaluate, and control safety and health hazards and provide for emergency response for hazardous waste operations.

(2) *Site characterization and analysis.* Hazardous waste sites shall be evaluated in accordance with paragraph (c) of this section to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards.

(3) *Site control.* Site control procedures shall be implemented in accordance with paragraph (d) of this section before clean-up work begins to control employee exposure to hazardous substances.

(4) *Training.* Initial or refresher or review training meeting the requirements of paragraph (e) of this section shall be provided to employees before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances, safety, or health hazards.

(5) *Medical surveillance.* Medical surveillance shall be provided in accordance with paragraph (f) of this section for employees exposed or potentially exposed to hazardous substances or health hazards or who wear respirators.

(6) *Engineering controls, work practices and personal protective equipment.* Engineering controls, work practices, personal protective equipment, or a combination of these shall be implemented in accordance with paragraph (g) of this section to protect employees from exposure to hazardous substances and health hazards.

(7) *Monitoring.* Monitoring shall be performed in accordance with paragraph (h) of this section to assure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed established permissible exposure limits for hazardous substances.

(8) *Informational program.* Employees, contractors, and subcontractors or their representative shall be informed of the degree and nature of safety and health hazards specific to the work site by using the safety and health plan outlined in paragraph (i) of this section.

(9) *Material handling.* Hazardous substances and contaminated soils, liquids, and other residues shall be handled, transported, labeled, and disposed of in accordance with paragraph (j) of this section.

(10) *Decontamination.* Procedures for all phases of decontamination shall be developed and implemented in accordance with paragraph (k) of this section.

(11) *Emergency response.* Emergency response to hazardous waste operation incidents shall be conducted in accordance with paragraph (l) of this section.

(12) *Illumination.* Areas accessible to employees shall be lighted in accordance with the requirements of paragraph (m) of this section.

(13) *Sanitation.* Facilities for employee sanitation shall be provided in accordance with paragraph (n) of this section.

(14) *Site excavation.* Site excavations created during initial site preparation or during hazardous waste operations shall be shored or sloped to prevent accidental collapse and conducted in accordance with Subpart P of 29 CFR Part 1926.

(15) *Contractors and sub-contractors.* An employer who retains contractor or sub-contractor services for work in hazardous waste operations shall inform those contractors, sub-contractors, or their representatives of any potential fire, explosion, health or other safety hazards of the hazardous waste operation that have been identified by the employer.

(c) *Site characterization and analysis.* (1) A preliminary evaluation of a site's characteristics shall be performed prior to site entry by a trained person to aid in the selection of appropriate employee protection methods prior to site entry. During site entry, a more detailed evaluation of the site's specific characteristics shall be performed by a trained person to further identify existing site hazards and to further aid in the selection of the appropriate engineering controls and personal protective equipment for the tasks to be performed.

(2) All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH) or other conditions that may cause death or serious harm shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

(3) The following information to the extent available shall be obtained by the employer prior to allowing employees to enter a site:

(i) Location and approximate size of the site.

(ii) Description of the response activity and/or the job task to be performed.

(iii) Duration of the planned employee activity.

(iv) Site topography.

(v) Site accessibility by air and roads.

(vi) Pathways for hazardous substance dispersion.

(vii) Present status and capabilities of emergency response teams that would provide assistance to on-site employees at the time of an emergency.

(viii) Hazardous substances and health hazards involved or expected at the site and their chemical and physical properties.

(4) Personal protective equipment (PPE) shall be provided and used during initial site entry in accordance with the following requirements:

(i) Based upon the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below established permissible exposure limits for known or suspected hazardous substances and health hazards and will provide protection against other known and suspected hazards identified during the preliminary site evaluation.

(ii) An escape self-contained breathing apparatus of at least five minutes duration shall be carried by employees or kept available at their immediate work station if positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble.

(iii) If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site an ensemble of Level B PPE shall be provided as minimum protection and direct reading instruments shall be carried for identifying IDLH conditions. (See Appendix B for guidelines on Level B protective equipment.)

(iv) Once the hazards of the site have been positively identified, the appropriate PPE shall be selected and used in accordance with paragraph (g) of this section.

(5) The following monitoring shall be conducted during site entry when the site evaluation produces information which show the potential for ionizing radiation or IDLH conditions, or when the site information is not sufficient to rule out these possible conditions:

(i) Monitoring for hazardous levels of ionizing radiation.

(ii) Monitoring the air with appropriate test equipment for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, toxic substances.)

(iii) Visually observe for signs of actual or potential IDLH or other dangerous conditions.

(6) Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified.

Note.—Risks to consider include, but are not limited to:

Exposures exceeding the appropriate Threshold Limit Values (TLVs), Permissible Exposure Limits (PELs), or Recommended Exposure Limits (RELs).

IDLH Concentrations.

Potential Skin Absorption and Irritation Sources.

Potential Eye Irritation Sources.

Explosion Sensitivity and Flammability Ranges.

(7) Any information concerning the chemical, physical, and toxicologic properties of each substance known or expected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform shall be made available to all employees prior to the commencement of their work activities.

(8) An ongoing air monitoring program in accordance with paragraph (h) of this section shall be implemented after site characterization has determined the site is safe for the start-up of operations.

(d) *Site control.* (1) A site control program for preventing contamination of employees shall be developed during the planning stages of a hazardous waste operation clean-up.

(2) The site control program shall, as a minimum, include: A site map; site work zones; the use of a "buddy system"; site communications; the standard operating procedures or safe work practices; and, identification of nearest medical assistance.

(e) *Training.* (1) All employees (such as equipment operators and general laborers) exposed to hazardous substances, health hazards, or safety hazards shall be thoroughly trained in the following:

(i) Names of personnel and alternates responsible for site safety and health;

(ii) Safety, health and other hazards present on the site;

(iii) Use of PPE;

(iv) Work practices by which the employee can minimize risks from hazards;

(v) Safe use of engineering controls and equipment on the site;

(vi) Medical surveillance requirements including recognition of symptoms and signs which might indicate over exposure to hazards; and

(vii) Paragraphs (G) through (K) of the site safety and health plan set forth in paragraph (i)(2)(i) of this section.

(2) All employees shall at the time of job assignment receive a minimum of 40 hours of initial instruction off the site, and a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Workers who may be exposed to unique or special hazards shall be provided additional training. The level of training provided shall be consistent with the employee's job function and responsibilities.

(3) On-site management and supervisors directly responsible for or who supervise employees engaged in hazardous waste operations shall receive training as provided in paragraph (e)(1) and (e)(2) of this section and at least eight additional hours of specialized training on managing such operations at the time of job assignment.

(4) Trainers shall have received a level of training higher than and including the subject matter of the level of instruction that they are providing.

(5) Employees shall not participate in field activities until they have been trained to a level required by their job function and responsibility.

(6) Employees and supervisors that have received and successfully completed the training and field experience specified in paragraphs (e)(1), (e)(2), and (e)(3) of this section shall be certified by their instructor as having completed the necessary training. Any person who has not been so certified or meets the requirements of paragraph (e)(1) of this section shall be prohibited from engaging in hazardous waste operations after March 16, 1987.

(7) Employees who are responsible for responding to hazardous emergency situations that may expose them to hazardous substances shall be trained in how to respond to expected emergencies.

(8) Employees specified in paragraph (e)(1) and managers specified in paragraph (e)(3) of this section shall receive eight hours of refresher training annually on the items specified in paragraph (e)(1) of this section and other relevant topics.

(9) Employers who can show by an employee's work experience and/or training that the employee has had initial training equivalent to that training required in paragraphs (e)(1), (e)(2), and (e)(3) of this section shall be considered as meeting the initial training requirements of those paragraphs. Equivalent training includes the training that existing employees might have already received from actual, on-site experience.

(f) *Medical surveillance*—(1) *Employees covered.* A medical surveillance program shall be instituted by the employer for:

(i) all employees who are or may be exposed to hazardous substances or health hazards at or above the established permissible exposure limits for these substances, without regard to the use of respirators, for 30 days or more a year, or

(ii) all employees who wear a respirator for 30 days or more a year, or

(iii) HAZMAT employees specified in paragraph (1)(4) of this section while engaged in hazardous waste operations covered by this section.

(iv) The employer shall make medical examinations or consultations available to all employees who may have been exposed in an emergency situation to hazardous substances at concentrations above the permissible exposure limits.

2) *Frequency of medical xaminations and consultations.* Medical examinations and consultations shall also be made available by the employer to each employee covered under paragraph (f)(1) of this section on the following schedules:

(i) Prior to assignment or for employees covered on the effective date of this standard as specified in paragraph (p) of this section.

(ii) At least once every twelve months for each employee covered.

(iii) At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months.

(iv) As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards

(v) At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary.

(3) *Content of medical examinations and consultations.* (i) Medical xaminations required by paragraph '2) of this section shall include a edical and work history with special mphasis on symptoms related to the handling of hazardous substances and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

(ii) The content of medical examinations or consultations made available to employees pursuant to paragraph (f) shall be determined by the examining physician.

(4) *Examination by a physician and costs.* All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

(5) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and its appendices.

(ii) A description of the employee's duties as they relate to the employee's exposures.

(iii) The employee's exposure levels or anticipated exposure levels.

(iv) A description of any personal tective equipment used or to be used.

(v) Information from previous medical examinations of the employee which is not readily available to the examining physician.

(6) *Physician's written opinion.* (i) The employer shall obtain and furnish the employee with a copy of a written opinion from the examining physician containing the following:

(A) The results of the medical examination and tests.

(B) The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health.

(C) The physician's recommended limitations upon the employees assigned work.

(D) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(ii) The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to occupational exposure.

(7) *Recordkeeping.* (i) An accurate record of the medical surveillance required by paragraph (f)(1) of this section shall be retained. This record shall be retained for the period specified and meet the criteria of 29 CFR 1910.20.

(ii) The record required in paragraph (f)(5)(i) of this section shall include at least the following information:

(A) The name and social security number of the employee;

(B) Physicians' written opinions;

(C) Any employee medical complaints related to exposure to hazardous substances;

(D) A copy of the information which shall be provided to the examining physician by the employer, with the exception of the standard and its appendices.

(iii) The employer shall ensure that this record is retained for the period specified in 29 CFR 1910.20.

(g) *Engineering controls, work practices, and personal protective equipment for employee protection*—(1) *Engineering controls, work practices and PPE.* (i) Engineering controls and work practices shall be instituted to reduce and maintain employee exposure to or below the permissible exposure limits of those hazardous substances regulated by 29 CFR Part 1910, Subpart Z, except to the extent that such controls and practices are not feasible.

Note.—Engineering controls which may be feasible are the use of pressurized cabs or control booths on equipment, and/or the use of remotely operated material handling equipment. Work practices which may be feasible are removing all nonessential employees from potential exposure during opening of drums, wetting down dusty operations and locating employees upwind of possible hazards.

(ii) Whenever engineering controls and work practices are not feasible, PPE shall be used to protect employees to reduce exposure to below established permissible exposure limits.

(iii) The employer shall not implement a schedule of employee rotation as a means of compliance with permissible exposure limits.

(2) *Engineering controls, work practices, and personal protective equipment for substances not regulated in Subpart Z.* An appropriate combination of engineering controls, work practices, and personal protective equipment shall be established to reduce and maintain employee exposure to or below the established permissible exposure limit for hazardous substances not regulated by 29 CFR Part 1910, Subpart Z and health hazards.

(3) *Personal protective equipment selection.* (i) Personal protective equipment (PPE) shall be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis.

(ii) Personal protective equipment selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

(iii) Positive pressure self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply shall be used in IDLH conditions.

(iv) Totally-encapsulating chemical protective suits (Level A protection) shall be used in conditions where contact of the skin by the hazardous substance may result in an IDLH situation.

(v) The level of protection provided by PPE selection shall be increased when additional information or site conditions show that increased protection is necessary to reduce employee exposure below established permissible exposure limits for hazardous substance and health hazards. (See Appendix B for guidance on selecting PPE ensembles.)

Note.—The level of protection provided may be decreased when additional information or site conditions show that decreased protection will not result in hazardous exposures to employees.

(vi) Personal protective equipment shall be selected and used to meet the requirements of 29 CFR Part 1910.

Subpart I, and additional requirements specified in this section.

(4) *Totally-encapsulating chemical protective suits.* (i) Totally-encapsulating suit materials used for Level A protection shall protect employees from the particular hazards which are identified during site characterization and analysis.

(ii) Totally-encapsulating suits shall be capable of maintaining positive air pressure. (See Appendix A.)

(iii) Totally-encapsulating suits shall be capable of preventing inward test gas leakage of more than 0.5 percent. (See Appendix A.)

(5) *Personal protective equipment (PPE) program.* A personal protective equipment program shall be established for hazardous waste operations. The PPE program shall address the following elements:

(i) Site hazards.

(ii) PPE selection.

(iii) PPE use.

(iv) Work mission duration.

(v) PPE maintenance and storage.

(vi) PPE decontamination.

(vii) PPE training and proper fitting.

(viii) PPE donning and doffing procedures.

(ix) PPE inspection.

(x) PPE in-use monitoring.

(xi) Evaluation of the effectiveness of the PPE program, and

(xii) Limitations during temperature extremes.

(h) *Monitoring.* (1) Air monitoring shall be used to identify and quantify airborne levels of hazardous substances in order to determine the appropriate level of employee protection needed on site.

(2) As a first step, air monitoring shall be conducted to identify any IDLH and other dangerous situations, such as the presence of flammable atmospheres, oxygen-deficient environments, toxic levels of airborne contaminants, and radioactive materials.

(3) As a minimum, periodic monitoring shall be conducted when:

(i) Work begins on a different portion of the site.

(ii) Contaminants other than those previously identified are being handled.

(iii) A different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling.)

(iv) Employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon.)

(4) High-risk employees, e.g., those closest to the source of contaminant generation, shall receive personal monitoring sufficient to characterize employee exposure.

(i) *Informational programs*—(1) *General.* As part of the safety and health program required in paragraph (b)(1) of this section, the employer shall develop and implement a site safety and health plan meeting the requirements of paragraph (i)(2) of this section for each hazardous waste operation.

(2) *Site safety and health plan.* The site safety and health plan, which shall be available on the site for inspection by employees, their designated representatives, and OSHA personnel, shall address the safety and health hazards of each phase of site operation and include the requirements and procedures for employee protection.

(i) The site safety and health plan, as a minimum, shall address the following:

(A) Names of key personnel and alternates responsible for site safety and health and appointment of a site safety and health officer.

(B) A safety and health risk analysis for each site task and operation.

(C) Employee training assignments.

(D) Personal protective equipment to be used by employees for each of the site tasks and operations being conducted.

(E) Medical surveillance requirements.

(F) Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used. Methods of maintenance and calibration of monitoring and sampling equipment to be used.

(G) Site control measures.

(H) Decontamination procedures.

(I) Site's standard operating procedures.

(J) A contingency plan meeting the requirements of paragraphs (l)(1) and (l)(2) of this section for safe and effective responses to emergencies including the necessary PPE and other equipment.

(K) Confined-space entry procedures.

(ii) Pre-entry briefings shall be held prior to initiating any site activity and at such other times as necessary to ensure that employees are apprised of the site safety and health plan and that it is being followed.

(iii) Inspections shall be conducted by the site safety and health officer or, in the absence of that individual, another individual acting on behalf of the employer as necessary to determine the effectiveness of the site safety and health plan. Any deficiencies in the effectiveness of the site safety and health plan shall be corrected by the employer.

(j) *Handling drums and containers*—(1) *General.* (i) Drums and containers used during the clean-up shall meet the appropriate DOT, OSHA, and EPA regulations for the wastes that they contain.

(ii) Drums and containers shall be inspected and their integrity shall be assured prior to being moved. Drums or containers that cannot be inspected before being moved because of inaccessible storage conditions shall be moved to an accessible location and inspected prior to further handling.

(iii) Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

(iv) Site operations shall be organized to minimize the amount of drum or container movement.

(v) Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers.

(vi) U.S. Department of Transportation specified salvage drums or containers and suitable quantities of proper absorbent shall be kept available and used in areas where spills, leaks, or ruptures may occur.

(vii) Where major spills may occur, a spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

(viii) Drums and containers that cannot be moved without rupture, leakage, or spillage shall be emptied into a sound container using a device classified for the material being transferred.

(ix) A ground-penetrating system or other type of detection system or device shall be used to estimate the location and depth of drums or containers.

(x) Soil or covering material shall be removed with caution to prevent drum or container rupture.

(xi) Fire extinguishing equipment meeting the requirements of 29 CFR Part 1910, Subpart L shall be on hand and ready for use to control small fires.

(2) *Opening drums and containers.* The following procedures shall be followed in areas where drums or containers are being opened:

(i) Where an airline respirator system is used, connections to the bank of air cylinders shall be protected from contamination and the entire system shall be protected from physical damage.

(ii) Employees not actually involved in opening drums or containers shall be kept a safe distance from the drums or containers being opened.

(iii) If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation shall be placed between the employee and the drums or containers being opened to protect the employee in case of accidental explosion.

(iv) Controls for drum or container opening equipment, monitoring equipment, and fire suppression equipment shall be located behind the explosion-resistant barrier.

(v) Material handling equipment and hand tools shall be of the type to prevent sources of ignition.

(vi) Drums and containers shall be opened in such a manner that excess interior pressure will be safely relieved. If pressure cannot be relieved from a remote location, appropriate shielding shall be placed between the employee and the drums or containers to reduce the risk of employee injury.

(vii) Employees shall not stand upon or work from drums or containers.

(3) *Electrical material handling equipment.* Electrical material handling equipment used to transfer drums and containers shall:

(i) Be positioned and operated to minimize sources of ignition related to the equipment from igniting vapors released from ruptured drums or containers, or

(ii) Meet the requirements of 29 CFR 1910.307 and be of the appropriate electrical classification for the materials being handled.

(4) *Radioactive wastes.* Drums and containers containing radioactive wastes shall not be handled until such time as their hazard to employees is properly assessed.

(5) *Shock sensitive wastes.*

Caution: Shipping of shock sensitive wastes may be prohibited under U.S. Department of Transportation regulations. Employers and their shippers should refer to 49 CFR 173.21 and 173.50.

As a minimum, the following special precautions shall be taken when drums and containers containing or suspected of containing shock-sensitive wastes are handled:

(i) All non-essential employees shall be evacuated from the area of transfer.

(ii) Material handling equipment shall be provided with explosive containment devices or protective shields to protect equipment operators from exploding containers.

(iii) An employee alarm system capable of being perceived above surrounding light and noise conditions shall be used to signal the commencement and completion of explosive waste handling activities.

(iv) Continuous communications (i.e., portable radios, hand signals, telephones, as appropriate) shall be maintained between the employee-in-charge of the immediate handling area and the site safety officer or command post until such time as the handling operation is completed. Communication equipment or methods that could cause shock sensitive materials to explode shall not be used.

(v) Drums and containers under pressure, as evidenced by bulging or swelling, shall not be moved until such time as the cause for excess pressure is determined and appropriate containment procedures have been implemented to protect employees from explosive relief of the drum.

(vi) Drums and containers containing packaged laboratory wastes shall be considered to contain shock-sensitive or explosive materials until they have been characterized.

(6) *Laboratory waste packs.* In addition to the requirements of paragraph (j)(5) of this section, the following precautions shall be taken, as a minimum, in handling laboratory waste packs (lab packs):

(i) Lab packs shall be opened only when necessary and then only by an individual knowledgeable in the inspection, classification, and segregation of the containers within the pack according the hazards of the wastes.

(ii) If crystalline material is noted on any container, the contents shall be handled as a shock-sensitive waste until the contents are identified.

(7) *Sampling drums and containers.* Sampling of containers and drums shall be done in accordance with a sampling procedure which is part of the site safety and health plan developed for and available to employees and others at the specific worksite.

(8) *Shipping and transport.* (i) Drums and containers shall be identified and classified prior to packaging for shipment.

(ii) Drum or container staging areas shall be kept to the minimum number necessary to safely identify and classify materials and prepare them for transport.

(iii) Staging areas shall be provided with adequate access and egress routes.

(iv) Bulking of hazardous wastes shall be permitted only after a thorough characterization of the materials has been completed.

(9) *Tank and vault procedures.* (i) Tanks and vaults containing hazardous substances shall be handled in a manner similar to that for drums and containers, taking into consideration the size of the tank or vault.

(ii) Appropriate tank or vault entry procedures meeting paragraph (i)(2)(i)(K) of this section shall be followed whenever employees must enter a tank or vault.

(k) *Decontamination.* (1) A decontamination procedure shall be developed, communicated to employees and implemented before any employees or equipment may enter areas on site where potential for exposure to hazardous substances exists.

(2) Standard operating procedures shall be developed to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances.

(3) Decontamination shall be performed in areas that will minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment.

(4) All employees leaving a contaminated area shall be appropriately decontaminated; all clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated.

(5) Decontamination procedures shall be monitored by the site safety and health officer to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies.

(6) All equipment and solvents used for decontamination shall be decontaminated or disposed of properly.

(7) Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.

(8) Impermeable protective clothing which contacts or is likely to have contacted hazardous substances shall be decontaminated before being removed by the employee.

(9) Employees whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.

(10) Unauthorized employees shall not remove protective clothing or equipment from change rooms.

(11) Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances.

(12) Where the decontamination procedure indicates a need for showers and change rooms, they shall be provided and meet the requirements of 29 CFR 1910.141.

(l) *Emergency response—*(1) *General.* (i) An emergency response plan shall be developed and implemented to handle anticipated on-site emergencies prior to the commencement of hazardous waste operations. Emergency response activities to all other hazardous waste operations shall follow an emergency response plan meeting the requirements of this section.

(ii) *Elements of an emergency response plan.* The employer shall develop an emergency response plan for on-site and off-site emergencies which shall address, as a minimum, the following:

(A) Pre-emergency planning.

(B) Personnel roles, lines of authority, training, and communication.

(C) Emergency recognition and prevention.

(D) Safe distances and places of refuge.

(E) Site security and control.

(F) Evacuation routes and procedures.

(G) Decontamination.

(H) Emergency medical treatment and first aid.

(I) Emergency alerting and response procedures.

(J) Critique of response and follow-up.

(K) PPE and emergency equipment.

(2) *On-site emergency response*—(i) *Training.* Training for site emergency response shall be conducted in accordance with paragraph (e) of this section.

(ii) *Procedures for handling site emergency incidents.* (A) In addition to the elements for the emergency response plan required in paragraph (l)(1)(ii) above, the following elements shall be included for site emergency response plans:

(*1*) Site topography, layout, and prevailing weather conditions.

(*2*) Procedures for reporting incidents to local, state, and federal governmental agencies.

(B) The site emergency response plan shall be a separate section of the Site Safety and Health Plan.

(C) The site emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

(D) The site emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

(E) The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.

(F) An employee alarm system shall be installed in accordance with 29 CFR 1910.165 to notify employees of an on-site emergency situation, to stop work activities if necessary, to lower background noise in order to speed communication, and to begin emergency procedures.

(G) Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the on-site emergency response plan.

(3) *Off-site emergency response*—(i) *Training.* Training for handling emergency responses involving hazardous substances shall be conducted on a monthly basis and shall be at least 24 hours annually. The training shall include as a minimum recognition of hazards, selection, care, and use of personal protective equipment and safe operating procedures to be used at the incident scene.

(ii) *Procedures for handling off-site emergency incidents.* (A) The senior officer responding to an incident involving a hazardous substance or waste shall establish an Incident Command System (ICS). All emergency responders and their communications shall be coordinated and controlled through the individual in charge of the ICS.

(B) The individual in charge of the ICS shall identify, to the extent possible, all hazardous substances or conditions present.

(C) Based on the hazardous substances and/or conditions present, the individual in charge of the ICS shall implement appropriate emergency operations, and assure that the personal protective equipment worn is appropriate for the hazards to be encountered. However, personal protective equipment shall meet, at a minimum, the criteria contained in 29 CFR 1910.156(e) when worn while performing fire fighting operations beyond the incipient stage.

(D) Self-contained breathing apparatus shall be worn at all times during emergency operations involving exposure to hazardous substances or health hazards. After October 18, 1988 only positive pressure self-contained respirators shall be used.

(E) The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site to those who are actively performing emergency operations. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more.

(F) Back-up personnel shall be standing by with equipment ready to provide assistance or rescue. Qualified basic life support personnel, as a minimum, shall also be standing by with medical equipment and transportation capability.

(G) The individual in charge of the ICS shall designate a safety officer, who is knowledgeable in fire fighting or rescue operations and hazardous substance handling procedures, with specific responsibility to identify and evaluate hazards and to provide direction with respect to the safety of operations for the emergency at hand.

(H) When activities are judged by the safety officer to be unsafe and/or to involve an imminent danger condition, the safety officer shall have the authority to alter, suspend, or terminate those activities. The safety officer shall immediately inform the individual in charge of the ICS of any actions taken to correct these hazards at an emergency scene.

(I) After emergency operations have terminated, the individual in charge of the ICS shall implement appropriate decontamination procedures.

(4) *Hazardous materials teams (HAZMAT).* (i) Employees who are members of the HAZMAT team, employees designated by the employer to plug, patch or otherwise temporarily control or stop leaks from containers which hold hazardous substances or health hazards shall be given training in accordance with paragraph (l)(3) of this section that includes the care and use of chemical protective clothing and procedures to be followed when working on leaking drums, containers, tanks, or bulk transport vehicles.

(ii) Members of HAZMAT teams shall receive an annual physical examination by a licensed physician and be provided medical surveillance as required in paragraph (f) of this section.

(iii) Personal protective clothing and equipment to be used by HAZMAT team members shall meet the requirements of paragraph (g) of this section.

(iv) Approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus shall meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.

(5) *Post-emergency response operations.* Upon completion of the emergency response, if it is determined that it is necessary to remove hazardous substances, health hazards and materials contaminated with them such

as contaminated soil or other elements of the natural environment, then such operations shall meet all the requirements of paragraphs (b) through (n) of this section.

(m) *Illumination.* Work areas shall be lighted to not less than the minimum illumination intensities listed in Table H-102.1 while any work is in progress:

TABLE H-102.1.—MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

Foot-candles	Area or operations
5	General site areas.
3	Excavation and waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways.
5	Tunnels, shafts, and general underground work areas (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading.
10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.
30	First aid stations, infirmaries, and offices.

(n) *Sanitation at temporary orkplaces*—(1) *Potable water.* (i) An equate supply of potable water shall e provided on the site.

(ii) Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers.

(iii) Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.

(iv) Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

(2) *Nonpotable water.* (i) Outlets for nonpotable water, such as water for industrial or firefighting purposes shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.

(ii) There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing nonpotable water.

(3) *Toilets facilities.* (i) Toilets shall be provided for employees according to Table H-102.2.

TABLE H-102.2.—TOILET FACILITIES

Number of employees	Minimum number of facilities
20 or fewer	One
More than 20, fewer than 200	One toilet seat and 1 urinal per 40 employees.
More than 200	One toilet seat and 1 urinal per 50 employees

(ii) Under temporary field conditions, provisions shall be made to assure not less than one toilet facility is available.

(iii) Hazardous waste sites, not provided with a sanitary sewer, shall be provided with the following toilet facilities unless prohibited by local codes:

(A) Privies;

(B) Chemical toilets;

(C) Recirculating toilets; or

(D) Combustion toilets.

(iv) The requirements of this paragraph for sanitation facilities shall not apply to mobile crews having transportation readily available to nearby toilet facilities.

(4) *Food handling.* All employees' food service facilities and operations shall meet the applicable laws, ordinances, and regulations of the jurisdictions in which they are located.

(5) *Temporary sleeping quarters.* When temporary sleeping quarters are provided, they shall be heated, ventilated, and lighted.

(6) *Washing facilities.* The employer shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees. Such facilities shall be in near proximity to the worksite, within controlled access work zones and shall be so equipped as to enable employees to remove hazardous substances.

(o) *Certain Operations Conducted under the Resource Conservation and Recovery Act of 1976 (RCRA).* Employees conducting operations specified in paragraph (g)(2)(iii) of this section shall:

(1) Implement a hazard communication program meeting the requirements of 29 CFR 1910.1200;

(2) Implement a medical surveillance program meeting the requirements of paragraph (f) of this section;

(3) Develop and implement a safety and health program for employees involved in hazardous waste operations. The program shall be designed to identify, evaluate and control safety and health hazards and provide for emergency response to their facilities for the purpose of employee protection;

(4) Develop and implement a decontamination procedure in accordance with paragraph (k) of this section, and

(5) Develop and implement a training program for employees involved with hazardous waste operations to enable each employee to perform their assigned duties and functions in a safe and healthful manner so as not to endanger themselves or other employees. The initial training shall be for 24 hours and refresher training shall be for eight hours annually.

(p) *Start-up dates*—(1) *Training and medical provisions.* Initial training and medical surveillance as specified by paragraph (e) and (f) of this section shall be commenced on the effective date of this standard, and be fully implemented as soon as possible but no later than March 16, 1987. Employees may continue in their work assignments until March 16, 1987 though training and medical examinations have not been completed so long as all feasible training and examinations have been completed.

(2) *Safety and health program.* The employer shall develop and implement a safety and health program as required by paragraph (b)(1) of this section as soon as is feasible and have it completed and implemented no later than March 16, 1987.

(3) *Engineering controls, work practices, and personal protective equipment.* (i) The engineering controls, work practices and personal protective equipment required by paragraph (g)(2) of this section shall be implemented as soon as feasible and implementation shall be completed no later than March 16, 1987.

(ii) The engineering controls, work practices and personal protective equipment required by paragraph (g)(1) of this section are existing requirements of other OSHA standards and continues to be required from the effective date of this standard.

(4) *Site safety and health plan.* The site safety and health plan required by paragraph (i)(2) of this section shall be completed as soon as feasible but no later than February 16, 1987.

(5) *Certain operations conducted under RCRA.* The requirements specified by paragraph (o) of this section shall be instituted by March 16, 1987.

(6) *Other requirements.* Requirements of this standard which do not have a separate start-up date and have not been required by other OSHA standards shall be carried out from the effective date of this standard.

(7) *New operations.* Operations covered by this section which are started after March 16, 1987, shall be in compliance with this section from the start of their operation.

Appendices to § 1910.120—Hazardous Waste Operations and Emergency Response

Note.—*The following appendices serve as non-mandatory guidelines to assist employees and employers in complying with the appropriate requirements of this section.*

Appendix A—Personal Protective Equipment Test Methods

This appendix sets forth the non-mandatory examples of tests which may be used to evaluate compliance with paragraphs 1910.120(g)(4) (ii) and (iii). Other tests and other challenge agents may be used to evaluate compliance.

A. Fully-Encapsulated Suit Pressure Test

1.0—Scope

1.1 This practice measures the ability of a gas tight totally-encapsulating chemical protective suit material, seams, and closures to maintain a fixed positive pressure. The results of this practice allow the gas tight integrity of a total-encapsulating chemical protective suit to be evaluated.

1.2 Resistance of the suit materials to permeation, penetration, and degradation by specific hazardous substances is not determined by this test method.

2.0—Description of Terms

2.1 Totally-encapsulated chemical protective suit (TECP suit)—A full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, and legs; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer by itself or in combination with the wearer's respiratory equipment, gloves, and boots.

2.2 Protective clothing material—Any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.

2.3 "Gas tight"—for the purpose of this practice the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.

2.4 "Shall"—This term indicates a mandatory requirement.

2.5 "Should"—This term indicates a recommendation or that which is advised but not required.

2.6 "May"—This term is used to state a permissive use or an alternative method to a specific requirement.

3.0—Summary of Practice

3.1 The TECP suit is visually inspected and modified for the test. The test apparatus is attached to the suit to permit inflation to the pre-test suit expansion pressure for removal of suit wrinkles and creases. The pressure is lowered to the test pressure and monitored for three minutes. If the pressure drop is excessive, the TECP suit fails the tests and is removed from service. After leak location and repair the test is repeated.

4.0—Required Supplies

4.1 Source of compressed air.

4.2 Test apparatus for suit testing including a pressure measurement device with a sensitivity of at least ¼ inch-water gauge.

4.3 Vent valve closure plugs or sealing tape.

4.4 Soapy water solution and soft brush.

4.5 Stop watch or appropriate timing device.

5.0—Safety Precautions

5.1 Care shall be taken to provide the correct pressure safety devices required for the source of compressed air used.

6.0—Test Procedure

6.1 Prior to each test, the tester shall perform a visual inspection of the suit. Check the suit for seam integrity by visually examining the seams and gently pulling on the seams. Ensure that all air supply lines, fittings, visor, zippers, and valves are secure and show no signs of deterioration.

6.1.1 Seal off the vent valves along with any other normal inlet or exhaust points (such as umbilical air line fittings or face piece opening) with tape or other appropriate means (caps, plugs, fixture, etc.). Care should be exercised in the sealing process not to damage any of the suit components.

6.1.2 Close all closure assemblies.

6.1.3 Prepare the suit for inflation by providing an improvised connection point on the suit for connecting an airline. Attach the pressure test apparatus to the suit to permit suit inflation from a compressed air source equipped with a pressure indicating regulator. The leak tightness of the pressure test apparatus should be tested before and after each test by closing off the end of the tubing attached to the suit and assuring a pressure of three inches water gauge for three minutes can be maintained. If a component is removed for the test, that component shall be replaced and a second test conducted with another component removed to permit a complete tests of the ensemble.

6.1.4 The pre-test expansion pressure (A) and the suit test pressure (B) shall be supplied by the suit manufacturer but in no case shall they be less than: A=3 inches water gauge and B=2 inches water gauge. The ending suit pressure (C) shall be no less than 80% (⅘) of the test pressure (B); i.e., the pressure drop shall not exceed 20% (⅕) of the test pressure (B).

6.1.5 Inflate the suit until the pressure inside is equal to pressure "A", the pre-test expansion suit pressure. Allow at least one minute to fill out the wrinkles in the suit. Release sufficient air to reduce the suit pressure to pressure "B", the suit test pressure. Begin timing. At the end of three minutes, record the suit pressure as pressure "C," the ending suit pressure, The difference between the suit test pressure and the ending suit test pressure (B−C) shall be defined as the suit pressure drop.

6.1.6 If the suit pressure drop is more than 20 percent (⅕) of the suit test pressure B during the three minute test period, the suit fails the test and shall be removed from service.

7.0—Retest Procedure

7.1 If the suit fails the test check for leaks by inflating the suit to pressure A and brushing or wiping the entire suit (including seams, closures, lens gaskets, glove-to-sleeve joints, etc.) with a mild soap and water solution. Observe the suit for the formation of soap bubbles, which is an indication of a leak. Repair all identified leaks.

7.2 Retest the TECP suit as outlined in Test procedure 6.0.

8.0—Report

8.1 Each TECP suit tested by this practice shall have the following information recorded.

8.1.1 Unique identification number identifying brand name, date of purchase, material of construction, and unique fit features; e.g., special breathing apparatus.

8.1.2 The actual values for test pressures, A, B, and C shall be recorded along with the specific observation times. If the ending pressure (C) is less than 80% of the test pressure (B) the suit shall be identified as failing the test. When possible, the specific leak location shall be identified in the test records. Retest pressure data shall be recorded as an additional test.

8.1.3 The source of the test apparatus used shall be identified and the sensitivity of the pressure gauge shall be recorded.

8.1.4 Records shall be kept for each pressure test even if repairs are being made at the test location.

Caution

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked.

Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.

B. Fully-Encapsulated Suit Qualitative Leak Test

1.0—Scope

1.1 This practice semi-qualitatively tests gas tight totally-encapsulating chemical protective suit integrity by detecting inward leakage of ammonia vapor. Since no modifications are made to the suit to carry out this test, the results from this practice provide a realistic test for the integrity of the entire suit.

1.2 Resistance of the suit materials to permeation, penetration, and degradation is not determined by this test method.

2.0—Description of Terms

2.1 Totally-encapsulated chemical protective suit (TECP suit)—A full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, and legs; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer by itself or in combination with the wearer's respiratory equipment, gloves, and boots.

2.2 Protective clothing material—Any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.

2.3 "Gas tight"—for the purpose of this practice the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.

2.4 "Shall"—This term indicates a mandatory requirement.

2.5 "Should"—This term indicates a recommendation or that which is advised but not required.

2.6 "May"—This term is used to state a permissive use or an alternative method to a specific requirement.

2.7 Intrusion Coefficient—A number expressing the level of protection provided by a gas tight totally-encapsulating chemical protective suit. The intrusion coefficient is calculated by dividing the test room challenge agent concentration by the concentration of challenge agent found inside the suit. The accuracy of the intrusion coefficient is dependent on the challenge agent monitoring methods. The larger the intrusion coefficient the greater the protection provided by the TECP suit.

3.0—Summary of Recommended Practice

3.1 The volume of ammonia solution required to generate the test atmosphere is determined using the directions outlined in 6.1 The suit is donned by a person wearing the appropriate respiratory equipment (normally a self-contained breathing apparatus) and worn inside the enclosed test room. The ammonia solution is taken by the suited individual into the test room and oured into an open plastic pan. A two- nute evaporation period is observed before e test room concentration is measured ng a high range ammonia length of stain detector tube When the ammonia reaches a concentration of between 1000 and 1200 ppm, the suited individual starts a standardized exercise protocol to stress and flex the suit. After this protocol is completed the test room concentration is measured again. The suited individual exits the test room and his stand-by person measures the ammonia concentration inside the suit using a low range ammonia length of stain detector tube or other more sensitive ammonia detector. A stand-by person is required to observe the test individual during the test procedure, aid the person in donning and doffing the TECP suit and monitor the suit interior. The intrusion coefficient of the suit can be calculated by dividing the average test area concentration by the interior suit concentration. A colorimetric indicator strip of bromophenol blue is placed on the inside of the suit face piece lens so that the suited individual is able to detect a color change and know if the suit has a significant leak. If a color change is observed the individual should leave the test room immediately.

4.0—Required Supplies

4.1 A supply of concentrated ammonia (58 percent ammonium hydroxide by weight).

4.2 A supply of bromophenol/blue indicating paper, sensitive to 5–10 ppm ammonia or greater over a two-minute period of exposure.

A supply of high range (0.5–10 volume ent) and low range (5–700 ppm) detector es for ammonia and the corresponding sampling pump. More sensitive ammonia detectors can be substituted for the low range detector tubes to improve the sensitivity of this practice.

4.4 A plastic pan (PVC) at least 12":14".1" and a half pint plastic container (PVC) with tightly closing lid.

4.5 Volumetric measuring device of at least 50 milliliters in volume with an accuracy of at least ±1 milliliters.

5.0—Safety Precautions

5.1 Concentrated ammonia is a corrosive volatile liquid requiring eye, skin, and respiratory protection.

5.2 Since the threshold limit value for ammonia is 25 ppm, only persons wearing the appropriate respirator protection shall be in the chamber. Normally only the person wearing the total-encapsulating suit will be inside the chamber. A stand-by person shall have a self-contained breathing apparatus, or equivalent breathing apparatus, available to enter the test area should the suited individual need assistance.

5.3 A method to monitor the suited individual must be used during this test. Visual contact is the simplest but other methods using communication devices are acceptable.

5.4 The test room shall be large enough to allow the exercise protocol to be carried out and ventilated to allow for easy exhaust of the ammonia test atmosphere after the test(s) are completed.

5.5 Individuals shall be medically screened for the use of respiratory protection and checked for allergies to ammonia before participating in this test procedure.

6.0—Test Procedure

6.1.1 Measure the test area to the nearest foot and calculate its volume in cubic feet. Multiply the test area volume by 0.2 milliliters of ammonia per cubic foot of test area volume to determine the approximate volume of ammonia required to generate 1000 ppm in the test area.

6.1.2 Measure this volume from the supply of concentrated ammonia and place it into a closed plastic container.

6.1.3 Place the jar, several high range ammonia detector tubes and the pump in the clean test pan and locate it near the test area entry door so that the suited individual has easy access to these supplies.

6.2.1 In a non-contaminated atmosphere, open a presealed ammonia indicator strip and fasten one end of the strip to the inside of suit face shield lens where it can be seen by the wearer. Care shall be taken not to contaminate the detector part of the indicator paper by touching it. A small piece of masking tape or equivalent should be used to attach the indicator strip to the interior of the suit face shield.

6.2.2 If problems are encountered with this method of attachment the indicator strip can be attached to the outside of the respirator face piece being used during the test, assuming the face piece is worn within the TECP suit.

6.3 Don the respiratory protective device normally used with the suit; and then don the TECP suit to be tested. Check to be sure all openings which are intended to be sealed (zippers, gloves, etc.) are completely sealed DO NOT, however, plug off any venting valves.

6.4 Step into the enclosed test room such as a closet, bathroom, or test booth, equipped with an exhaust fan. No air should be exhausted from the chamber during the test because this will dilute the ammonia challenge concentrations.

6.5 Open the container with the pre-measured volume of ammonia within the enclosed test room, and pour the liquid into the empty plastic test pan. Wait two minutes to allow for adequate volatilization of the ammonia. A small mixing fan can be used near the evaporation pan to increase the evaporation rate of ammonia.

6.6 After two minutes a determination of the ammonia concentration within the chamber should be made using the high range colorimetric detector tube. A concentration of 1000 ppm ammonia or greater shall be generated before the exercises are started.

6.7 To test the integrity of the suit the following four minute exercise protocol should be followed:

6.7.1 Raising the arms above the head with at least 15 raising motions completed in one minute.

6.7.2 Walking in place for one minute with at least 15 raising motions of each leg in a one-minute period.

6.7.3 Touching the toes with a least 10 complete motions of the arms from above the head to touching of the toes in a one-minute period.

6.7.4 Deep knee bends with at least 10 complete standing and squatting motions in a one-minute period.

6.8 At any time during the test should the colorimetric indicating paper change colors the test should be stopped and section 6.10 and 6.12 initiated.

6.9 After completion of the test exercise, the test area concentration should be measured again using the high range colorimetric detector tube.

6.10 Exit the test area.

6.11 The opening created by the suit zipper or other appropriate suit penetration should be used to determine the ammonia concentration in the suit with the low range length of stain detector tube or other ammonia monitor. The internal TECP suit air should be sampled far enough from the enclosed test area to prevent a false ammonia reading.

6.12 After completion of the measurement of the suit interior ammonia concentration the test is concluded and the suit is doffed and the respirator removed.

6.13 The ventilating fan for the test room should be turned on and allowed to run for enough time to remove the ammonia gas.

6.14 Any detectable ammonia in the suit interior (5 ppm NH_3 or more for the length of stain detector tube) indicates the suit fails the test When other ammonia detectors are used, a lower level of detection is possible and it should be specified as the pass fail criteria.

6.15 By following this practice an intrusion coefficient of approximately 200 or more can be measured with the suit in a completely operational condition.

7.0—Retest Procedures

7.1 If the suit fails this test check for leaks by following the pressure test in test A above.

7.2 Retest the TECP suit as outlined in the test procedure 6.0.

8.0—Report:

8.1 Each gas tight totally-encapsulating chemical protective suit tested by this practice shall have the following information recorded.

8.1.1 Unique identification number identifying brand name, date of purchase, material of construction, and unique suit features; e.g., special breathing apparatus.

8.1.2 General description of test room used for test.

8.1.3 Brand name and purchase date of ammonia detector strips.

8.1.4 Brand name, sampling range, and expiration date of the length of stain ammonia detector tubes. The brand name and model of the sampling pump should also be recorded. If another type of ammonia detector is used, it should be identified along with its minimum detection limit for ammonia.

8.1.5 Actual test results shall list the two test area concentrations, their average, the interior suit concentration, and the calculated intrusion coefficient. Retest data shall be recorded as an additional test.

8.2 The evaluation of the data shall be specified as "suit passed" or "suit failed" and the date of the test. Any detectable ammonia (5 ppm or greater for the length of stain detector tube) in the suit interior indicates the suit fails this test. When other ammonia detectors are used, a lower level of detection is possible and it should be specified as the pass fail criteria.

Caution

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked.

Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.

Appendix B—General Description and Discussion of the Levels of Protection and Protective Gear

This appendix sets forth information about personal protective equipment (PPE) protection levels which may be used to assist employers in complying with the PPE requirements of this section.

As required by the standard, PPE must be selected which will protect employees from the specific hazards which they are likely to encounter during their work on-site.

Selection of the appropriate PPE is a complex process which must take into consideration a variety of factors. Key factors involved in this process are identification of the hazards, or suspected hazards, their routes of potential hazard to employees (inhalation, skin absorption, ingestion, and eye or skin contact), and the performance of the PPE *materials* (e d seams) in providing a barrier to these hazards. The amount of protection provided by PPE is material-hazard specific. That is, protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, protective equipment materials cannot be found which will provide continuous protection from the particular hazardous substance. In these cases the breakthrough time of the protective material should exceed the work durations, or the exposure after breakthrough must not pose a hazardous level.

Other factors in this selection process to be considered are matching the PPE to the employee's work requirements and task-specific conditions. The durability of PPE materials, such as tear strength and seam strength, in relation to the employee's tasks must be considered. The effects of PPE in relation to heat stress and task duration are a factor in selecting and using PPE. In some cases layers of PPE may be necessary to provide sufficient protection, or to protect expensive PPE inner garments, suits or equipment.

The more that is known about the hazards at the site, the easier the job of PPE selection becomes. As more information about the hazards and conditions at the site becomes available, the site supervisor can make decisions to up-grade or down-grade the level of PPE protection to match the tasks at hand.

The following are guidelines which an employer can use to begin the selection of the appropriate PPE. As noted above, the site information may suggest the use of combinations of PPE selected from the different protection levels (i.e., A, B, C, or D) as being more suitable to the hazards of the work. It should be cautioned that the listing below does not fully address the performance of the specific PPE material in relation to the specific hazards at the job site, and that PPE selection, evaluation and re-selection is an ongoing process until sufficient information about the hazards and PPE performance is obtained.

Part A. Personal protective equipment has been divided into four categories based on the degree of protection afforded and are as follows (See Part B of this appendix for further explanation of Levels A, B, C, and D hazards):

I. *Level A*—To be selected when the greatest level of skin, respiratory, and eye protection is required.

Level A equipment: used as appropriate

1. Pressure-demand, full face-piece self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Totally-encapsulating chemical-protective suit.
3. Coveralls.*
4. Long underwear.*
5. Gloves, outer, chemical-resistant.
6. Gloves, inner, chemical-resistant.
7. Boots, chemical-resistant, steel toe and shank.
8. Hard hat (under suit)*
9. Disposable protective suit, gloves and boots (Depending on suit construction, may be worn over totally-encapsulating suit).
10. Two-way radios (worn inside encapsulating suit).

*Optional, as applicable.

II. *Level B*—The highest level of respiratory protection is necessary but a lesser level of skin protection is needed.

Level B equipment: used as appropriate

1. Pressure-demand, full-facepiece self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls*.
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots, outer, chemical-resistant steel toe and shank.
7. Boot-covers, outer, chemical-resistant (disposable)*.
8. Hard hat.
9. Two-way radios (worn inside encapsulating suit).
10. Face shield.*

*Optional, as applicable.

III. *Level C*—The concentration(s) and type(s) of airborne substance(S) is known and the criteria for using air purifying respirators are met.

Level C equipment: used as appropriate

1. Full-face or half-mask, air purifying, canisterequipped respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls*.
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots (outer), chemical-resistant steel toe and shank*.
7. Boot-covers, outer, chemical-resistant (disposable)*.
8. Hard hat
9. Escape mask*
10. Two-way radios (worn under outside protective clothing).
11. Face shield*

*Optional, as applicable.

IV. *Level D*—A work uniform affording minimal protection: used for nuisance contamination only.

Level D equipment: used as appropriate

1. Coveralls.
2. Gloves*
3. Boots/shoes, chemical-resistant steel toe and shank.
4. Boots, outer, chemical-resistant (disposable)*.
5. Safety glasses or chemical splash goggles*.
6. Hard hat.
7. Escape mask*.
8. Face shield*.

*Optional, as applicable.

Part B. The types of hazards for which levels A, B, C, and D protection are appropriate are described below:

I. *Level A*—Level A protection should be used when:

1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of

atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin.

2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible, or

3. Operations must be conducted in confined, poorly ventilated areas and the absence of conditions requiring Level A have not yet been determined.

II. Level B protection should be used when:

1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection.

Note.—This involves atmospheres with IDLH concentrations of specific substances that do not represent a severe skin hazard; or that do not meet the criteria for use of air-purifying respirators.

2. The atmosphere contains less than 19.5 percent oxygen, or

3. The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

III. Level C protection should be used when:

1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin.

2. The types of air contaminants have been identified, concentrations measured, and a canister respirator is available that can remove the contaminants, and

3. All criteria for the use of air-purifying respirators are met.

IV. Level D protection should be used when:

1. The atmosphere contains no known hazard, and

2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Note.—As stated before combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

Appendix C—Compliance Guidelines

1. *Occupational Safety and Health Program.* Each hazardous waste site clean-up effort will require a site specific occupational safety and health program headed by the site coordinator or the employer's representative. The program will be designed for the protection of employees at the site. The program will need to be developed before work begins on the site and implemented as work proceeds. The program is to facilitate coordination and communication among personnel responsible for the various activities which will take place at the site. It will provide the overall means for planning and implementing the needed safety and health training and job orientation of employees, who will be working at the site. The program will provide the means for identifying and controlling worksite hazards and the means for monitoring program effectiveness. The program will need to cover the responsibilities and authority of the site coordinator for the safety and health of employees at the site, and the relationships with contractors or support services as to what each employer's safety and health responsibilities are for their employees on the site. Each contractor on the site needs to have its own safety and health program so structured that it will smoothly interface with the program of the site coordinator.

Each site safety and health program will need to include the following: (1) Policy statements of the line of authority and accountability for implementing the program, the objectives of the program and the role of the site safety and health officer or manager and staff; (2) means or methods for the development of procedures for identifying and controlling workplace hazards at the site; (3) means or methods for the development and communication to employees of the various plans, work rules, standard operating procedures and practices that pertain to individual employees and supervisors; (4) the training of supervisors and employees to develop the needed skills and knowledge to perform their work in a safe and healthful manner; (5) means to anticipate and prepare for emergency situations and; (6) information feedback to aid in evaluating the program and for improving the effectiveness of the program. The management and employees should be trying continually to improve the effectiveness of the program thereby enhancing the protection being afforded those working on the site.

Accidents on the site should be investigated to provide information on how such occurrences can be avoided in the future. When injuries or illnesses occur on the site, they will need to be investigated to determine what needs to be done to prevent this incident from occurring again. Such information will need to be used as feedback on the effectiveness of the program and the information turned into positive steps to prevent any reoccurrence. Receipt of employee suggestions or complaints relating to safety and health issues involved with site activities is also a feedback mechanism that needs to be used effectively to improve the program and may serve in part as an evaluative tool(s).

2. *Training.* The employer is encouraged to utilize those training programs that have been recognized by the National Institute of Environmental Health Sciences through its training grants program. These training and educational programs are being developed for the employees who work directly with hazardous substances. For further information about these programs contact: National Institute of Environmental Health Sciences, P.O. Box 12233, Research Triangle Park, NC 27709.

Training programs for emergency service organizations are available from the U.S. National Fire Academy, Emmitsburg, MD and the various state fire training schools. The International Society of Fire Service Instructors, Ashland, MA is another resource.

3. *Decontamination.* Decontamination procedures should be tailored to the specific hazards of the site and will vary in complexity, and number of steps, depending on the level of hazard and the employee's exposure to the hazard. Decontamination procedures and PPE decontamination methods will vary depending upon the specific substance, since one procedure or method will not work for all substances. Evaluation of decontamination methods and procedures should be performed, as necessary, to assure that employees are not exposed to hazards by reusing PPE. References in Appendix D may be used for guidance in establishing an effective decontamination program.

4. Emergency response plans. States, along with designated districts within the states, will be developing or have developed emergency response plans. These district and state plans are to be utilized in the emergency response plans called for in this standard. Each employer needs to assure that its emergency response plan is compatible with the local plan. In addition, the CAER program of the Chemical Manufacturers' Association (CMA) is another helpful resource in formulating an effective emergency response plan. Also the current Emergency Response Guidebook from the U.S. Department of Transportation, CMA's CHEMTREC and the Fire Service Emergency Management Handbook should be used as resources as well.

Appendix D—References to Appendix

The following references to the Appendix may be consulted for further information on the subject of this notice:

1. OSHA Instruction DFO CPL 2.70—January 29, 1986, *Special Emphasis Program: Hazardous Waste Sites.*

2. OSHA Instruction DFO CPL 2-2.37A—January 29, 1986, *Technical Assistance and Guidelines for Superfund and Other Hazardous Waste Site Activities.*

3. OSHA Instruction DTS CPL 2.74—January 29, 1986, *Hazardous Waste Activity Form, OSHA 175.*

4. *Hazardous Waste Inspections Reference Manual.* U.S. Department of Labor, Occupational Safety and Health Administration, 1986.

5. Memorandum of Understanding Among the National Institute for Occupational Safety and Health, the Occupational Safety and Health Administration, the United States Coast Guard, and the United States Environmental Protection Agency, *Guidance for Worker Protection During Hazardous Waste Site Investigations and Clean-up and Hazardous Substance Emergencies.* December 18, 1980.

6. *National Priorities List,* 1st Edition, October 1984, U.S. Environmental Protection Agency, Revised periodically.

7. *The Decontamination of Response Personnel,* Field Standard Operating Procedures (F.S.O.P.) 7; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, December 1984.

8. *Preparation of a Site Safety Plan.* Field Standard Operating Procedures (F.S.O.P.) 9: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, April 1985.

9. *Standard Operating Safety Guidelines:* U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, Environmental Response Team: November 1984.

10. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.* National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), and Environmental Protection Agency (EPA): October 1985.

11. *Protecting Health and Safety at Hazardous Waste Sites: An Overview.* U.S. Environmental Protection Agency, EPA/625/9-85/006; September 1985.

12. *Hazardous Waste Sites and Hazardous Substance Emergencies.* NIOSH Worker Bulletin. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health: December 1982.

13. *Personal Protective Equipment for Hazardous Materials Incidents: A Selection Guide:* U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health: October 1984.

14. *Fire Service Emergency Management Handbook.* Federal Emergency Management Agency, Washington, DC, January 1985.

15. *Emergency Response Guidebook.* U.S. Department of Transportation, Washington, DC, 1983.

[FR Doc. 86-28471 Filed 12-16-86, 12:57 am]

Journal

CONFERENCES SCHEDULED

Jan. 8, 1987 — Workshop on Risk Assessment, Arlington, Va. (Environ Corp., 1000 Potomac St. N.W., Washington, D.C. 20007, (800) ENVIRON or (202) 337-7444).

2-4 — 15th Annual Professional Development Conference, College Station, Texas (Joe Machac, Metropolitan Transit Authority, 500 Jefferson, P.O. Box 61429, Houston, Texas 77208-1429; (713) 739-4947).

Feb. 15-20 — 36th Annual Industrial Ventilation Conference, East Lansing, Mich. (Myrtle Jones, Michigan State University, 46 Kellogg Center, East Lansing, Mich. 48824; (517) 353-9407).

Feb. 24-25 — Third Annual Asbestos Design & Management of the Asbestos Abatement Project Conference, Dallas, Texas (Kim Heck, Director of Education, Hall-Kimbrell Educational Services Inc., 4840 W. 15th St., Lawrence, Kan. 66046, (800) 445-0682).

Feb. 28-March 7 — Symposium on Toxicology and Toxic Torts, Breckenridge, Colo. (Richard J. Hayes, Executive Director, 20 N. Wacker Drive, Suite 3100, Chicago, Ill. 60606; (312) 368-1494).

March 3-4 — 34th Annual Western Safety Congress & Exhibition, Anaheim, Calif. (John P. Maxwell, Congress Director, 616 S. Westmoreland Ave., Los Angeles, Calif. 90005; (213) 385-6461).

March 3-4 — American Conference on Chemical Labeling, Crystal City, Va. (ACCL, Suite 1000, 1155 Connecticut Ave. N.W., Washington, D.C. 20036; (202) 457-9500).

March 16-20 — Deep South Occupational Health and Safety Institute, New Orleans, La. (Donna Tracy, School of Public Health, University of Alabama at Birmingham, University Station, Birmingham, Ala. 35294; (205) 934-7032).

[illegible] 20-21 — Eighth Annual Update in Occupational Medicine, St. Paul, Minn. (Ruth K. McIntyre, Midwest Center for Occupational Health and Safety, St. Paul-Ramsey Medical Center, 640 Jackson Street, St. Paul, Minn. 55101; (612) 221-3992).

March 23-25 — Texas Safety Association Annual Conference and Exposition, Houston, Texas (Texas Safety Association, Attn: Conference Coordinator, P.O. Box 9345, Austin, Texas 78766; (512) 343-6525).

March 23-26 — Lasers in Manufacturing: S.P.O.T. '87 Conference and Exhibits, Los Angeles, Calif. (Kathleen Warren, Technical Activities Dept., Society of Manufacturing Engineers, One SME Drive, P.O. Box 930, Dearborn, Mich. 48121; (313) 271-1500, ext. 376).

March 25 — American Standards Institute Conference on Industry Self-Regulation, Arlington, Va. (Cindy Swanteck, American National Standards Institute Inc., 1430 Broadway, New York, N.Y. 10018; (212) 642-4922).

March 30-April 3 — 29th Annual Industrial Ventilation Conference, Raleigh, N.C. (Connie McElroy or Nancy Tapscott, Div. for Lifelong Education, N.C. State University, Box 7401, Raleigh, N.C. 27695-7401; (919) 737-2261).

April 2-3 — 16th Annual New Hampshire Safety Conference and Exhibition, Waterville Valley, N.H. (New Hampshire Safety Council Inc., 76 S. State St., P.O. Box 1382, Concord, N.H. 03301-1382; (603) 228-1401).

April 7-9 — Second Buffalo Tool & Manufacturing Engineering Conference & Exposition, Buffalo, N.Y. (Public Relations Dept., Society of Manufacturing Engineers, One SME Drive, P.O. Box 930, Dearborn, Mich. 48121; (313) 271-0777).

April 21-22 — 57th Annual Michigan Safety Conference, Lansing, Mich. (Michigan Safety Conference, 3338 Christine Drive, Lansing, Mich. 48911; (517) 882-3225).

April 25-May 1 — American Occupational Health Conference, Philadelphia, Pa. (American Occupational Medical Assn., 2340 S. Arlington Heights Road, Arlington Heights, Ill 60005, (312) 228-6850).

April 26-30 — 17th International Symposium and Exhibition on Industrial Robots, Chicago, Ill. (RI/SME Public Relations, One SME Drive, P.O. Box 930, Dearborn, Mich. 48121, (313) 271-0777)

APPENDIX E

Stablex Proposal/Letters of Notification

STABLEX

U – U

January 27, 1986

AVCO LYCOMING
550 South Main Street
Stratford, CT
USA
06497

Attention: Ms. Donna Ashford

We have analysed the representative sample from your facility. Please find enclosed the code, the cost for treatment per U.S. tonne and drum, and the procedures requested you follow when coming to the Blainville Treatment Center.

We would like to take this opportunity to thank you for your co-operation and trust you have shown in us. We at Stablex Canada Inc., hope that our personnel and facility can be of service to you in the very near future.

Should you require any additional information, please feel free to call us.

Yours truly,

William M. Hartman
Regional Marketing and Sales Manager

WMH/cp

STABLEX CANADA INC. 760 BOUL INDUSTRIEL BLAINVILLE QUEBEC
Adresse postale C P 420 Sainte-Therese de Blainville Quebec J7E 4J7 (514) 430-9230 Telex 05835569

STABLEX

INTRODUCTION:

Pursuant to our representative's visit with you at your facility, it was mutually agreed that samples of your waste would be taken and forwarded to the Stablex laboratory in Blainville, Quebec.

OBJECTIVE:

Analyze the waste products from your facility, to determine composition and evaluate compatibility with Stablex's "Sealosafe" process. Assuming wastes are compatible, a treatment and disposal cost will be proposed.

SUMMARY:

It has been determined that:

A) the wastes you have submitted to Stablex Canada Inc. are compatible with Stablex's "Sealosafe" process.

B) the treated wastes that have been formulated into Stablex material will meet the requirements prescribed by our operating permit (permit number D060001).

C) the cost per metric tonne or drum for the treatment and disposal of your waste is:

Description	Stablex Code	Price
Alkalyne chrome	XBSKAVCS06	$98.00 US / US Tonne

- Your wastes have been coded for ease of identification and control procedures at the Stablex Treatment Center in Blainville. Please reference the appropriate code in any correspondance with Stablex Canada Inc.

- Terms are net 30 days.

- Stablex Canada Inc. will quote a price with transportation included upon request.

- Your waste will be subjected to a fingerprint analysis on arrival at the Stablex Blainville Treatment Center. The fingerprint analysis will be compared with the waste characterization control sample which was coded.

- This procedure is performed at no extra cost to you providing the shipment corresponds to the coded samples. You will be notified by our order desk if the shipment is off-spec (analysis does not conform with waste characterization testing) but is compatible with the "Sealosafe" process. The waste will be accepted once we have received approval from your company for any additional charges. There may be an additional charge of $200.00 (Canadian Funds) for off-spec shipments.

- You will receive copies of the weight scale ticket for the vehicle transporting your wastes and fingerprint analysis of wastes accepted for processing.

CONCLUSION:

STABLEX CANADA INC. offers you a guaranteed, secure, convenient and Government approved service to treat and dispose of inorganic wastes from your facility.

STABLEX CANADA INC. will accept full responsibility and liability to treat and dispose of your waste once it has been accepted at Stablex's Treatment Center located in Blainville, Quebec.

We trust that this proposal meets with your approval and will lead to a long and growing business relationship between our respective companies.

STABLEX CANADA INC. treats and disposes of said wastes in accordance with the Quebec Quality Act and the regulation respecting liquid waste disposal.

STABLEX CANADA INC.

STABLEX.

SUGGESTED PROCEDURES

1. Verify and select a waste hauler with the required permits and licenses. Stablex Canada Inc. can help with transportation arrangements to Blainville.

2. Contact the Sales Order Desk at Stablex Canada Inc., telephone number 1-514-430-9240 or telex number 05-835569 with the following informations:

    - Waste description and code;
    - Quantity in gallons or metric tons to be shipped;
    - Purchase order number;
    - Desired shipping date;
    - Waste hauler selected

3. The Stablex Order Desk will confirm details.

4. Please notify U.S. EPA in accordance with the attached form letter.

N.B.: The U.S. EPA requires a 30 day prior notification of your intention to ship a waste to Canada. Transport Canada & Environment Canada each requires 60 day prior notification. These notifications cover shipments for the given calendar year.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 26 1987

OFFICE OF
INTERNATIONAL ACTIVITIES

John Fleming
Avco Lycoming Textron
550 South Main Street
Stratford, CT 06497

Dear Mr. Fleming:

This is to acknowledge receipt of your notice dated February 4, 1987 of intent to export hazardous waste to Canada as required by Section 262.53 of the Resource Conservation and Recovery Act (RCRA). In accordance with the U.S.-Canada bilateral agreement on the transboundary movement of hazardous waste, the U.S. Environmental Protection Agency (EPA) has forwarded your notice to the Government of Canada.

Under terms of the Agreement, Canada has 30 days from the date of receipt to object to the terms of your notice. Since we have received no objection from Canada during that time, this letter constitutes the EPA Acknowledgment of Consent for the export of hazardous waste as specified in your notice. Thus, shipments can be made to Stablex Canada, Inc., for 1987.

Please be advised that a copy of this letter must be attached the the manifest which accompanies <u>each</u> shipment and that if major terms of the notice should change, renotification will be necessary.

Sincerely,

Wendy Grieder

Wendy Grieder
International Activities Specialist

NOTIFICATION LETTER TO:

Director General
Director of the Waste Management Branch
Environmental Protection Program Directorate
Environmental Protection Service
Environment Canada
Ottawa, Ontario
K1A 1C8

In compliance with the Regulations Respecting the handling, offering for transport and the transporting of dangerous goods, I am writing to inform your office that:

COMPANY/GENERATOR'S NAME: ______________________________

FACILITY NAME: ______________________________

ADDRESS: ______________________________

INTENDS TO SHIP/TRANSPORT:

General description of waste/shipping name: ....

UN ID number, State ID number,
Transport of Dangerous Goods Act Number: ....

DOT Number: ....

Classification code Canadian
Federal Regulation: ....

Packing group, Canadian
Federal Regulation: ....

Quantity intended to ship for a
calendar year: ....
(metric tonnes)

Stablex Code: ....

TO: STABLEX CANADA INC.
P.O. Box 420
760 Boulevard Industriel
Blainville, Québec
J7E 4J7

The first shipment is scheduled for: ....
(date)

It is understood that this notification will cover shipments of the above waste (s) through calendar year 1986.

Please direct any comments or questions regarding subject notification to the undersigned.

COMPANY/GENERATOR'S REPRESENTATIVE: ______________________________

* Date must be 60 days prior to first shipment.

Date: ______________________

Notification letter to EPA

Ms. Wendy Grieder
USEPA
Office of International Activities
401 M. Street S.W.
Washington, D.C.
20460
Mail Drop A 106

Dear Ms. Grieder:

In compliance with 40 C.F.R. Section 262.50 plus amendments, I am writing to inform your office that:

COMPANY/GENERATOR'S NAME:

FACILITY NAME:

ADDRESS:

BUSINESS PHONE:

intends to transport ....
(general description of waste (s) in tonnes)

.... and ....
(EPA WASTE I.D. #) (DOT #)

TO: STABLEX CANADA INC.
Inorganic Waste Treatment Center
760 Boul. Industriel
P.O. Box 420
Ste-Thérèse-de-Blainville, Québec
CANADA
J7E 4J7

The first shipment is scheduled for ....
(date *)

It is understood that this notification will cover shipment of the above waste (s) through calendar year 1986.

Please direct any comments or questions regarding subject notification to the undersigned.

COMPANY/GENERATOR'S REPRESENTATIVE: ______________________________
(Signature - Printed Name)

* Date must be at least one month prior to first shipment.

Transport Canada
3rd Floor, Tower B
Place d'Youville
Ottawa, Ontario
K1A 0N5

Attention: Mr. Duncan Ellison

In compliance with the Regulations Respecting the handling, offering for transport and the transporting of dangerous goods, I am writing to inform your office that:

COMPANY/GENERATOR'S NAME: ____________________

FACILITY NAME: ____________________

ADDRESS: ____________________

INTENDS TO SHIP/TRANSPORT:

General description of waste/shipping name: ....

UN ID number, State ID number, Transport of Dangerous Goods Act Number: ....

DOT Number: ....

Classification code Canadian Federal Regulation: ....

Packing group, Canadian Federal Regulation: ....

Quantity intended to ship for a calendar year: ....
(metric tonnes)

Stablex Code: ....

TO: STABLEX CANADA INC.
P.O. Box 420
760 Boulevard Industriel
Blainville, Québec
J7E 4J7

The first shipment is scheduled for: ....
(date)

It is understood that this notification will cover shipments of the above waste (s) through calendar year 1986.

Please direct any comments or questions regarding subject notification to the undersigned.

COMPANY/GENERATOR'S REPRESENTATIVE: ____________________

* Date must be 60 days prior to first shipment.

APPENDIX F

Closure Cost Estimates

METCALF & EDDY, INC.
COST ESTIMATE

JOB NO :	3005	CLIENT :	AVCO-LYCOMING
DATE :	23-Feb-88	PROJECT :	SURF. IMP. CLOSURE
LOCATION :	STRATFORD,CT.	CAPACITY:	
PREPARED BY:	R. SULLIVAN	ACCURACY:	± 20 %

SUMMARY - GEOTEXTILE/GEOMEMBRANE CAP

ACCOUNT	DESCRIPTION	MANHOURS	MATERIAL	LABOR	TOTAL
1.	EQUIPMENT				
2.	GENERAL CIVIL SITEWORK	9,533	1,493,348	286,002	1,779,33
3.	CONCRETE / FOUNDATIONS				
4.	MISCELLANEOUS & STRUCTURAL STEEL				
5.	SEWERS AND UNDERGROUND PIPING				
6.	BUILDING / ARCHITECTURAL				
7.	HVAC & PIPING				
8.	ELECTRICAL				
9.	INSTRUMENTATION				
10.	INSULATION AND PAINTING				
	SUBTOTAL DIRECT COSTS	9,533	1,493,348	286,002	1,779,3
11.	CONTRACTOR OVERHEAD & PROFIT 22%				391,4
12.	MISCELLANEOUS				
13.	ENGINEERING				
	SUBTOTAL DIRECT & INDIRECT COSTS				2,170,308
	CONTINGENCIES 10%				217.[illegible]
	GRAND TOTAL				2,388.

DATE PRINTED : 24-Feb-88

NO : 3005 METCALF & EDDY ENGINEERS
: 23-Feb-88 COST ESTIMATE
LOCATION : STRATFORD,CT.
PREPARED BY P. SULLIVAN

CLIENT : AVCO-LYCOMING
PROJECT : SURF. IMP. CLOSURE
CAPACITY:
ACCURACY: ± 20 %

ACCOUNT NO	DESCRIPTION	QUANTITY	UN	MANHOURS		MATERIAL		LABOR		TOTAL
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	DIRECT COST
-2-	SITEWORK									
1000	MOBILIZATION	1	LS	0.00	0	20,000.00	20,000	30.00	0	20,00
	TRAILER,DECONTAMINATION	6	MO	0.00	0	1,200.00	7,200	30.00	0	7,2
1100	PREPARE DECONTAMINATION AREA	1	LS	500.00	500	0.00	0	30.00	15,000	15,00
1200	EXCAVATE AND DEWATER SLUDGE	400	CY	0.5	200	0	0	30.00	6,000	6,00
1300	EXCAVATE & REMOVE PUMP STATION AND PIPING									
	P.S. IS ONE CONT(BOX) LOAD	1	LD	145.00	145	2,000.00	2,000	30.00	4,350	6,35
	300 LF 10" PIPE 1/2 CONT.	1	LD	300.00	300	2,000.00	2,000	30.00	9,000	11,00
	240 LF 8" PIPE 1/2 CONT.	1	LD	240.00	240	2,000.00	2,000	30.00	7,200	9,20
	1100 LF 4" PIPE 1PLUS CONT.	1	LD	1,100.00	1,100	2,000.00	2,000	30.00	33,000	35,0
	80 LF 12" DRAIN PIPE	1	LD	80.00	80.00	2,000.00	2,000	30.00	2,400	4,40
	NOTE: PIPE MUST BE FLUSH CUT AND SHIPPED OUT AS HAZARDOUS WASTE									
1400	CONFIRMATION SAMPLING									
	SOIL SAMPLES 40@ $50	1	LS	0.00	0	2,000.00	2,000	30.00	0	2,
	LAB ANALYSIS 40 @$1500 EACH	1	LS	0.00	0	60,000.00	60,000	30.00	0	60,

JOB NO :
DATE :
LOCATION :
PREPARED BY

3005 METCALF & EDDY ENGINEERS
23-Feb-88 COST ESTIMATE
STRATFORD,CT.
R. SULLIVAN

CLIENT : AVCO-LYCOMING
PROJECT : SURF. IMP. CLOSURE
CAPACITY:
ACCURACY: ± 30 %

ACCOUNT NO	DESCRIPTION	QUANTITY	UN	MANHOURS MHR/ UNIT	TOTAL MH	MATERIAL UNIT COST	TOTAL MATL	LABOR WAGE RATE	TOTAL LABOR	TOTAL DIRECT COST
	INSTALL WOOD SHEETING	6770	SF	0.10	677	3.00	20,310	30.00	20,310	40,6
1500	EXCAVATE SOIL FROM LAGOON AREA									
	LAGOON #1	2,000	CY	0.30	600	3.00	6,000	30.00	18,000	24,0
	LAGOON 2,3,4,	2,300	CY	0.30	690	3.00	6,900	30.00	20,700	27,6
1600	SHIP MATERIAL OFF SITE									
	20 CY/LOAD 4800 CY/20	240	LD	0.00	0	1,300.00	312,000	30.00	0	312
	TREATMENT AT STABLEX	7,125	TN	0.00	0	120.00	855,000	30.00	0	855,
1700	BACKFILL FOR CAP BASE									
	LAGOON #1,2,3,4	5,000	CY	0.20	1,000	6.00	30,000	30.00	30,000	60,
1800	CONSTRUCT CAP									
	LOAM 6"= 1500CY	1,500	CY	0.25	375	10.00	15,000	30.00	11,250	26,
	BANK-RUN GRAVEL 12"	2,900	CY	0.20	580	9.00	26,100	30.00	17,400	43,500
	SCREENED GRAVEL 12"	2,900	CY	0.20	580	11.00	31,900	30.00	17,400	49,
	CONC. SAND 2-6" LAYERS	2,900	CY	0.30	870	8.50	24,650	30.00	26,100	50,75
	WOVEN TEXTILE(MIRAFI 700X)	9,000	SY	0.03	270	0.70	6,300	30.00	8,100	14
	GEOMEMBRANE 60 MIL HDPE	9,000	SY	0.12	1,080	3.75	33,750	30.00	32,400	66

3005 METCALF & EDDY ENGINEERS
22-Feb-88 COST ESTIMATE
STRATFORD,CT.
R. SULLIVAN

CLIENT : AVCO-LYCOMING
PROJECT : SURF. IMP. CLOSURE
CAPACITY:
ACCURACY: ± 20 %

LOCATION :
PREPARED :

ACCOUNT NO.	DESCRIPTION	QUANTITY	UNIT	MANHOURS MHR/ UNIT	MANHOURS TOTAL MH	MATERIAL UNIT COST	MATERIAL TOTAL MATL	LABOR WAGE RATE	LABOR TOTAL LABOR	TOTAL DIRECT COST
1900	INSTALL MONITORING WELLS									
	CONSTRUCT NEW WELLS	4	EA	20.00	80	700.00	2,800	30.00	2,400	5,200
2000	ADD'TL LOAM & SEED	1,890	SY	0.03	57	2.50	4,725	30.00	1,701	6,426
	HYDROSEED	8520	SY	0.0033	28	0.15	1,278	30.00	843	2,121
2100	ERECT FENCE									
	NEW FENCE	100	LF	0.12	12	12.00	1,200	30.00	360	1,560
	TEMPORARY FENCE	280	LF	0.12	34	2.00	560	30.00	1,008	1,568
	REMOVE FENCE AND REPLACE SOME FENCE	300	LF	0.12	36	2.25	675	30.00	1,080	1,755
2200	SURVEY AND CERTIFICATION	1	LS	0.00	0	5,000.00	5,000	30.00	0	5,000
2300	DEMOBILIZATION	1	LS	0.00	0	10,000.00	10,000	30.00	0	10,000
	SUBTOTAL SITEWORK				9,533		1,493,348		286,002	1,779,350

APPENDIX G

Landfill Cap References and Manufacturer's Specifications

REFERENCES

1. Landfill Runoff:
Schroeder, Paul R., August 1983. Hydrologic Evaluation of Landfill Performance, HELP Version 1. USAE Waterways Experiment Station, Vicksburg, MS 39180.

2. Slope Stability Analyses:
GEOCOMP Corp., 1984. GEOSCOPE, Version 2.0. GEOCOMP Corp., Concord, MA 01742

Fabric Properties

Fabric Property 500X	Unit	Test Method	Typical Values(1)
Resistance to Installation Damage			
Grab Tensile Strength	lb	ASTM D-1682-64	200
Grab Tensile Elongation	%	ASTM D-1682-64	30 (max)
Burst Strength	psi	ASTM D-3786-80a(2)	400
Trapezoid Tear Strength	lb	ASTM D-1117-80	115
Puncture Resistance	lb	ASTM D-3787-80(3)	85

Fabric Property 600X	Unit	Test Method	Typical Values(1)
Resistance to Installation Damage			
Grab Tensile Strength	lb	ASTM D-1682-64	300
Grab Tensile Elongation	%	ASTM D-1682-64	35 (max)
Burst Strength	psi	ASTM D-3786-80a(2)	>600
Trapezoid Tear Strength	lb	ASTM D-1117-80	120
Puncture Resistance	lb	ASTM D-3787-80(3)	130

[1] The values listed are average values Contact the Mirafi Technical Department for minimum certifiable values

[2] Diaphragm Bursting Tester

[3] Tension Testing Machine with ring clamp, steel ball replaced with a 5/16-inch diameter solid steel cylinder (with hemispherical tip) centered within the ring clamp

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Gundle Lining Systems Inc®

Gundle

GUNDLINE HD is a high quality formulation of High Density Polyethylene containing approximately 97.5% polymer and 2.5% of carbon black, anti-oxidants and heat stabilizers. The product was designed specifically for exposed conditions. It contains no additives or fillers which can leach out and cause deterioration over time.

GUNDLINE® HD SPECIFICATIONS

PROPERTY	TEST METHOD	GAUGE (NOMINAL) 20 mil (0.5 mm)	30 mil (0.75 mm)	40 mil (1.0 mm)	60 mil (1.5 mm)	80 mil (2.0 mm)	100 mil (2.5 mm)
Density (g/cc) (Minimum)	ASTM D1505	0.94	0.94	0.94	0.94	0.94	0.94
Melt Flow Index (g/10 min.)	ASTM D 1238 Condition E (190°C, 2.16 kg.)	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Tensile Properties (Each direction)	ASTM D638 Type IV Dumb-bell at 2 ipm.						
1. Tensile Strength at Break (Pounds/inch width)		80	120	160	240	320	400
2. Tensile Strength at Yield (Pounds/inch width)		50	70	95	140	190	240
3. Elongation at Break (Percent)		700	700	700	700	700	700
4. Elongation at Yield (Percent)		13	13	13	13	13	13
5. Modulus of Elasticity (Pounds/square inch)	ASTM D882	110,000	110,000	110,000	110,000	110,000	110,000
Tear Resistance Initiation (lbs Min.)	ASTM D1004 Die C	15	22	30	45	60	75
Low Temperature/Brittleness	ASTM D746 Procedure B	−112°F	−112°F	−112°F	−112°F	−112°F	−112°F
Dimensional Stability (Each direction, % change max.)	ASTM D1204 212°F 1 hr.	±2	±2	±2	±2	±2	±2
Volatile Loss (Max. %)	ASTM D1203 Method A	0.1	0.1	0.1	0.1	0.1	0.1
Resistance to Soil Burial (Maximum percent change in original value)	ASTM D3083 using ASTM D638 Type IV Dumb-bell at 2 ipm.						
Tensile Strength at Break and Yield	% Change	±5	±5	±5	±5	±5	±5
Elongation at Break and Yield	% Change	±10	±10	±10	±10	±10	±10
Ozone Resistance	ASTM D1149 7 days 100 pphm, 104°F Magnification	No cracks 7 ×	No cracks 7 ×	No cracks 7 ×	No cracks 7 ×	No cracks 7 ×	No cracks 7 ×
Environmental Stress Crack (Minimum hours)	ASTM D1693 Condition C (100°C)	1500	1500	1500	1500	1500	1500
Puncture Resistance (Pounds)	FTMS 101B Method 2031	85	135	175	270	350	440
Water Absorption (Max. % Wt. change)	ASTM D570	0.1	0.1	0.1	0.1	0.1	0.1
Hydrostatic Resistance (Pounds/square inch)	ASTM D751 Method A Procedure I	160	240	315	490	650	810
Coefficient of Linear Thermal Expansion $(\times 10^{-4} \frac{cm}{cm\ °C})$ Nominal	ASTM D696	1.2	1.2	1.2	1.2	1.2	1.2
Moisture Vapor Transmission (g/m² · day)	ASTM E96	0.06	0.05	0.04	0.03	0.02	0.0
Thermal Stability Oxidative Induction Time (OIT) (minutes, minimum)	ASTM D3895 130°C, 800 psi O_2	2000	2000	2000	2000	2000	20

APPENDIX C - QUALITY ASSURANCE PROJECT PLAN

1.0 Introduction

This Quality Assurance Project Plan (QAPP) describes methods and approaches for providing quality control of field sampling and laboratory activities performed as part of closure activities of four hazardous waste surface impoundments, at the AVCO Lycoming TEXTRON facility in Stratford, Connecticiut. It has been prepared in accordance with guidelines and specifications presented in the U.S. EPA document "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", QAMS-005/80, December 29, 1980. The purpose of this QAPP is to present, in specific terms, the policies, organization, objectives, functional activities and specific Quality Assurance (QA) and Quality Control (QC) activities designed to achieve the data quality goals of the sampling and testing program.

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3.0 Project Description

The soil sampling and testing program described herein is a part of the closure activities for four hazardous waste lagoons at the AVCO-TEXTRON facility.

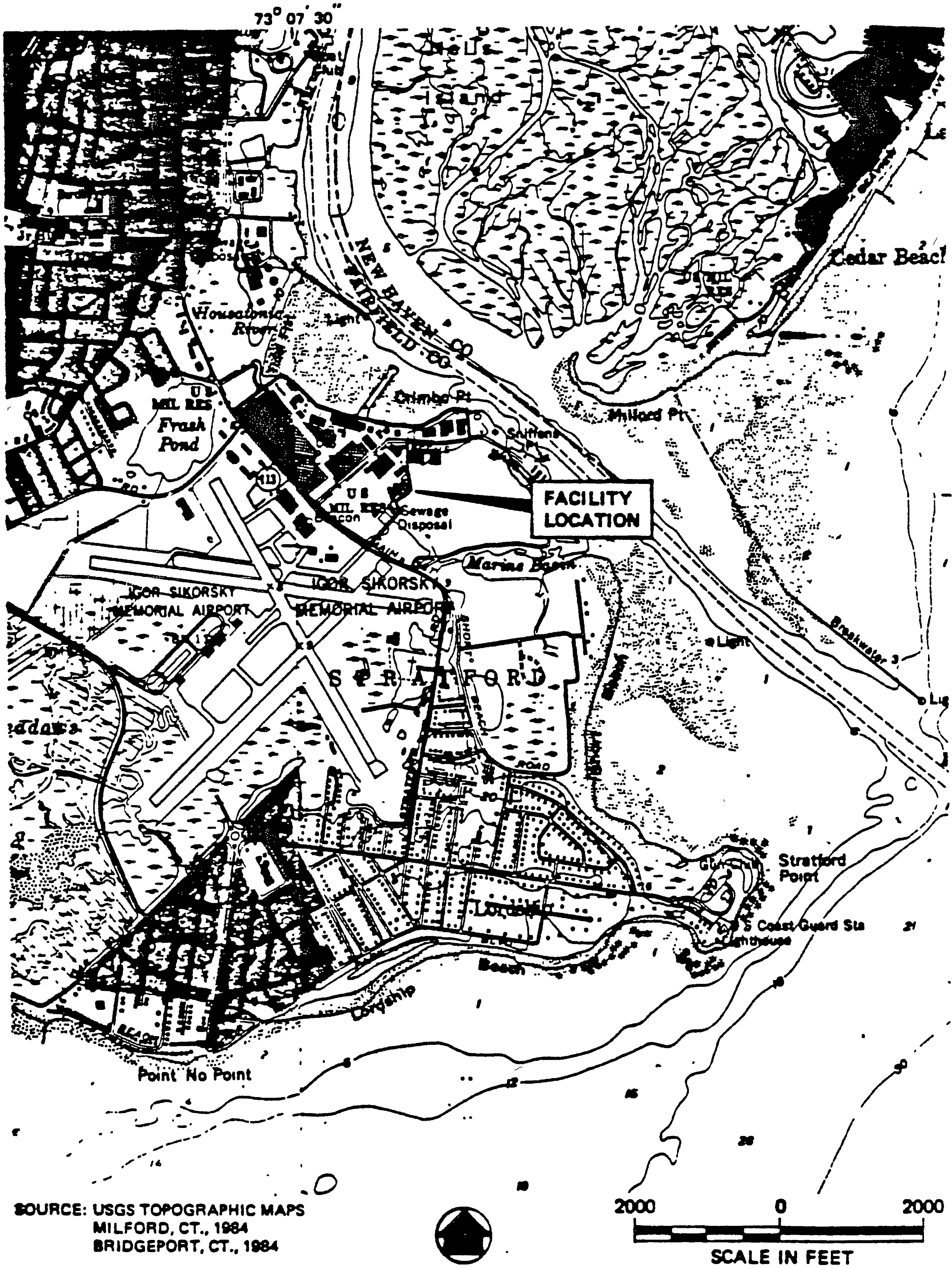
Following the removal, treatment, and disposal of standing liquid and some sludge from these lagoons, it is proposed to remove the remaining sludge in addition to soil from the lagoon bottoms and laterally around each lagoon.

The vertical limit of excavation will be the seasonal low water table. The lateral extent of soil excavation will be determined by following an excavate and test cycle (see Section 3.2).

Upon complete removal of contaminated soils, the open excavations will be backfilled and a landfill cap will be constructed.

3.1 Background & Site Description

The Avco facility, which is owned by the U.S. Army and operated by Avco Lycoming TEXTRON, is located in Stratford, Connecticut just west (approximately 1,000 feet) of where the Housatonic River enters the Long Island Sound (see Figure 3.1 and 3.2). The activities at the facility include the manufacturing of gas turbine engines. The production includes the plating of engine and other miscellaneous parts in zinc, cadmium, chrome, copper, magnesium, nickel and black oxide baths. The spent plating baths are discharged to an equalization lagoon.



SOURCE: USGS TOPOGRAPHIC MAPS
MILFORD, CT., 1984
BRIDGEPORT, CT., 1984

FIGURE 3.1. LOCATION MAP - AVCO LYCOMING FACILITY

NOTES:

1. BASE MAP FROM METCALF & EDDY SURVEYS 1985 & 1986.
2. ALL ELEVATIONS REFERENCED TO MEAN SEA LEVEL.

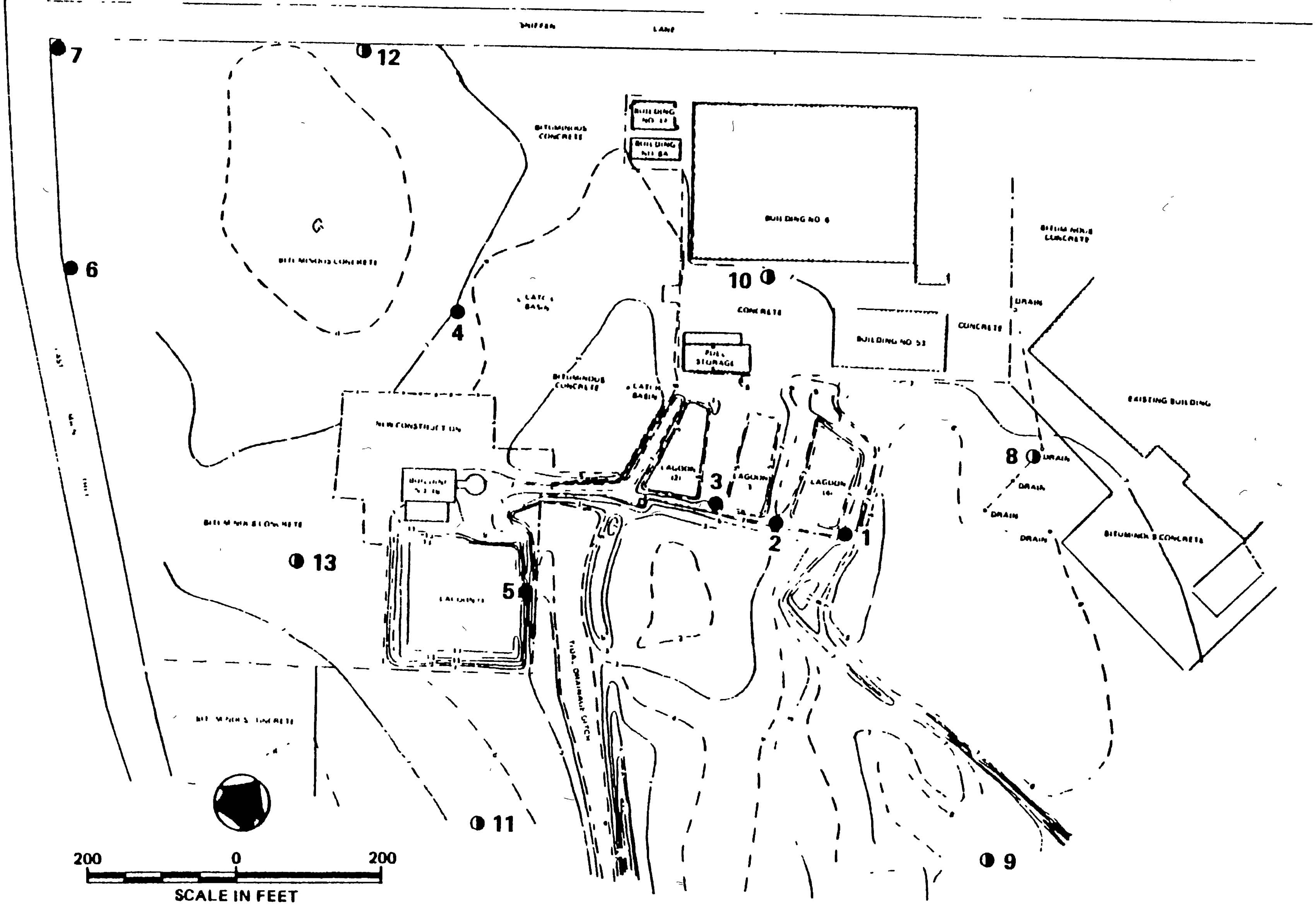


FIGURE 3.2. SITE PLAN - AVCO LYCOMING FACILITY

Wastewater from this lagoon is pumped to a chemical waste treatment plant which, in turn, produces a metal hydroxide sludge which is pumped to one of three sludge storage lagoons.

The operation of these hazardous waste surface impoundments has been regulated under the Resource Conservation and Recovery Act (RCRA) since the effective date of these regulations on November 19, 1980. In compliance with the first requirement of RCRA, Avco submitted Part A of the RCRA permit application to the U.S. EPA on November 13, 1980.

On November 8, 1984, RCRA was amended by the "Hazardous and Solid Waste Amendments of 1984" (HSWA). Section 213 of the HSWA required that all land disposal facilities either cease operation or submit a complete Part B permit application by November 8, 1985. In compliance with this requirement, Avco submitted its Part B permit application to USEPA, Region I and the Connecticut Department of Environmental Protection (DEP) on November 8, 1985. Until this permit application is reviewed and the final RCRA permit issued, Avco is considered to be operating under "interim status".

The chemical waste treatment plant at AVCO has been modified to include an equalization tank to replace the equalization lagoon, and filtration with off-site disposal to replace the three sludge lagoons. Without the need for the four surface impoundments, Avco plans to close the impoundments. The planned start-up of the modified treatment plant was scheduled for July 1, 1987. As an interim status RCRA facility, Avco is resubmitting a partial closure plan under 40 CFR Part 265 subpart G and Connecticut Hazardous Waste Management Regulations 220-449 (c)-29. Partial closure refers to the four surface impoundments at Avco, which will be closed in a manner set forth in the interim status facility performance standards, 40 CFR 265.111. These performance standards require that Avco close its surface impoundments in a manner that:

1) Minimize the need for further maintenance
2) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere, and
3) Complies with the closure requirements of Chapter G including, but not limited to, the requirements of 265.197, 265.228, 265.258, 265.280, 265.310, 265.351, 265.381 and 265.404.

3.2 Project Objective

The objective of the soil sampling at Avco is to confirm that all contaminated soils have been removed from the surface impoundments. During the excavation process, the walls of the excavations will be screened with a portable photoionization analyzer to help direct the excavation process toward the more highly contaminated soils. Limits of excavation for confirmation soil sampling are indicated on the Contract Drawings. Samples will be obtained in two ways: 1) from test pits on the north and east sides of the equalization lagoon, and 2) from the walls of the excavation for the sludge storage lagoons and the remaining sides of the equalization lagoon. Test pits will be dug along the line of the sheeting in order to ensure that the sheeting is installed outside the limits of contamination.

It is assumed that because of downward and lateral contaminant migration in the unsaturated zone, more contamination will be present in lower portions of the excavation. As a result, confirmation soil sampling will take place along an imaginary horizontal line located at one-third of the total excavation depth as measured from the bottom of the excavation. For test pits, sampling will take place at the bottom of the pit, elevation 3.0. In each excavation, samples will be obtained at 35-foot intervals along that horizontal line. It has been assumed that the distribution of wastes within all the surface impoundments is fairly uniform over the long period of disposal, but to address the possibility of some waste segregation the 35-foot sampling interval was selected. This interval will produce a minimum of 21 confirmation samples from the 3 sludge lagoons and a minimum of 18 confirmation samples from the equalization lagoon. Although differing rates of contaminant migration will affect the depth of penetration, the uniform distribution of waste in these surface impoundments is considered the controlling factor. Additional soil sampling will take place at "hot spot" locations identified by either visual inspection or screening with the photoionization analyzer.

3.3 Schedule

The proposed schedule for soil sampling activities is presented in Figure 3.3.

3.4 Data Usage

Analysis of the soil samples will be conducted by a USEPA and Connecticut DEP approved Laboratory. The data obtained during the sampling and testing activities will be used to achieve the objectives outlined above (Section 3.2). For metals, cyanide and chromium, the removal standard will be Drinking Water Standards, and for volatile organics, ten times the Connecticut Action Levels.

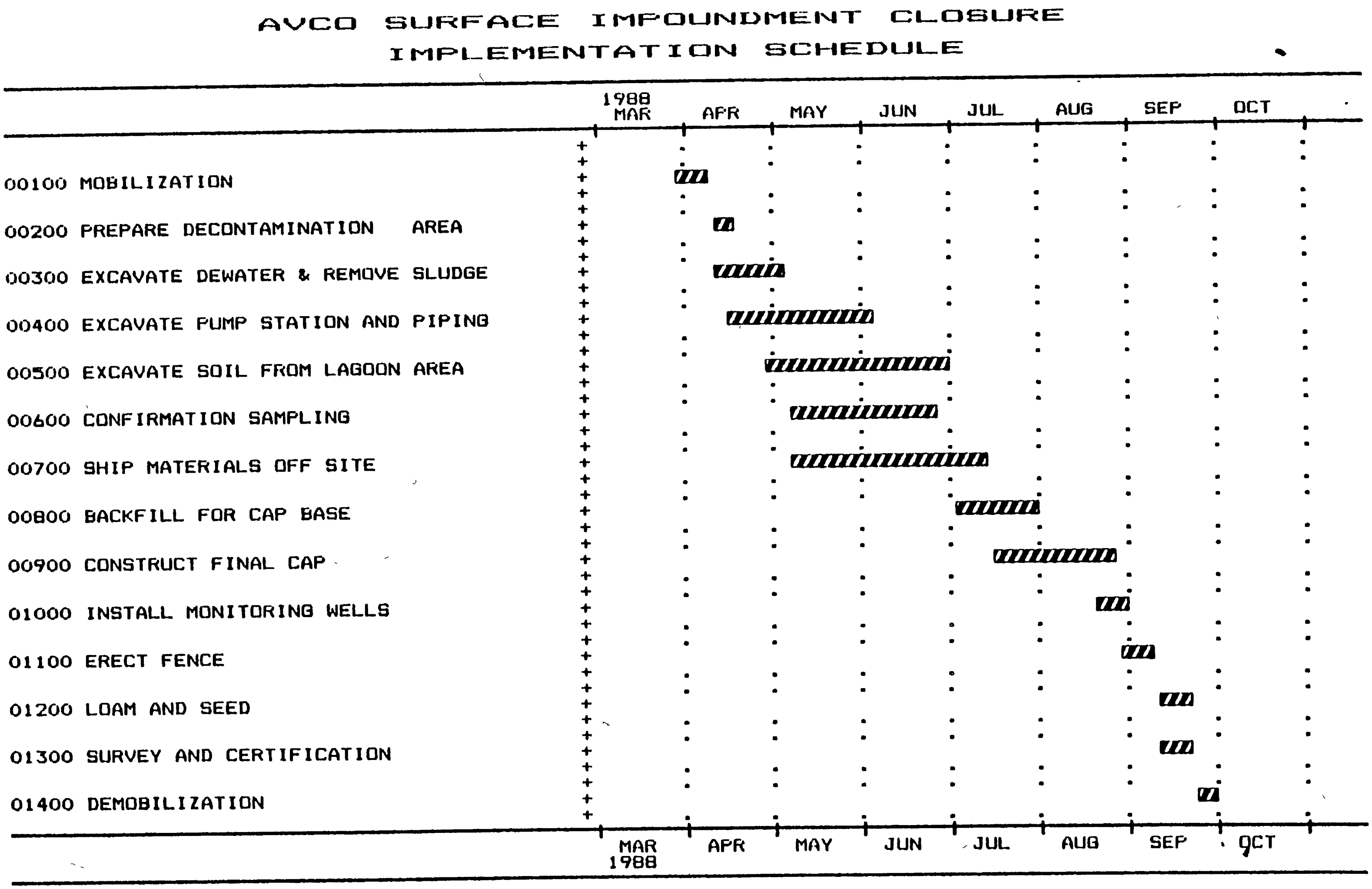


FIGURE 3.3 SCHEDULE OF CLOSURE ACTIVITIES

4.0 Project Organization

Figure 4.1 illustrates the Avco Lycoming closure project organization.

The Corps of Engineers, through its Contracting Officer, will oversee the field activities and investigations, and ensure compliance with established objectives, budgets, schedules, and scope of work.

The Contractor/Sampler will be responsible for carrying out the sampling procedures, as described herein, and will submit samples to the laboratory, for analysis in accordance with Quality Assurance Standards established in this plan.

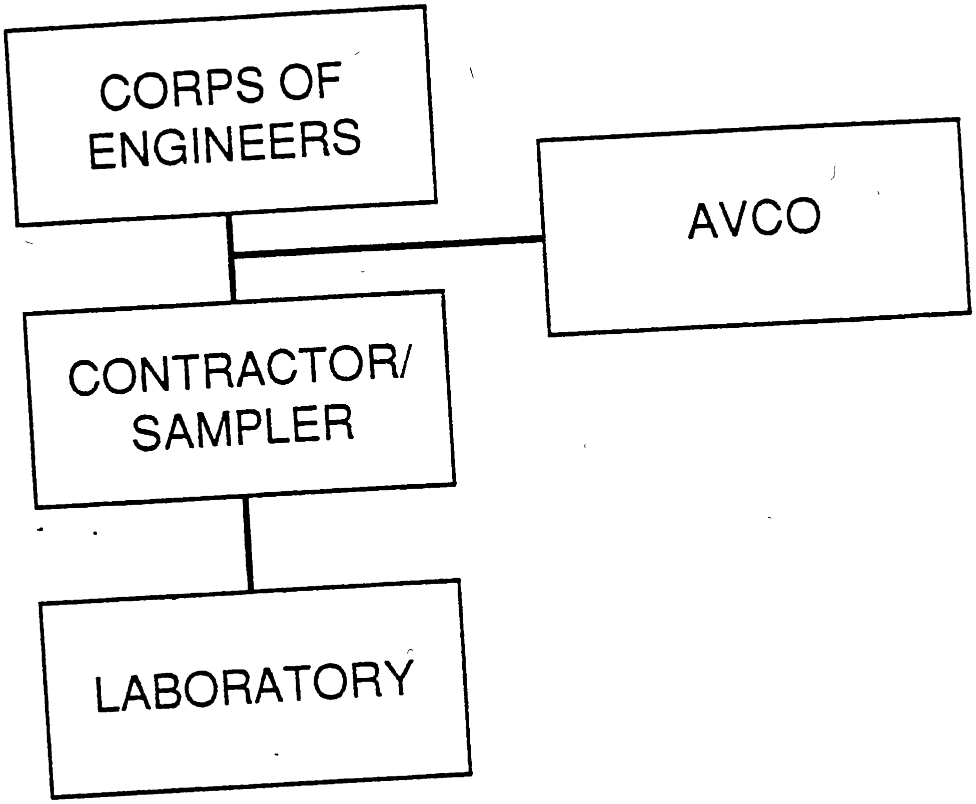


FIGURE 4.1 PROJECT ORGANIZATION

5.0 Quality Assurance for Measurement Data

The overall QA objective is to develop and implement procedures for field sampling, chain of custody, laboratory analysis and reporting that will provide legally defensible results in a court of law. Specific procedures to be used for sampling, chain of custody, calibration, laboratory analysis, reporting, internal quality control, audit, preventive maintenance and corrective actions are described in other sections of this Quality Assurance Project Plan. This section defines the goals for level of QA effort; accuracy, precision and sensitivity of analyses; and completeness, representativeness, and comparability of measurement data from all analytical laboratories. QA objectives for field measurements are also discussed.

5.1 Regulatory and Legal Requirements

There are no special regulatory or legal requirements in that compliance with regulations or laws other than RCRA is not an objective or issue at this site.

5.2 Level of QA Effort

Field duplicates and field blanks will be taken and submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Field duplicate samples are analyzed to check for sampling and analytical reproducibility. Field blank samples will be analyzed to check for procedural contamination and/or ambient conditions at the site which are causing sample contamination. The general level of this QA effort will be one field quality control sample, duplicate or blank, for every 10 confirmation samples.

5.3 Precision, Accuracy, and Completeness Objectives

The quality assurance objectives for the analytical methods, expressed in terms of precision, accuracy and completeness are presented in Table 9-1 of Section 9 - Analytical Procedures.

5.4 Field Measurements

Measurements data will be generated in many field activities that are incidental to collecting samples for analytical testing or unrelated to sampling. These activities include, but are not limited to, the following:

- Documenting time and weather conditions
- Determining penetration depth of lateral samples.

The general QA objective for such measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of data through standardized procedures.

6.0 Sampling Procedures

The procedures to be used for the confirmation soil sampling are outlined below. Sample containers, preservative techniques, and maximum holding times are in the form of a Standard Operating Procedure (Appendix B).

6.1 Soil Sampling Procedures. Soil sampling will consist of composite sampling at or near the surface.

All sampler parts should be decontaminated before each sample is taken. Decontamination will be carried out according to Standard Operating Procedures (SOP) for Decontamination (Appendix A).

6.1.1 Confirmation Samples from the Excavated Areas

Initial samples will be taken around the perimeter of the excavations at 35 foot intervals as described in Section 3.2. Composite samples will be collected from each area and submitted for chemical analysis. Materials needed for samples to be taken at or near the surface include a stainless steel trowel and a tile spade. Procedures for samples are as follows:

Procedures for Collecting Surface Soil Samples

1. Use tile spade to excavate to two inches, once in the center and four times at a one-foot radius, equally spaced.

2. Decontaminate tile spade as specified in Appendix A.

3. Collect composite sample from the five locations using the decontaminated stainless steel trowel.

4. Place composite sample in appropriate sample container (see Appendix B) filling the container as completely as possible to minimize air space.

5. Log-in each sample and fill out chain-of-custody forms.

6. Place sample container into cooler and pack with ice.

6.2 Field Sampling/Monitoring Procedures

6.2.1 HNu Photoionization Detector During the excavation and confirmation sampling operations, the HNu will provide two services; field monitoring organic vapors and field screening of excavation walls for relative levels of volatile organic compounds. Monitoring for organic vapor levels in the breathing zone of workers on-site will help determine appropriate levels of respiratory protection. Field screening of excavation walls will assist in directing the excavation process toward the more highly contaminated soils, and in identifying "hot spots" for additional sampling.

6.2.1.1 Instrument Operation Each HNu will be prepared for use each day according to the following procedure:

1. Warm-up: 5-10 minutes

2. Battery Check: Turn function switch to battery check position. The needle should reach within or above the green battery are on the scaleplate. If the needle is in the lower portion of the battery arc, the instrument must be recharged prior to

making any measurements. If the red LED comes on, the battery must be recharged.

3. Check UV Light Source: Turn the function switch to the "on" position. In this position, the UV light source should be on. Check by looking quickly into the end of the probe to see purple glow of the lamp.

4. Zero Instrument: Turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection while counterclockwise rotation yields a downscale deflection. If the span adjustment setting is changed after the zero is set, the zero should be rechecked and adjusted, if necessary Wait 15 or 20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero. The zero must be checked periodically during the day to check for zero drift and must be rezeroed or repaired as necessary.

5. Calibrate instrument: Calibration gas: 64 ppm isobutylene @ 9.8 span with 10.2ev lamp (HNu System, Inc., Catalog Number 101-350). Turn function switch to proper measurement range (0-20, 0-200, 0-2000 ppm). Attach regulator to HNu calibration gas cylinder. Attach tygon tubing from regulator to HNu probe. Crack the valve of the pressurized container until a slight flow is indicated on the cylinder gauge. Adjust the span pot knob until the instrument is reading the exact value of the calibration gas concentration noted on the cylinder. (If the instrument span setting is changed, the instrument must be turned back to the standby position and the electronic zero readjusted as necessary)

6. Recharging Instrument. All HNu's must be recharged overnight after each day's use. To charge the battery, place the mini phone plug into the jack on left side of the bezel prior to plugging charger into 120 VAC. When disconnecting charger, remove from 120 VAC before removing mini phone plug. The battery is completely recharged overnight (ca. 14

hours). To ensure that the charger is functioning, turn the function switch to the battery check position, place phone plug into jack and plug charger into AC outlet. The meter should go upscale if charger is working and is correctly inserted into the jack.

6.2.1.2 Health and Safety Monitoring The health and safety officer will monitor the breathing zone of workers in the field on a semi-continuous basis. He/she will designate protective equipment to be used as delineated in the Health and Safety Plan.

All monitoring readings must be recorded in the Health and Safety Officer's field notebook and any correlation with specific field activities noted.

7.0 Sample Custody

An overriding consideration for environmental measurement data is the ability to demonstrate that samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt and laboratory custody until disposal must be documented to accomplish this. Documentation is accomplished through a chain-of-custody record that records each sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is:

- In a person's actual possession.
- In view after being in physical possession.
- Sealed so that no one can tamper with it after having been in physical custody.
- In a secured area, restricted to authorized personnel.

Sample custody will be initiated by Contractor field personnel upon collection of samples. Documents specifically prepared for such purposes will be used for recording pertinent information about the types and numbers of samples collected and shipped for analysis. The samples collected will first be brought to an on-site location for batching and paperwork checks. Labels and log information are checked to be sure there is no error in identification. Samples are packaged to prevent breakage or leakage and labeled according to DOT regulations for transport as laboratory samples. Copies of forms will be maintained for the project record. Originals will be maintained at the Laboratory.

7.1 Chain-of-Custody Record Form.

Figure 7.1 is an example of the chain of custody form to be used by Contractor personnel in collecting and shipping samples. The Laboratory shall not accept samples for analysis without a correctly prepared chain-of-custody form.

The chain-of-custody form shall be signed by each individual who has the samples in their possession. Preparation of the chain-of-custody form shall be as follows:

- The chain-of-custody record shall be initiated in the field by the person collecting the sample, for every sample. Every sample shall be assigned a unique identification number that is entered on the chain-of-custody form. Samples can be grouped for shipment using a single form. The form shown as Figure 7.1 allows for fifteen samples. If more than fifteen samples are shipped in the same container, more than one chain-of-custody form is required.
- The record shall be completed in the field to indicate project, sampling team, etc.
- Because the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for

  Relinquished By _________, Received By ________ shall be completed in the field.

- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record form as Transported By __________.
- Because the samples are to be shipped to the laboratory by commercial carrier, the chain-of-custody form shall be sealed in a watertight envelope, placed in the shipping container, and the shipping container sealed prior to being given to the carrier.
- The commercial carriers waybill shall serve as an extension of the chain-of-custody record between the final field custodian and receipt in the laboratory.
- Upon receipt in the laboratory, the Quality Control Coordinator, or designated representative, shall open the shipping containers, compare the contents with the chain-of-custody record, and sign and date the record. Any discrepancies shall be noted on the chain-of-custody form.
- If discrepancies occur, the samples in question shall be segregated from normal sample storage and the field personnel immediately notified.
- Chain-of-custody records shall be maintained with the specific project files, becoming part of the permanent closure documentation.

7.2 Field Collection and Shipment. In addition to initiating the chain-of-custody form, field personnel are responsible for uniquely identifying (required on the chain of custody form) and labeling samples, providing proper filtration and preservation, and packaging samples to preclude breakage during shipment.

Every sample shall be labeled to identify:

- Project number
- Unique sample number

- Sample location and depth (such as borehole and depth)
- Sampling data and time
- Person obtaining the sample
- Method of sample preservation/filtration, if any.

Samples must be placed in containers compatible with the intended analysis and properly preserved. Also, collection of samples must consider the time interval between acquiring the sample and analysis (holding time) so that the sample is representative. Appendix B provides requirements for various analytical parameters with respect to the type of container, preservation methods, and maximum holding time between collection and analysis.

Shipping containers are to be sealed prior to shipment, both during direct transport via field personnel as well as when the commercial carrier is used. The only exception to this is if sufficient holding time exists so that the samples can be held in the field and it is necessary to re-ice the containers prior to or during transport. The Laboratory should be telephoned as soon as the shipping containers are consiged to the shipper, and the estimated time of arrival at the Laboratory given.

7.3 Laboratory Custody Procedures.

The Laboratory responsibility for sample security and integrity begins with the delivery of the samples to the Laboratory. Upon sample receipt, the Laboratory Quality Control Coordinator or his designee shall:

- Examine all samples and determine if proper temperature has been maintained during shipment. If samples have been damaged during shipment, the remaining samples shall be carefully examined to determine whether they were affected. Any samples affected shall also be considered damaged. It will be noted on the chain-of-custody record that specific samples were damaged and that they must be resampled, or the testing program changed, and an estimate of the cause of damage provided.
- Compare samples received against those listed on the chain-of-custody.
- Verify that sample holding times have not been exceeded.
- Sign and date the chain-of-custody form and attach the way bill to the chain-of-custody.
- Assign laboratory identification numbers to the Chemical Analysis Form and these numbers are plainly marked on the appropriate sample containers.
- Place the samples in the laboratory master log-in book which contains the following information:
  - Project identification number
  - Sample numbers
  - Type of samples
  - Date received in laboratory
  - Date put into storage after analysis is completed
  - Date of disposal.

  The last two items will be added to the log when the action is taken.

- Notify the Laboratory Manager of sample arrival.
- Place the complete chain-of-custody records in the project file.
- All laboratories are locked at the end of the day.

The laboratory project file will be submitted to Connecticut DEP as part of the final evidence files 6 months after the final acceptance of the Report.

7.4 Laboratory Storage of Samples.

The primary considerations for sample storage are:

- Maintenance of prescribed temperature, if required, which is typically four degrees Celcius
- Extracting and/or analyzing samples within the prescribed holding time for the parameters of interest.

The requirements of Appendix B for temperatures and holding times shall be used. Placement of samples in the proper storage environment is the responsibility of the Quality Control Coordinator, who should notify the Laboratory Manager or his designated representative, if there are any samples which mut be analyzed immediately because of holding-time requirements.

7.5 Initiation of Testing Program.

The Quality Control Coordinator is responsible for prioritizing samples on the basis of holding time and required reporting time into the laboratory sample stream.

7.6 Sample Disposal. The chain-of-custody for the sample is completed as part of sample disposal. There are several possibilities for sample disposition:

> Samples and sample processing products (e.g., digestate, distillate, extract) shall be held by the laboratory at 4 degrees Centrigrade for 30 days after the date of the analysis. After the 30 day holding period at 4 degrees Centrigrade, the samples shall be held for an additional 90 days (refrigeration not required for 90 day holding period). If the Department has not requested that the be returned to the Department before the end of the 90 day holding period, it is the responsibility of the laboratory to properly dispose of the samples.

TODAY'S :____/____/____

CHAIN OF CUSTODY RECORD

SAMPLES SENT TO:____________ ____________

PROJ. NO.	PROJECT NAME					NO. OF CONTAINERS							REMARKS
SAMPLERS: *(Signature)*													
STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION								

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks	

Distrit : Original to Lab, Copy 1 to field files, Copy 2 to project manager

8.0 Calibration Procedures and Frequencies

This section describes calibration procedures and policies pertinent to this project.

8.1 Calibration Practices. Instruments and equipment used in the Laboratory are controlled by a formal calibration program. The program verifies that equipment is of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. All instruments and equipment which measure a quantity, or whose performance is expected at a stated level, are subject to calibration. Calibration may be performed by Laboratory personnel using reference standards, or externally by calibration agencies or equipment manufacturers.

Implementation of the laboratory calibration program is the responsibility of the Laboratory Manager and Analysts. The Laboratory Quality Control Coordinator shall review the implementation of the program.

Two types of calibration are discussed in this section:

- Operational calibration which is routinely performed as part of instrument usage, such as the development of a standard curve for use with an atomic absorption spectrophotometer. Operational calibration is generally performed for instrument systems.
- Periodic calibration which is performed at prescribed intervals for equipment, such as balances and ovens. In general, equipment which can be calibrated periodically is a distinct, single purpose unit and is relatively stable in performance.

8.1.1 Calibration Procedures Whenever possible, recognized procedures, such as those published by ASTM or the USEPA, or procedures provided by manufacturers shall be adopted.

At a minimum, the procedures shall include:

- Equipment to be calibrated
- Reference standards used for calibration
- Calibration technique and sequential actions
- Acceptable performance tolerances
- Frequency of calibration
- Calibration documentation format.

8.1.2 Equipment Identification Equipment that is subject to calibration shall be uniquely identified so that calibration records can be designated with a specific instrument.

8.1.3 Calibration Frequency Instruments and equipment shall be calibrated at prescribed intervals and/or as part of the operational use of the equipment. Frequency shall be based on the type of equipment, inherent stability, manufacturer's recommendations, values provided in recognized standards, intended use, effect of error upon the measurement process, and prior experience.

8.1.4 Calibration Reference Standards Two types of reference standards will be used within the Laboratory for calibration:

- Physical standards, such as weights for calibrating balances and certified thermometers for calibrating working thermometers and ovens, which are generally used for periodic calibration

- Chemical standards such as Standard Reference Materials (SRMs) provided by the National Bureau of Standards (NBS) which are primarily used for operational calibration.

Whenever possible, physical and chemical reference standards shall have known relationships to nationally recognized standards (e.g., NBS) or accepted values of natural physical constants. If national standards do not exist, the basis for the reference standard shall be documented.

8.1.5 Calibration Failure Equipment that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use, or shall be tagged to indicate it is out of calibration. Such equipment shall be repaired and satisfactorily recalibrated before reuse.

8.1.6 Calibration Records Records shall be prepared and maintained for each piece of equipment subject to calibration. Records demonstrating accuracy of reference standards shall also be maintained.

For instruments and equipment that are calibrated on an operational basis, calibration generally consists of determining instrumental response against compounds of known composition and concentration or the preparation of a standard response curve of the same compound at different concentrations. Records of these calibrations can be maintained in several ways:

- The calibration data can be kept with analytical sample data

- A log book can be prepared for each instrument which contains all calibration data.

The former method provides response factor information, etc., directly with analytical data so that the analytical data can be readily processed and verified. Also, the raw data package is complete as a unit.

The latter method provides an ongoing record of the calibration undertaken for a specific instrument; however, to process and verify the analytical data the log must be used in conjunction with the raw data.

For operational calibration of instrumentation used for this project, calibration data will be included with the raw analytical data and maintained in project files.

8.2 Operational Calibration. Operational calibration is generally performed as part of the analytical procedure. Included may be the analysis of a method blank and the preparation of a standard response (standard calibration) curve.

Following is a brief discussion of the analysis of method blanks and preparation of standard curves.

8.2.1.1 Method Blank. The Analyst defines the method blank to determine if the cumulative blank interferes with the analysis. The method blank is defined by following the procedure step by step, including the addition of all of the reagents and solvents, in the quantity required by the method. If the cumulative blank interferes with the determination, steps must be taken to eliminate or reduce the interference to a level that will permit the combination of solvents and reagents to be used. If the blank interference cannot be eliminated, the magnitude of the interference must be considered when calculating the concentration of specific constituents in the samples analyzed.

A method blank should be determined whenever an analysis is made. The number of blanks is determined by the method of analysis and the number of samples analyzed at a given time.

8.2.1.2 Preparation of Standard Calibration Curve Concurrent with preparation of reagent and method blanks, a standard calibration curve is prepared for the instrumentation. Preparation of a standard calibration curve is accomplished by using calibration standards. The process may be summarized as follows:

- Preparation of a standard calibration curve is accomplished by using calibration standards prepared by mixing the species to be analyzed into the solvent that is to be introduced into the instrument.
- The concentration of the calibration standards are chosen to cover the working range of the instrument.
- All sample measurements are made within this working range.
- The calibration curve is prepared by plotting instrument response versus concentration of the species analyzed.

- Concentrations of the sample prepared with the same procedure are read directly from the calibration curve or determined by interpolation.

8.2.2 Calibration of the Gas Chromatograph Calibration of the gas chromatograph (GC) is performed during operation of the instrument. A three-point standard curve, consisting of a method blank and three standards should be analyzed daily to calibrate instrument response by the external standard procedure and to define the working range of the GC for the compounds of interest. A calibration standard should be repeated at the end of each day to monitor any changes in instrument response over the course of the daily analysis program.

Response factors are to be calculated for each compound at each concentration level. These RF will be averaged to generate the mean daily RF for each compound over the range of the standard curve. The mean response factor will be used to calculate the sample concentration of the compound of interest. When sample response exceed the range of the standard curve, the sample will be diluted to fall within the range of the standard curve and be reanalyzed. The results of the daily GC standardization will be tabulated and filed with the corresponding sample analyses.

8.2.3 Calibration of Inductively Coupled Argon Plasma Spectrometer (ICAP) and Atomic Absorption Spectrophotometer (AAS)

The ICAP and AAS are standardized for the metal of interest by the analysis of a set of calibration standards prepared by diluting a stock solution of known concentration, or in accordance with instrument manufacturer's recommendations. Three to five working standards are prepared by dilution of the stock standard. The concentration of the calibration standards is chosen so as to cover the working range of the instrument. Subsequently, all sample measurements are made within this working range. Once the working standards are prepared, they are analyzed on the ICAP or AAS and the instrument response is calibrated to provide a direct readout in micrograms of metal per milliliter of water or parts per million.

The calibration is accomplished by inputting the metal concentration equivalent to the readout in absorbance/emission units during analysis of the working standards.

Once the instrument has been initially calibrated, the analysis of the working standards is repeated during sample analysis to standardize instrument response during analysis and to confirm the calibration settings. A typical analysis sequence is presented below:

- Working standards are prepared by dilution of a stock standard solution of the metal of interest.

- A calibration curve within the working range of the instrument is established by analysis of three to five working standards.
- The working standards are reanalyzed to confirm the calibration settings. If the calibration settings are not confirmed, the instrument is recalibrated.
- The samples are analyzed for the metal of interest.
- During sample analysis, a midpoint standard is analyzed to monitor instrument stability. If the analysis indicates the instrument calibration has changed, the instrument is recalibrated and the analysis is repeated.
- Following completion of the sample analyses, the working standards are reanalyzed to confirm calibration settings. If calibration settings are confirmed, the analysis is completed. However, if the calibration settings are not confirmed, the problem is corrected, and the analyses are repeated.
- Analysis data may be input (if available) into a computer data file for later calculation and normalization for matrix effects.

8.3 Periodic Calibration. Periodic calibration shall be performed for equipment such as balances, thermometers, ovens, and furnaces that are required in analytical methods, but which are not routinely calibrated as part of the analytical procedure. Documentation of calibration shall be kept for each equipment item.

Calibration requirements are determined within each ITAS laboratory depending upon the equipment used and its operating function.

9.0 Analytical Methods, Precision, Accuracy and Completeness Objectives

Table 9.1 summarizes the analytical method references and the corresponding quality assurance objectives for the parameters to be analyzed off-site. The quality assurance objectives are expressed in terms of precision, accuracy and completeness.

TABLE 9.1. ANALYTICAL METHOD REFERENCES, PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES OF OFF-SITE ANALYSIS

Parameter	Method (1)	Description	Precision Objective (2)	Accuracy Objective (3)	Completeness Objective (4)
Aromatic Volatile Organics	A 5030/8020	Purge and Trap Gas Chromatography/Photoionization Detection	35	25	90
Halogenated Volatile Organics	A 5030/8010	Purge and Trap Gas, Chromatography/Electrolytic Conductivity Detection	35	25	90
Total Leachable Cyanide	B 412 (p 329) A 9010	Leaching procedure Colorimetric	- 10	- 10	- 95
Extraction Procedure (EP) Toxicity Test	A 1310	Extraction Procedure	-	-	-
Arsenic	A 7060	Furnace Atomic Absorption Spectroscopy (FAAS)	20	25	95
Barium	A 6010	Inductively-Coupled Argon Plasma Spectroscopy (ICP)	20	25	95
Cadmium	A 6010	ICP	20	25	95
Chromium (Total)	A 6010	ICP	20	25	95

(1) A = "Test Methods for Evaluating Solid Waste (SW-846)", Third Edition, Office of Solid Waste and Emergency Response, USEPA, November 1986

B = Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition, 1985.

(2) Expressed as Relative Percent Difference of duplicate measurements made on a single laboratory sample.

(3) Expressed as Percent Error.

(4) Percent Completeness = $\frac{\text{Valid Data Obtained}}{\text{Total Data Planned}}$ X 100

TABLE 9.1 (Continued). ANALYTICAL METHOD REFERENCES, PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES OF OFF-SITE ANALYSIS

Parameter	Method (1)	Description	Precision Objective (2)	Accuracy Objective (3)	Completeness Objective (4)
Lead	A 7421	FAAS	20	25	90
Mercury	A 7470	Cold Vapor AAS	20	25	95
Selenium	A 7740	FAAS	20	25	95
Silver	A 6010	ICP	20	25	95
Hexavalent-Chromium	A 7196	Colormetric	10	10	95

(1) A = "Test Methods for Evaluating Solid Waste (SW-846)", Third Edition, Office of Solid Waste and Emergency Response, USEPA, November 1986

B = Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition, 1985.

(2) Expressed as Relative Percent Difference of duplicate measrements made on a single laboratory sample.

(3) Expressed as Percent Error.

(4) Percent Completeness = $\frac{\text{Valid Data Obtained}}{\text{Total Data Planned}}$ X 100

10.0 Data Reduction, Validation, and Reporting

This section describes data reduction, validation, and reporting procedures which will be used at the Laboratory. Primary responsibility for implementation of these procedures within the laboratory will reside with the Laboratory Manager. The principal points of contact between the Contracting Officer and QA Program Manager will be the Laboratory Manager and the Laboratory Quality Control Program Manager.

10.1 Data Validation. Data validation begins with the processing of data and continues through review of the data and the reporting of analytical results. Data processing can be performed by the Analyst who obtained the data or another Analyst. Data review starts with an Analyst independent of the data acquisition and processing, reviewing (validating) that data processing has been correctly performed and continues through verifying that the reported analytical results correspond to the data acquired and processed. Final review of the data to be reported is by the Project Manager.

As stated, the first step in validation is data processing. In general, data will be processed by an Analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets

- Input of raw data for computer processing
- Direct acquisition and processing of raw data by a computer.

If data are manually processed by an Analyst, all steps in the computation shall be provided including equations used and the source of input parameters such as response factors, dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, calculations should be attached to the data sheets.

The Analyst shall sign (full signature) and date in ink each page of calculations.

For data that are input by an Analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the project number and other information as needed. The samples analyzed shall be evident and the input signed and dated by the Analyst.

If data are directly acquired from instrumentation and processed, the Analyst shall verify that the following are correct: project and sample numbers, calibration constants and response factors, output parameters such as units and numerical values used for detection limits (if a value is reported as less than). The Analyst shall sign and date the resulting output.

10.1.1 Review of Data Processing. Following is a discussion of the method to be used for reviewing (checking) data processing. At least 20 percent of all data shall be checked in this manner. If, during the checking process, errors are determined, checking shall be completely (100 percent) performed for the data set.

- The Analyst performing the data processing shall give an Analyst independent of the work the data package. The package shall include, as appropriate, raw data, data sheets, strip charts, computer input/output, calculations, sources for input parameters such as response factors, etc.
- The independent Analyst (checker) shall review the data for:
  - Appropriateness of equations used
  - Correctness of numerical input
  - Numerical correctness of all calculations. This should be done by reperforming numerical computations.
  - Correct interpretation of strip charts, etc.
- All entries and calculations that the checker reviews shall be marked in ink with a check mark. The checking process must be thorough enough to validate that the results are correct. If the checker disagrees with any part of the computations, the checker shall mark through the number with a single line and place the revised number above it.
- Any changes made by the checker shall be backchecked by the originator. If the originator agrees with the change, no action is necessary. If the originator disagrees, the originator and checker must resolve the difference so they agree with the result presented.
- The checker shall sign originals and date in ink all pages of the data package (except for groups of printout such as chromatograms). Signing and dating indicates that reviewer agrees with the calculations and that any changes made have been agreed to by the originator.

- If the data have been processed by computer, the reviewer shall check every input entry. Agreement should be indicated by a check mark for every line. If the checker disagrees with the input, the number should be marked through with a line and corrected number indicated above it. Corrections must be backchecked by the originator as discussed above.
- If an input error is identified and the data have been processed, it will be necessary to reprocess the data. In this event, the checker shall mark the second set of input to indicate agreement with the input changes. The checker shall sign and date in ink the computer input to indicate agreement.
- Raw data that are automatically acquired and processed do not require any validation at this point beyond that previously discussed.

10.1.2 Review of Data Reporting. Review of data reports is required to verify that information reported by the Laboratory corresponds with processed analytical results. Review is only required of the data as it is presented for issuance. Intermediate steps performed after the processed data are checked to prepare the data report (such as data summaries) do not require validation. Preparation of the report is the responsibility of the Laboratory QA Manager or her designated representative.

After the draft data report is prepared (generally in tabular form), the reported results should be checked against the reviewed processed data so that transcription errors do not occur. The checking process follows:

- Using the draft report, all data entries are checked by an Analyst. The checker is not required to be independent of the work because only the transcription from the reviewed data to the data report is being checked.

- The draft data report should be checked so that the items cited for data presentation in Section 10.2 are complete and correct. As the reviewer checks the entries on the draft report, an ink checkmark is placed beside each correct entry. Corrected entries are marked through with a single line and the correct entry provided. The reviewer will indicate that corrections have been made in the report by placing a second check mark by the correction after comparing the change with the revised copy. The checker shall sign and date every page of the data report in ink.

- Use of the draft data report results in a checkprint which should be maintained as a record to demonstrate the review.

- If data printouts, such as chromatograms or GC/MS data processing, are included in the data report, review is not required for the data printout.

- If computer output is used directly as the data report without further transcription, only the input requires review as discussed in Section 10.1.1.

After checking of the data report is complete, it is given to the Laboratory QA Manager or her designated representative for final review. This step is not intended to verify the reported data. This review is intended to determine that the report meets project requirements. The data report is approved for issue by the Laboratory QA Manager.

10.2 Data Reporting. The following are applicable to data presentation:

- The final presentation shall be checked in accordance with data verification requirements of Section 10.1.2 and approved by the Laboratory QA Manager.

- Data will be presented in a tabular format whenever possible.

- Each page of data will be identified with the project number and name; date of issue; and, if appropriate, client name.

- Data presentation will include:

  - Sample identification number used by the Laboratory and/or the sample identification provided to the Laboratory, if different than identification used in the Laboratory

  - Chemical parameters analyzed, reported values, and units of measurement

  - Detection limit of the analytical procedure if the reported value is less than the detection limit

  - Data for a chemical parameter are reported with consistent significant figures for all samples

  - Results of Quality Control sample analysis if appropriate

  - Achieved accuracy, precision, and completeness of data if appropriate

  - Footnotes referenced to specific data if required to explain reported values.

- Data will be transmitted from the laboratory only by the Laboratory Manager.

11.0 Quality Assurance/Quality Control Procedures

11.1 Quality Control Procedures

All analyses performed in support of this program will be done using standardized laboratory procedures. The QC program will make use of QC samples which are both known and unknown, or "blind", to the laboratory. These QC samples include: calibration check samples, laboratory control samples, method blanks, field blanks, trip blanks, replicates, matrix spike/matrix spike duplicates and surrogate spikes. The various types of both field and laboratory generated QC samples are described below.

FIELD GENERATED QC SAMPLES FOR OFF-SITE ANALYSES

a. One (1) trip blank with every batch of samples (both water and sludge) sent to the laboratory for the analysis of volatile organics. **Definition of trip blank:** Two 40 ml septum vials are filled with laboratory-pure, analyte-free water, transported to the site, handled like a sample, and returned to the laboratory for analysis of volatiles (trip blanks are not to be opened in the field).

b. One (1) set of equipment blanks for every day of sampling if a device other than the sample container is required to collect the sample. **Definition of Equipment Blank:** laboratory-pure, analyte-free, water is poured into the sampling device, or pumped through it (in the case of sampling pumps), transferred to the sample bottle, and then transported to the laboratory for analysis. The equipment blanks (also called De-Con blanks) are analyzed for the same parameters as the samples.

c. Ten (10) percent field duplicates for all sample types and all parameters. **Definition of Duplicate:** two samples collected independently at a sampling location during a single episode of sampling. Field duplicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are duplicates.

OFF-SITE LABORATORY GENERATED QC SAMPLES

a. One (1) Laboratory Control Standard (LCS) for every batch of samples analyzed for all parameters. **Definition of LCS:** Solutions prepared by adding known quantities of EMSL-Cincinnati or NBS Standard Reference or independently prepared stock materials to deionized water. The LCS are routinely used to establish that an instrument or procedure is in Control before analysis of samples begins. The analyst notes the LCS result in the instrument logbook and on the Control chart; the result must be within Control limits before sample analysis begins. An LCS is normally carried through the entire sample preparation and analysis procedure.

b. One (1) calibration check sample (CCS) for every 10 samples analyzed sequentially for inorganic parameters. **Definition of CCS:** one of the working calibration standards is periodically re-analyzed and the subsequent values used to demonstrate that the original calibration is still valid.

c. One (1) method/reagent blank for every batch of samples analyzed for all parameters. **Definition of method Blank:** laboratory-pure, analyte-free water carried through the entire preparation and analysis procedure.

d. Ten (10) percent laboratory replicates for all samples. Definition of Replicate: a single sample (e.g., one particular aliquot) is collected, then divided into two equal parts for the purpose of determining analytical precision. Replicate samples are often called "Splits" if each half of the replicate is sent to separate labs for independent analysis. Laboratory replicates can be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are replicates.

e. One (1) matrix spike and one (1) matrix spike duplicate for every ten (10) samples analyzed for volatile organics (a minimum of one per matrix).

f. One (1) matrix spike for every (10) samples analyzed for metals (a minimum of one per matrix).

g. One (1) matrix spike for every batch of samples analyzed for inorganic general chemistry parameters (cyanide and hexavalent chromium).

Every blank, standard and environmental sample analyzed for organics (including matrix spike/matrix spike duplicate samples) shall be spiked with surrogate compounds prior to purging or extraction. Surrogates shall be spiked into samples according to the appropriate analytical methods. Surrogate spike recoveries shall fall within the control limits set in accordance with procedures specified in the method or within ±20 percent for samples falling within the quantitation limits without dilution.

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12.0 Performance and Systems Audits

Audits of an analytical laboratory are described as:

- Performance audits conducted on an ongoing basis within the laboratory by the Quality Control Coordinator.
- System audits performed on a scheduled, periodic basis by the Contracting Officer and Laboratory Quality Assurance Managers.

The Laboratory will receive at least one performance audit during the period of performance of the analyses of project samples. The performance audit will cover all target parameters of the site investigation. The Laboratory QA Program Manager will collect the information and reports from these audits conducted by the Laboratory Quality Assurance Manager for project files and followup as necessary. Connecticut DEP may conduct its own independent performance audits. In addition, the Laboratory QA Program Manager will conduct at least one system audit of the Laboratory during the period of performance. He may be accompanied by the Contracting Officer and Connecticut DEP personnel, or the latter may conduct their own independent systems audit.

The content and conduct of the audits are discussed below.

12.1 Performance Audits. The inorganic and organic laboratory supervisors are responsible for the preparation of Quality Control samples, insertion into the sample stream, and analysis of the results. The samples are analyzed on a daily, ongoing basis and provide the means for demonstrating data quality by statistical analyses.

To complete internal laboratory reviews, the Quality Assurance Manager shall provide ongoing monitoring of the Laboratory Manager to verify that the laboratory Quality Assurance Program is implemented and functioning on a daily basis. The review is intended to be a spot check and should include:

- Sample maintenance
  - Are stated temperatures for sample storage provided?
  - Are samples processed and tested within prescribed holding times?
- Calibration
  - Is calibration data documented in instrument log books, or as part of project data if required?
  - Do calibration results indicate a trend in instrument performance?
- Preventive maintenance
  - Are adequate spare parts available?
  - Do specific instruments have repeated maintenance problems?
  - Is preventive maintenance performed and properly documented?
- Receipt and storage of standards, chemicals, and gases
  - Are all reagents, chemicals, and gases purchased for use in the laboratory of adequate grade for the intended use?
  - Are certifications of material compositions provided when required?

  - Are materials adequately stored to prevent degradation?
  - Are materials kept beyond stated shelf life?
  - Are internal standards kept beyond stated shelf life?
- Data verification
  - Are data processed and validated as prescribed?
- Records management
  - Are the records of analyses complete and properly identified?
  - Are documents submitted to the record system in a timely manner and are they properly maintained?

Nonconformances observed by the Laboratory Quality Assurance Manager shall be reported to the Laboratory Manager or Quality Assurance Program Manager, if necessary, for corrective action to be taken. The Laboratory Quality Assurance Manager shall keep a log of nonconformances observed. The log shall document the nonconformance; date of occurrence; reason for occurrence, if known; date of corrective action; and the corrective action taken.

12.2 System Audits. System audits shall be conducted by the Quality Assurance Program Manager. These audits shall be on a semiannual basis and provide a thorough overview of implementation of the Quality Assurance Program within the laboratory. The audit will focus only on the performance of the laboratory for the project.

System audits will review operation of the laboratory and resulting documentation, including all items reviewed by the Laboratory Quality Assurance Manager. Particular emphasis will be placed upon implementation of the the Quality Control sample program and nonconformance log. Review of these aspects of the laboratory Quality Assurance Program should indicate trends adverse to data quality.

13.0 Preventive Maintenance

Table 13.1 summarizes requirements for the preventive maintenance of analytical instrumentation associated with this project.

TABLE 13.1 MINIMUM PREVENTIVE MAINTENANCE REQUIREMENTS

Instrument	Maintenance	Frequency	Documentation	Reference
Atomic Absorption Spectrophotometer	Check nebulizer, mixing chamber and burner system	Daily	Log Book	Manufacturer's Manual
	Clean nebulizer, mixing chamber and burner system	As required	Log Book	Manufacturer's Manual
	Check drain trap and waste-vessel	Daily	Log Book	Laboratory SOP
	Empty waste-vessel	As required	NA	NA
	Inspect/clean sample compartment windowns	Inspect daily; clean weekly	Log Book	Manufacturer's Manual
	Check gas supplies	Daily	Log Book	Laboratory SOP
Heated Graphite Furnace	Check plumbing	Whenever turned on	Log Book	Manufacturer's Manual
	Clean/replace graphite tubes	As required	Log Book	Manufacturer's Manual
	Clean atomizer windows	Daily	Log Book	Manufacturer's Manual
	Inspect/clean sample compartment windowns	Inspect daily, clean weekly	Log Book	Manufacturer's Manual
	Check argon flow	Daily	Log Book	Manufacturer's Manual
Inductively Coupled Plasma Spectrophotometer	Inspect chamber, nebulizer and torch assembly	Daily	Log Book	Manufacturer's Manual
	Check optics	Daily	Log Book	Manufacturer's Manual
	Check pumps	Daily	Log Book	Manufacturer's Manual
	Check exhaust	Daily	Log Book	Manufacturer's Manual
Gas Chromotagraphs	Condition moisture trap	2 months, or when gas source is changed	Log Book	Manufacturer's Manual
	Repack moisture trap	Every 10 conditionings	Log Book	Manufacturer's Manual

TABLE 13.1 (Continued). MINIMUM PREVENTIVE MAINTENANCE REQUIREMENTS

Instrument	Maintenance	Frequency	Documentation	Reference
Gas Chromotagraphs (Continued)	Condition chemical filter	2 months, or when gas source is changed	Log Book	Manufacturer's Manual
	Leak check carrier and support gases	As required	Log Book	Manufacturer's Manual
	Adjust air solenoid	Initial set-up or when flow conditions change	Log Book	Manufacturer's Manual
	Condition column	When column is changed or when chrometographic conditions or samples require	Log Book	Manufacturer's Manual
	Repack/Replace column	As required	Log Book	Manufacturer's Manual
	Injection Port			
	Clean injection port	As required	Log Book	Manufacturer's Manual
	Replace septum	Every 20 Manual Injections, or as required	Log Book	Manufacturer's Manual
	Leak check injection port	As required	Log Book	Manufacturer's Manual
	Capillary Inlet			
	Leak test inlet	As required	Log Book	Manufacturer's Manual
	Replace septum	Weekly, or as required	Log Book	Manufacturer's Manual

TABLE 13.1 (Continued). MINIMUM PREVENTIVE MAINTENANCE REQUIREMENTS

Instrument	Maintenance	Frequency	Documentation	Reference
Gas Chromotagraphs (Continued)	Clean insert	Whenever insert is changed	Log Book	Manufacturer's Manual
	Replace insert seal	Whenever leak occurs, or damage is apparent.	Log Book	Manufacturer's Manual
	Atmosampler			
	Align transport stops	As required	Log Book	Manufacturer's Manual
	Needle positioning	On installation, then as required	Log Book	Manufacturer's Manual
	Detectors			
	Leak check FID/NPD	As required	Log Book	Manufacturer's Manual
	Clean FID	As required	Log Book	Manufacturer's Manual
	Clean FID/NPD jet	2 months for capillary as required for packed columns	Log Book	Manufacturer's Manual
	Clean FID collector	As required	Log Book	Manufacturer's Manual
	Clean FID/NPD Air/H_2 controls	As required	Log Book	Manufacturer's Manual
	Adjust FID/NPD solenoids	Initial set-up or when flow conditions change	Log Book	Manufacturer's Manual
	Evaluate ECD carrier gas	When carrier gas is changed	Log Book	Manufacturer's Manual

TABLE 13.1 (Continued). MINIMUM PREVENTIVE MAINTENANCE REQUIREMENTS

Instrument	Maintenance	Frequency	Documentation	Reference
Gas Chromotagraphs (Continued)	Leak check ECD	When column is changed	Log Book	Manufacturer's Manual
	Thermal clean ECD	Monthly	Log Book	Manufacturer's Manual
	NRC wipe test ECD	6 months	Log Book	Manufacturer's Manual
pH Meter	Check electronics	Daily	Log Book	Manufacturer's Manual
	Change electrolyte	Checked weekly, changed when low	Log Book	Manufacturer's Manual
Analytical Balance	Service internal weight train, gears, electronics	Annual service	Log Book, service sticker	Manufacturer's Manual

14.0 Routine Procedures for Assessing Precision, Accuracy and Completeness

Following are the procedures recommended for evaluating the precision and accuracy of all environmental measurement data generated in the project. Quality control sample analyses are performed as appropriate for organic or inorganic sample analyses as discussed in Section 11. The protocol used will be in accordance with specific analytical procedures if QC requirements are stated in the procedure.

14.1 Review of QC Samples Data. When the analyses of a sample set are completed, the results will be reviewed and evaluated to assess the validity of the data set. Review is based on the criteria in Section 11, applied as follows:

- Method Blank Evaluation - The reagent and/or method blank results are evaluated for high readings #haracteristic of background contaminations. If high blank values are observed, laboratory glassware and reagents will be checked for contamination and the analysis halted until the system is brought under control before further sample analysis proceeds. A high background is defined as a background value sufficient to result in a difference in the sample value, if not corrected, greater than or equal to smallest significant digit known to be true.

- Field Blank Evaluation - Field blank results are evaluated for high readings similar to the reagent and/or method blanks described above. If high field blank readings are encountered, the procedure for sample collection, shipment, and laboratory analysis should be reviewed. If both the reagent and/or method blanks and the field blanks exhibit significant background contamination, the source of contamination is probably within the laboratory.

- Matrix Spike Evaluation - The observed recovery of the spike versus the theoretical spike recovery is used to calculate accuracy as defined by the percent recovery. If the average accuracy value exceeds the acceptance criteria for the given parameters (Table 9.1) the Quality Control Coordinator is notified. The sample set may be reanalyzed for the parameter in question.

- Calibration Standard Evaluation - The calibration curve is evaluated to determine linearity through its full range, and to verify that sample values are within the range defined by the low and high standards. If the curve is not linear, as defined in Section 8.1, sample values must be corrected for nonlinearity by deriving sample concentrations from a graph or by using an appropriate algorithm to fit a nonlinear curve to the standards.

- Replicate Sample Evaluation - Duplicate sample analysis for the sample set is used to determine the precision of the analytical method for the sample matrix. The duplicate results are used to calculate the precision as defined by the relative percent difference (RPD). If the precision value exceeds the acceptance criteria for the given parameter (Table 9.1), the Quality Control Coordinator is notified. The sample set may be reanalyzed for the parameter in question. Attainable precision limits will be specified by the Quality Control Coordinators and updated periodically following review of data.

- Blind Replicate Evaluation - The blind replicate analysis is evaluated in the same manner as described above for the duplicate sample analysis and is treated as a duplicate result for purposes of evaluating the precision of the analytical method. This evaluation is performed independently by the Quality Control Coordinator.

- Reference Standard Evaluation - Standard Reference Materials analyses are compared with true values and acceptable ranges. Values outside the acceptable ranges require corrective action to determine the source of error and provide corrective action. All sample analyses should be halted pending this evaluation.

Following correction of the problem, the Standard Reference Material should be reanalyzed.

- Check Standard Evaluation - The results of check standard analysis are compared with the true values, and the percent recovery of the check standard is calculated. If correction is required, the check standard should be reanalyzed to demonstrate that the corrective action has been successful.

- Surrogate Standard Evaluation - The results of surrogate standard determinations are compared with the true values spiked into the sample matrix prior to extraction and analysis and the percent recoveries of the surrogate standards are determined.

14.2 Evaluation of Completeness. Completeness is calculated as the percentage of total usable data points out of the set of total data points collected and analyzed and available. Data points may not be usable if analytical results show samples exceeded holding times, or if quality control sample criteria were not met and reanalysis of samples is not possible, or if samples were broken in the lab.

15.0 Corrective Action

A nonconformance is any event which is beyond the limits established for laboratory operation. Nonconformances can be due to data which lie outside accepted bounds for accuracy and precision, improper equipment calibration or maintenance, or improper data verification. Any activity in the laboratory which affects data quality can result in a nonconformance.

Nonconformances associated with the statistical analysis and review of data are straightforward to identify. The Laboratory Quality Assurance Manager will be responsible for assessment of Quality Control sample information. If data lie outside accepted limits, the Laboratory Quality Assurance Manager shall immediately notify the Laboratory Manager or her designated representative. If the situation is not corrected so that an out-of-control condition occurs, or is expected to, the Laboratory Quality Assurance Manager shall notify the Laboratory Manager. The Laboratory Manager or his designated representative is responsible for action. Completion of corrective action should be evidenced by data returning to prescribed acceptable limits.

Nonconformances which do not readily result in an observed impact on data quality are more difficult to identify. Such events could be samples stored at an incorrect temperature or held beyond prescribed holding times. All laboratory staffs have responsibility for proper maintenance of records. Everyone in the laboratory is responsible for reporting "system" nonconformances. Analysts should report nonconformances to the Laboratory Manager or his designated representative. Corrective action is again the responsibility of the Laboratory Manager or his designated representative. They shall review and approve the action taken.

Documentation of the nonconformance and the corrective action taken shall be prepared if the nonconformance directly affects data quality.

Nonconformances and required corrective action can also result from the ongoing laboratory review of the Laboratory Quality Assurance Manager and audits performed by the Quality Assurance Program Manager. These activities are discussed in Section 14.

16.0 Quality Assurance Reports to Management

The analytical work on this project will last longer than one calendar month, so monthly progress reports will be provided. The report will summarize the status of all the samples in the project, the number of samples from the project analyzed during the month, samples received during the month, samples reported during the month, the number of samples scheduled for the following month, the number and types of QC samples analyzed during the month, and any unacceptable or unusual QC or sample results. The monthly laboratory analysis report may be incorporated into monthly project progress report.

A summary report describing the performance of measurement systems and data quality will be prepared for inclusion in the final report. This report will address, at a minimum, the following:

- Results of performance audits of all field sampling and laboratory analysis activities performed during the subject reporting period

- Results of systems audits
- Assessment of measurement data accuracy, precision, and completeness, including review of all Aqualab Laboratory measurement data
- Significant QA problems and corrective actions.

APPENDIX A

STANDARD OPERATING PROCEDURES FOR DECONTAMINATION

STANDARD DECONTAMINATION PROCEDURES

1. GENERAL

1.1 Introduction

The cleaning procedures outlined in this section are to be used by all field personnel to clean sampling and other field equipment as well as sample containers prior to field use. Sufficient clean equipment and sample containers should be transported to the field so that an entire investigation can be conducted without the need for cleaning equipment in the field. However, this will not always be possible when using specialized field equipment. Field cleaning procedures are included to cover these special problem areas.

These procedures are the standard operating procedures (SOP) for this project; any deviation from them must be documented in field records and investigative reports.

1.2 Cleaning Materials

The cleaning materials referred to throughout this section are defined in the following paragraphs.

Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute for tap water.

The laboratory detergent shall be a standard brand of phosphate-free laboratory detergent such as Sparkleen® or Liquinox®. The use of any other detergent must be justified and documented in the field log books.

The nitric acid solution shall be made from ACS reagent-grade nitric acid and deionized water.

The standard cleaning solvent shall be reagent-grade isopropanol. However, solvents may be substituted for a particular investigation if needed. Pesticide-grade acetone or methanol may be acceptable. However, it should be noted that if pesticide-grade acetone is used, the detection of acetone in samples collected with acetone rinsed equipment is suspect. Pesticide-grade methanol is much more hazardous to use than either pesticide-grade isopropanol or acetone, and its use is discouraged. Pesticide-grade hexane and petroleum ether are not miscible with water; therefore, these two solvents are not effective rinsing agents. The use of any solvent other than pesticide-grade ispropanol for equipment cleaning purposes must be justified and its use must be documented in field log books and inspection or investigation reports.

Deionized water is defined as tap water that has been treated by passing it through a standard deionizing resin column. Most commercial systems utilize a 5-micron prefilter followed by a mixed bed deionization unit to produce deionized water. The deionized water should contain no heavy metals or other inorganic compounds. Organic-free water is defined as tap water that has been treated with activated carbon and deionizing units. Usually, commercial units utilize a 5-micron prefilter, activated carbon unit, two mixed bed deionizing units (in series), a 0.2 micron post filter, and a postcarbon filter to produce organic-free water. Organic-free water should contain no pesticides, herbicides, extractable organic compounds, and less than 50 ug/l of purgeable organic compounds as measured by a low level GC/MS scan.

The brushes used to clean equipment as outlined in the various sections of this appendix shall not be of the wire-wrapped type.

The solvent, nitric acid solution, laboratory detergent, and rinse waters used to clean equipment shall not be reused, except as specifically permitted in the footnote for Step 3. Section 3.

1.3 Marking of Cleaned Sampling Equipment and Containers

All equipment and sample containers that are cleaned utilizing these procedures shall be labeled or marked with the date that the equipment was cleaned. Also, if there was a deviation from the standard cleaning procedures outlined in this appendix, this fact should be noted on the label.

When sample containers are cleaned and prepared, they should be cleaned in standard sized lots to facilitate the quality control procedures outlined in Section 2.

1.4 Marking and Segregation of Used Field Equipment

Field or sampling equipment that needs to be repaired shall be identified with a red tag. Any problems encountered with the equipment and needed repairs shall be noted on this tag. Field equipment or reusable sample containers needing cleaning or repairs shall not be stored with clean equipment' sample tubing, or sample containers. Field equipment, reusable sample containers, disposable sample containers, and sample tubing that are not used during the course of an investigation may not be replaced in storage, without being recleaned if these materials have been transported to a facility or study site where herbicides, pesticides, organic compounds, or other toxic materials are present or suspected of being present.

1.5 Decontamination of Equipment Used to Collect Samples of Toxic or Hazardous Waste

Equipment that is used to collect samples of hazardous materials or toxic wastes or materials from hazardous waste sites, RCRA facilities, or in-process waste streams shall be decontaminated before it is returned from the field. At a minimum, this decontamination procedure shall consist of washing with laboratory detergent and rinsing with tap water. More stringent decontamination procedures may be required, depending on the waste sampled.

1.6 Proper Disposal of Cleaning Materials

The solvent used to rinse sampling equipment and containers shall be collected and disposed of by allowing it to evaporate under a fume hood or be containerized and disposed of through an approved hazardous waste disposal contract. Similarly, spent nitric acid shall be collected and disposed of through the same disposal contract. These procedures apply whether the cleaning operations take place in a laboratory or in the field.

1.7 Use of Safety Procedures to be Utilized During Cleaning Operations

The materials used to implement the cleaning procedures outlined in this appendix can be dangerous if improperly handled. Caution must be exercised by all personnel and all applicable safety procedures shall be followed. At a minimum, the following precautions shall be taken in the lab and in the field during these cleaning operations:

1. Safety glasses with splash shields or goggles, neoprene gloves, and a neoprene laboratory apron will be worn during all cleaning operations.
2. All solvent rinsing operations will be conducted under a fume hood or in the open (never in a closed room).
3. No eating, smoking, drinking, chewing, or any hand to mouth contact shall be permitted during cleaning operations.

1.8 Storage of Field Equipment and Sample Containers

All field equipment and sample containers shall be stored in a contaminant free environment after being cleaned using the procedures outlined in this section.

2. SPECIFIC QUALITY CONTROL PROCEDURES FOR CLEANING OPERATIONS

2.1 Sampling Equipment Cleaned in the Field

The effectiveness of field cleaning procedures shall be monitored by rinsing field cleaned equipment with organic-free water and submitting the rinse water in standard sample containers to the laboratory for Analysis. Any time equipment is cleaned in the field, at least one such quality control sample should be collected. No more than five percent of the equipment cleaned during large scale field studies shall be subjected to these procedures.

3. CLEANING PROCEDURES FOR STAINLESS STEEL OR METAL SAMPLING EQUIPMENT USED FOR THE COLLECTION OF SAMPLES FOR TRACE ORGANIC COMPOUNDS AND/OR METALS ANALYSES*

1. Wash equipment thoroughly with laboratory detergent and hot water using a brush to remove any particulate matter or surface film.
2. Rinse equipment thoroughly with hot tap water.
3. Rinse equipment thoroughly with deionized water.

4. Rinse equipment twice with solvent and allow to air dry.
5. Wrap equipment completely with solvent rinsed aluminum foil to prevent contamination during storage and/or transport to the field.
6. Rinse the stainless steel or metal sampling equipment thoroughly with tap water in the field as soon as possible after use.

4. MISCELLANEOUS EQUIPMENT CLEANING PROCEDURES

4.1 Ice Chests and Shipping Containers

All ice chests and reusable containers will be washed with laboratory detergent (interior and exterior) and rinsed with tap water and air dried before storage. In the event that an ice

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* - When this sampling equipment is used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide grade acetone or hexane to remove the materials before proceeding with Step 1. In extreme cases, when equipment is painted, badly rusted, or coated with materials that are difficult to remove, it may be necessary to steam clean, wire brush, or sandblast equipment before proceeding with Step 1. Any stainless steel or other sampling equipment that cannot be cleaned using these procedures should be discarded.

chest becomes severely contaminated, in the opinion of the field investigator, with concentrated waste or other toxic material, it shall be cleaned as thoroughly as possible and disposed of properly.

4.2 Vehicles

All vehicles utilized in the field should be washed (if possible) at the conclusion of each field trip. This routine maintenance should minimize any chance of contamination of equipment or samples due to contamination of vehicles. When vehicles are used in conjunction with hazardous waste site inspections, or on studies where toxic materials are known or suspected to be present, a thorough interior and exterior cleaning is mandatory at the conclusion of such investigations. It shall be the responsibility of the project leader and/or field investigators to see that this procedure is followed.

APPENDIX B

REQUIRED CONTAINERS PRESERVATION TECHNIQUES, AND HOLDING TIMES

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES - ORGANIC TESTS(8)

Parameter name	Container(1)	Preservation(2)(3)	Maximum holding time(4)
Purgeable halocarbons	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$(5)	14 days
Purgeable aromatics	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$, HCl to pH 2(9)	14 days
Acrolein, acrylonitrile	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$, adjust to pH 4-5(10)	14 days
Phenols(11)	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
Benzidines(11)	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$(5)	7 days until extraction(13)
Phthalate esters	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitrosamines(11)(14)	G, Teflon-lined cap	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$(5)	
PCBs(11)	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitroaromatics and isophorone	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$,(5) store in dark	7 days until extraction; 40 days after extraction

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES - ORGANIC TESTS(8) (Continued)

Parameter name	Container(1)	Preservation(2)(3)	Maximum holding time(4)
Polynuclear aromatic hydrocarbons(11)	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$,(5) store in dark	7 days until extraction; 40 days after extraction
Haloethers(11)	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
Chlorinated hydrocarbons	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
TCDD(11)	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
Pesticides	G, Teflon-lined cap	Cool, 4°C pH 5-9(15)	7 days until extraction; 40 days after extraction

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES - ORGANICS (Continued)

Parameter name	Container(1)	Preservation(2)(3)	Maximum holding time(4)
Acid extractables	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 30 days after extraction
Base/neutral extractables	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 30 days after extraction

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES - BACTERIAL TESTS(8)

Parameter name	Container(1)	Preservation(2)(3)	Maximum holding time(4)
Coliform, fecal and total	P, G	Cool, 4°C, 0.008% $Na_2S_2O_3$(5)	6 hours
Fecal streptococci	P, G	Cool, 4°C, 0.008% $Na_2S_2O_3$(5)	6 hours

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES - INORGANIC TESTS

Parameter name	Container(1)	Preservation(2)(3)	Maximum holding time(4)
Acidity	P, G	Cool, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days
Biochemical oxygen demand	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Biochemical oxygen demand, carbonaceous	P, G	Cool, 4°C	48 hours
Chemical oxygen demand	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days
Chloride	P, G	None required	20 days
Chlorine, total residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4°C	48 hours
Cyanide, total and amenable to chlorination	P, G	Cool, 4°C, NaOH to pH >12, 0.6 g ascorbic acid(5)	14 days(6)
Fluoride	P	None required	28 days
Hardness	P, G	HNO_3 to pH <2, H_2SO_4 to pH <2	6 months
Hydrogen ion (pH)	P, G	None required	Analyze immediately

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES - INORGANIC TESTS (Continued)

Parameter name	Container(1)	Preservation(2)(3)	Maximum holding time(4)
Kjeldahl and organic nitrogen	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days
Metals,(7) except chromium VI and mercury	P, G	HNO_3 to pH <2	6 months
Chromium VI	P, G	Cool, 4°C	24 hours
Mercury	P, G	HNO_3 to pH <2	28 days
Nitrate	P, G	Cool, 4°C	48 hours
Nitrate-nitrite	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days
Nitrite	P, G	Cool, 4°C	48 hours
Oil and grease	G	Cool, 4°C, H_2SO_4 to pH <2	28 days
Organic carbon	P, G	Cool, 4°C, HCl or H_2SO_4 to pH <2	28 days
Orthophosphate	P, G	Filter immediately, cool, 4°C	48 hours
Oxygen, dissolved probe	G bottle and top	None required	Analyze immediately
Winkler	G bottle and top	Fix on site and store in dark	8 hours
Phenols	G only	Cool, 4°C, H_2SO_4 to pH <2	28 days
Phosphorus (elemental)	G	Cool, 4°C	48 hours

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES - INORGANIC TESTS (Continued)

Parameter name	Container[1]	Preservation[2][3]	Maximum holding time[4]
Phosphorus, total	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days
Residue, total	P, G	Cool, 4°C	7 days
Residue, filterable	P, G	Cool, 4°C	48 hours
Residue, nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, settleable	P, G	Cool, 4°C	48 hours
Residue, volatile	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	28 days
Sulfide	P, G	Cool, 4°C add zinc acetate plus sodium hydroxide to pH >9	7 days
Sulfite	P, G	None required	Analyze immediately
Surfactants	P, G	Cool, 4°C	48 hours
Temperature	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours

NOTES TO TABLES OF REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

1. Polyethylene (P) or Glass (G).
2. Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
3. When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (NHO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator under §136.3(e). Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the samples for a shorter time if knowledge exists to show that this is necessary to maintain sample stability. See §136.3(e) for details.
5. Should only be used in the presence of residual chlorine.
6. Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
7. Samples should be filtered immediately on-site before adding preservative for dissolved metals.
8. Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

NOTES TO TABLES OF REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES (Continued)

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9. Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
10. The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
11. When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held 7 days before extraction and 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine), and footnotes 12, 13 (re the analysis of benzidine).
12. If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ±0.2 to prevent rearrangement to benzidine.
13. Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
14. For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.
15. The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

Source: 40 CFR Part 136, Friday October 26, 1984, p. 28

APPENDIX C

HEALTH & SAFETY PLAN
FOR A
SURFACE IMPOUNDMENT CLOSURE
AT
AVCO LYCOMING

NOTE:

This plan is site specific and, at a minimum, meets the requirements of 29CFR1910.120 OSHA.

TABLE OF CONTENTS

HEALTH & SAFETY PLAN

I. GENERAL INFORMATION

SITE: Avco Lycoming Textron

LOCATION: Stratford Connecticut

PREPARED BY: Dan Watton (Metcalf & Eddy) DATE: 16 November 1987

OBJECTIVE(S): Health Safety requirements for the closure of AVCO Lycoming Surface Impoundments

PROPOSED DATE OF INVESTIGATION: Spring 1988

BACKGROUND REVIEW: Complete: X Preliminary: ____ Incomplete: ____

II. SITE/HAZARD OVERVIEW

APPARENT HAZARD:

Serious ____
Moderate X
Low ____
None ____
Unknown ____
____

TYPE OF FACILITY:

Imp. X
Dump ____
Landfill ____
Open ____
Enc. ____
Other ____

STATUS OF FACILITY:

Active X
Inactive ____
Unknown ____
____

WASTE TYPE(S):

Gas ____
Liquid X
Sludge X
Solid ____
Unknown ____
Other ____

WASTE CHARACTERISTICS:

Toxic X
Corrosive X
Ignitable ____
Volatile X
Radioactive ____
Reactive ____
Unknown ____
Other ____

TYPE/FORM OF HAZARD:

Dust X
Liquid X
Fumes ____
Vapors X
Contact X
Respiratory X
Other ____
IDLH ____

III. SITE DESCRIPTION & HISTORY

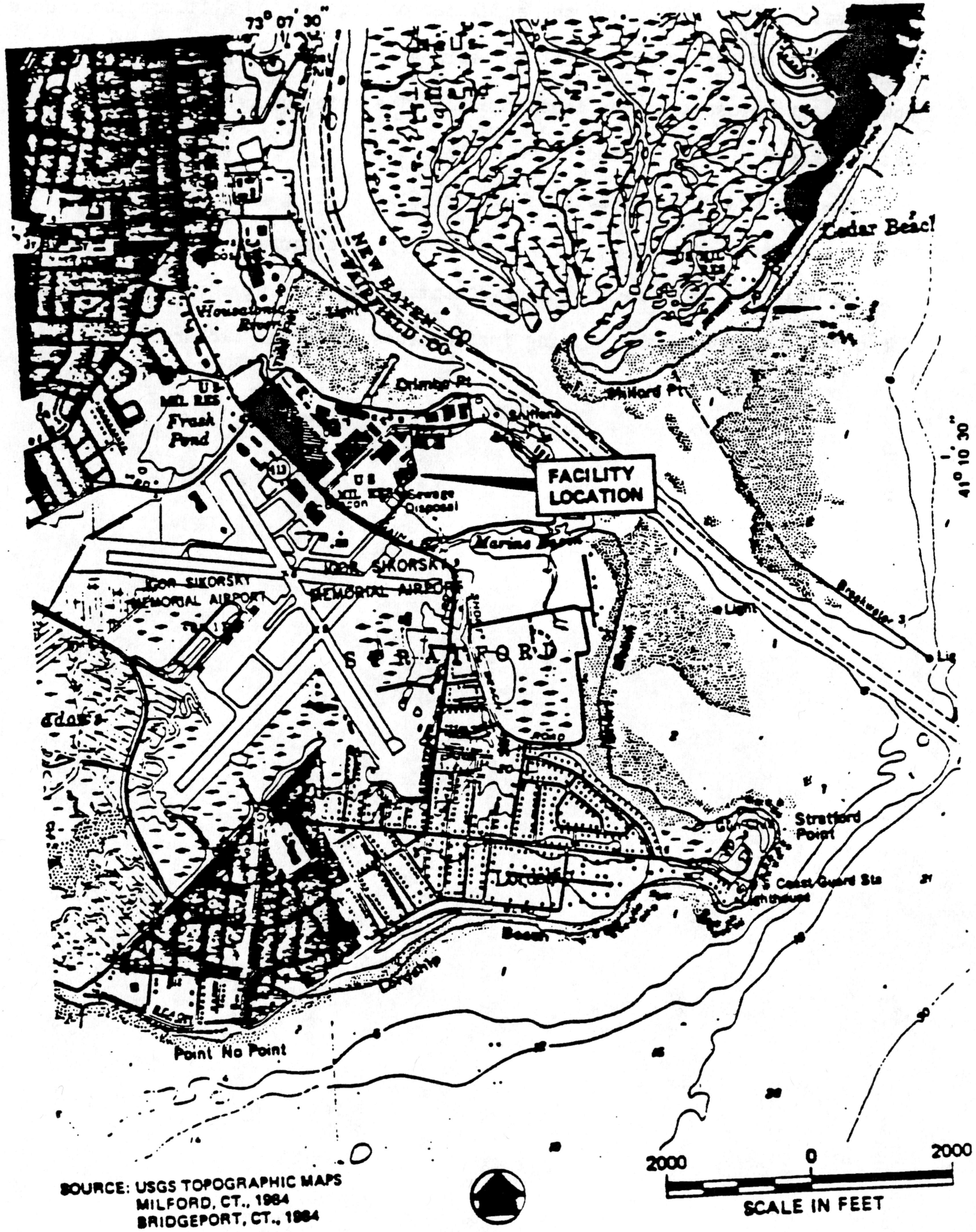
DESCRIPTION:

The AVCO facility is owned by the U.S. Army and operated by Avco Lycoming TEXTRON. The site is located in Stratford Connecticut just west (approximately 1,000 feet) from where the Housatonic River enters Long Island Sound (see Figure 1). The facility activities include the manufacturing of gas turbine engines. The production of these engines includes the plating of parts in zinc, cadmium, chrome, copper, magnesium, nickel, and black oxide baths. The spent plating bath solutions are discharged to an equalization lagoon. The wastewater from this lagoon is then pumped to a chemical waste treatment plant. The waste treatment plant produces a metal hydroxide sludge which is pumped to one of three sludge storage lagoons (surface impoundments). The equalization lagoon and the three storage lagoons are now being closed.

HISTORY:

The operation of the four surface impoundments at AVCO is regulated under the Resource Conservation and Recovery Act (RCRA) since the effective date of these regulations on 19 November 1980. In compliance with the first requirement of RCRA, AVCO submitted a Part A permit application to the U.S. EPA on 13 November 1980. When RCRA was amended by the Hazardous and Solid Waste Amendments of 1984, AVCO submitted a Part B permit application to the U.S. EPA and the Connecticut Department of Environmental Protection (DEP). Until this permit application is reviewed and the final RCRA permit is issued, AVCO is considered to be operating it's four impoundments under "interim status".

FIGURE 1. LOCATION MAP



SOURCE: USGS TOPOGRAPHIC MAPS
MILFORD, CT., 1984
BRIDGEPORT, CT., 1984

AVCO has since modified it's chemical waste treatment plant to include an equalization tank to replace the equalization lagoon, and a filtration process which requires off-site disposal to replace the three sludge lagoons. AVCO now plans to close the four impoundments. These impoundments contain hazardous waste as regulated under 40 CFR.

The closure of these lagoons will require pumping of surface waters for onsite treatment, pumping out sludge for offsite disposal, excavating and decontaminating impoundment pumping equipment, excavating impoundment soils for offsite disposal, and capping impoundments for final closure.

IV. HAZARD EVALUATION

The hazard potential to workers performing surface impoundment closure activities on this site is rated at low to moderate. The highest potential for workers to be exposed to contaminants will be during sludge excavation activities. During these activities, contaminants are likely to be released in the form of vapors and toxic particulates. In addition to air contaminants, the possibility exists for workers to come in contact with contaminated surface waters and sludge. A summary of chemical hazards is provided in Table 1.

Other hazards which workers might encounter include physical injury from heavy equipment, injuries from falls and trips, and injury from heat stress and/or cold stress. Workers should be aware of the symptoms of heat stress and cold stress as provided in Appendix A, and should schedule work rest periods based on weather conditions.

TABLE 1. CHEMICAL HAZARDS

Compound	Route of Exposure	Symptoms/Target Organs
BENZENE	Inhalation Absorption Ingestion Contact	Can cause irritation to eyes, nose, and respiratory system, headaches, nausea, dermatitis, and fatigue. Can result in damage to blood, central nervous system, skin, bone marrow, eyes, and respiratory system. TLV* = 10 ppm [suspected carcinogen]
ETHYLBENZENE	Inhalation Ingestion Contact	Can cause irritation to skin, headaches, insomnia, dermatitis, and muscle fatigue. Can damage central nervous system, kidneys, and skin. TLV = 100 ppm
TRICHLOROETHYLENE	Inhalation Ingestion Contact	Can cause headaches, vertigo, visual distortion, tremors, nausea, and irritation to eyes and skin. Can result in damage to respiratory system, heart, liver, kidneys central nervous system, and skin. TLV = 50 ppm
DICHLOROBENZENE	Inhalation Absorption Ingestion Contact	Can cause irritation to nose, eyes, and skin. Can result in damage to liver, kidneys, skin, and eyes. TLV = 50 ppm

* The TLV (Threshold Limit Value) is defined as the concentration of a chemical in air to which a worker can be exposed 8 hours/day at 40 hours/week without suffering adverse effect. The TLV's given were obtained from the 1987-1988 TLV guide of the American Conference of Governmental Industrial Hygienists.

TABLE 1 (Continued). CHEMICAL HAZARDS

Compound	Route of Exposure	Symptoms/Target Organs
CYANIDE	Ingestion Contact	Can cause weakness, headaches, confusion, nausea, vomiting, slow gasping, asphyxiation, and irritation to eyes and skin. Can cause damage to central nervous system, cardiovascular system, liver, kidneys, and skin. TLV = 5 mg/m^3
CHROME (soluble)	Ingestion Contact	Can cause sensitized dermatitis resulting in skin damage. TLV = 0.05 mg/m^3 [suspected carcinogen]
TOLUENE	Inhalation Absorption Ingestion Contact	Can cause irritation to skin, headaches, insomnia, dematitis, and muscle fatigue. Can damage central nervous system, kidneys, and skin. TVL = 100 ppm

V. SITE SAFETY WORK PLAN

PERSONNEL

General:

The contractor shall identify responsible personnel who will be onsite performing the basin closure activities. These personnel shall include:

RESPONSIBILITY	NAME	TASK DESCRIPTION
Project Manager		Oversee and coordinate all technical aspects of the project.
Corporate Safety Officer		Review project scope of work and assure that all workers understand and comply with the safety plan.
Project Foreman		Coordinate project operations from onsite.
Site Safety Officer		Enforce all aspects of the safety plan and identify new hazards.

SAFETY BRIEFING

A site safety briefing will be held onsite prior to initiating operations. All workers will attend this briefing. Immediately after the discovery of real or potential hazards which were not anticipated, a safety briefing will be held. Prior to any new or non-scheduled operation, a safety briefing will be held.

The safety briefing will present the following information:

- The hazards workers face
- Hazard monitoring techniques
- Personnel protective equipment requirements

- Personnel protective equipment use
- Decontamination procedures
- Safe operation procedures for heavy equipment
- Response to injuries
- Response to fires
- Chain of command

SAFETY TRAINING/MEDICAL SURVEILLANCE

All workers shall participate in a safety training program and a medical surveillance program prior to working on this site. The regulations in 29 CFR 1910.120 (OSHA) shall be complied with regarding worker safety training and medical surveillance. A copy of 29 CFR 1910.120 is provided in Appendix B.

GENERAL SAFETY REQUIREMENTS

- All persons entering and/or working on the site shall read, sign and become familiar with this Health & Safety Plan. The master copy will be available on-site through the Health & Safety Officer.
- No employee or subcontractor may be allowed on-site without the prior knowledge and consent of the site Health & Safety Officer.
- There will be no activities conducted on-site without sufficient backup personnel. At a minimum, two persons must be present at the site.
- All contractor or subcontractor personnel shall bring to the attention of the site Health & Safety Officer or resident project representative any unsafe condition or practice associated with the site activities that they are unable to correct themselves.
- There will be no smoking, eating, chewing gun, or drinking in the restricted area.
- Hands shall be thoroughly cleaned prior to smoking, eating or other activities outside the restricted area.

- Workers must avoid unnecessary contamination (i.e., walking through known or suspected "hot" zones or contaminated puddles, kneeling or sitting on the ground, leaning against potentially contaminated equipment).
- Personnel will be fit tested and issued an individual respirator to ensure a proper face to mask seal prior to work startup.
- Respiratory devices may not be worn with beards, long sideburns, or under the conditions that prevent a proper seal.
- Respiratory devices may not be worn with contact lenses.
- Aerial obstructions such as powerlines will be identified prior to operation of large construction equipment.
- Verification of buried electrical cables, powerlines, utility lines and communications lines will proceed excavation activities.
- At a minimum all construction and excavation activities shall meet the safety requirements in 29 CFR 1926.600-.606 (OSHA).

PERSONNEL PROTECTIVE EQUIPMENT (PPE)

Equipment Staging and Preparation:

All operations required for equipment staging and preparation will be performed in Level D PPE. Level D will consist of the following:

- Hard hat and safety goggles
- Routine work clothing (e.g., coveralls)
- Disposable cotton work gloves
- Neoprene steel toe/steel shank work boots

Basin Surface Water Removal:

Removal of basin surface waters (pumping operations) will be performed in Level D PPE. Level D will consist of the following:

- Hard hat with face splash shield
- Disposable tyvek coveralls over routine work clothing

- Nitrite latex gloves over disposable vinyl gloves
- Neoprene steel toe/steel shank work boots

Sludge and Decommissioned Waste Water Piping Removal:

Removal of basin sludge and associated piping will be performed in Level C PPE. Level C will consist of the following:

- Hard hat
- Disposable tyvek coveralls over routine work clothing
- Nitrate latex gloves over disposable vinyl gloves
- Neoprene steel toe/steel shank work boots
- Full face air purifying respirator equipped with organic vapor/acid gas/toxic particulate filter cartridges or cannisters

Basin Cap Construction:

Construction of the basin cap will be performed in Level D PPE. Level D will consist of the following:

- Hard hat and safety goggles
- Routine work clothing
- Disposable cotton gloves
- Neoprene steel toe/steel shank work boots

MONITORING EQUIPMENT

General:

The site safety officer will monitor the ambient air for total organic vapor concentrations and combustible gasses during all onsite operations. The site safety officer will establish air monitoring frequency based on type of operations being performed. Air monitoring will be performed by a portable

Photo-Ionization Detector (PID) with an electron volt range able to detect BENZENE. A portable combustible gas indicator will also be used to detect percent ranges of the lower explosive limit (LEL).

All monitoring equipment will be operated, maintained an calibrated according to the manufacturers equipment operations manual.

MONITORING CONTINGENCIES

1. Any consistent "continuous reading" detection in the breathing zone of 5 ppm (1/2 the TLV of BENZENE) on the photo-ionization detector will require workers to don LEVEL C protective equipment. Level C will consist of the following:

   - Hard hat
   - Disposable tyvek coveralls over routine work clothing
   - Nitrile latex gloves over disposable vinyl gloves
   - Neoprene steel toe/steel shank work boots
   - Full face air purifying respirator equipped with Organic Vapor/Acid gas/toxic particulate filter cartridges or canisters

2. Any consistent "continuous reading" detection in the breathing zone of 100 ppm on the photo-ionization detector will require workers to egress from the site. The safety officer will then determine the need for additional air monitoring, change work procedures, or the possible use of supplied air breathing equipment for workers.

3. Any detection of 19.5% of greater on the combustible gas indicator will require an egress from the site and notification of AVCO security.

DECONTAMINATION

Personnel:

Personnel decontamination will consist of good work practice, maximum use of disposable clothing, personal hygiene and a field decontamination station to be used at the completion of each work evolution. Because the likeliest point of personnel contact with contaminants will be the feet and hands, the field decontamination will involve the following steps:

1. Boots will be scrubbed with a water and mild soap solution before they are removed.
2. Outer gloves will be washed with a water and mild soap solution before they are removed.
3. Disposable coveralls will be removed and disposed of in a plastic trash bag.
4. Inner gloves (vinyl surgical) will be removed and disposed of in a plastic trash bag.

The personnel decontamination station will be positioned at a location just outside of the contaminated area and in the clean zone. The components of the decontamination station will consist of:

• Long handle scrub brushes	(3 each)
• Metal wash basins large enough to step into	(2 each)
• Hand pressurized sprayer	(1 each)
• Plastic sheeting	(3 rolls)
• Plastic tubs or bowls for washing hands	(2 each)
• Plastic trash cans with trash liners	(3 each)
• Table	(1 each)
• First aid kit	(1 each)
• Portable eye wash	(2 each)
• Mild soap solution	(1 gallon)
• 5 gallon water container	(1 each)
• Class A, B, C fire extinguisher	(1 each)

Equipment:

All equipment shall be decontaminated before leaving the site. Heavy equipment (trucks, backhoes, etc.) directly involved in on-site activities shall be either steam cleaned then scrubbed with a water and mild soap solution or washed under high pressure water then scrubbed with a water and mild soap solution before departing the site. Light equipment (shovels, pails, hand tools) shall be scrubbed with a mild soap and water solution followed by a rinse before being removed from the site. All electronic monitoring equipment will be wrapped in clear plastic with openings for sampling ports. Field decontamination of equipment will be performed by the following steps:

1. Physically remove packed dirt and grit with wire brushes
2. Steam clean with water/soap solution
3. Rinse with high pressure water
4. Allow to air dry before departing the site

CONSTRUCTION DERIVED WASTE

Solid Waste:

All solid waste generated onsite such as disposable coveralls, gloves, soda cans, packing boxes, and general trash will be treated as "non-hazardous". This waste will be disposed of as a municipal trash.

Liquid Waste:

All liquid waste from decontamination rinse water will be collected in the sump by the vehicle decontamination pad and pumped to the head of the existing onsite waste water treatment works.

INJURIES/EMERGENCIES

Injury:

If an injury should occur, the victim shall be removed from potentially contaminated areas if possible, immobilized if necessary, and transported to the local hospital for treatment. If the victim has received a potential spinal injury, they should be immobilized if possible and transported to the local hospital by a trained ambulance "EMS" crew. Minor injuries such as small cuts and lacerations can be treated onsite by qualified first aid trained workers. All potentially contaminated clothing should be removed from an injured worker onsite prior to medical treatment.

A copy of this plan should be given to the emergency room chief physician at the Bridgeport Hospital prior to startup of field operations.

Fire:

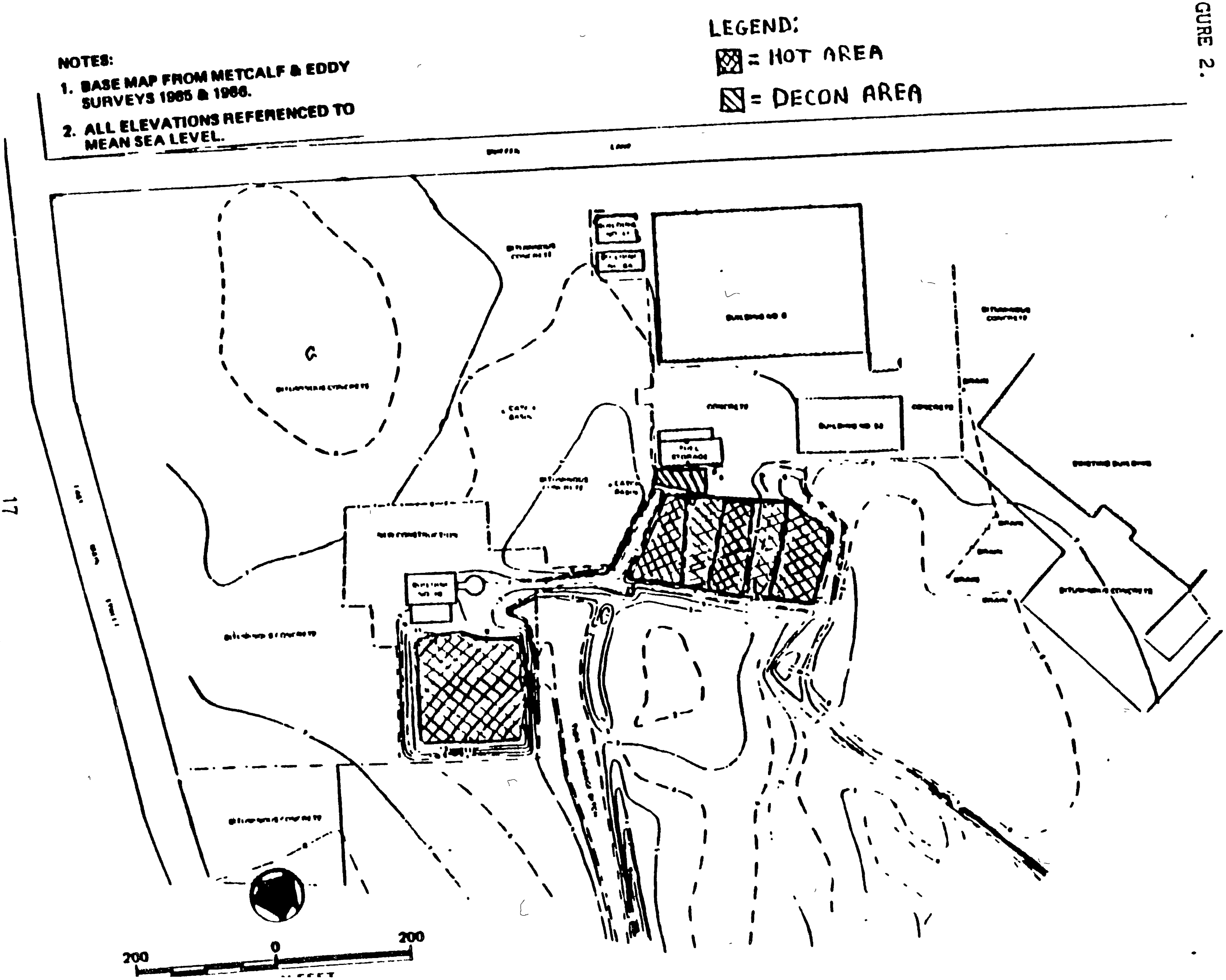
In the event of fire, the following steps should be taken:

1. Attempt to extinguish or control fire with Class A, B, C, fire extinguishers
2. Notify local fire department
3. Remove vehicles from area
4. Remove flammable materials such as fuels and solvents from area
5. Egress from site to an upwind position
6. Perform a personnel count "verification"
7. Await fire fighting forces

WORK ZONES

During all project operations, a series of work zones will be established as shown in Figure 2. These zones include a "Hot Zone" or area of work where contamination is probable, a "Decontamination Zone" where personnel and equipment will be decontaminated after work evolutions, and a "Cool Zone" or staging area where clean equipment can be staged and workers can rest.

FIGURE 2.



NOTES:

1. BASE MAP FROM METCALF & EDDY SURVEYS 1985 & 1986.
2. ALL ELEVATIONS REFERENCED TO MEAN SEA LEVEL.

LEGEND:

▩ = HOT AREA

▧ = DECON AREA

VI. EMERGENCY INFORMATION

LOCAL RESOURCES

Ambulance:	911 (Emergency Service Dispatch)
Fire:	911 (Emergency Service Dispatch)
Police:	911 (Emergency Service Dispatch)
Security:	385-2231 (AVCO Security)
Hospital:	384-3566 (Bridgeport Hospital)

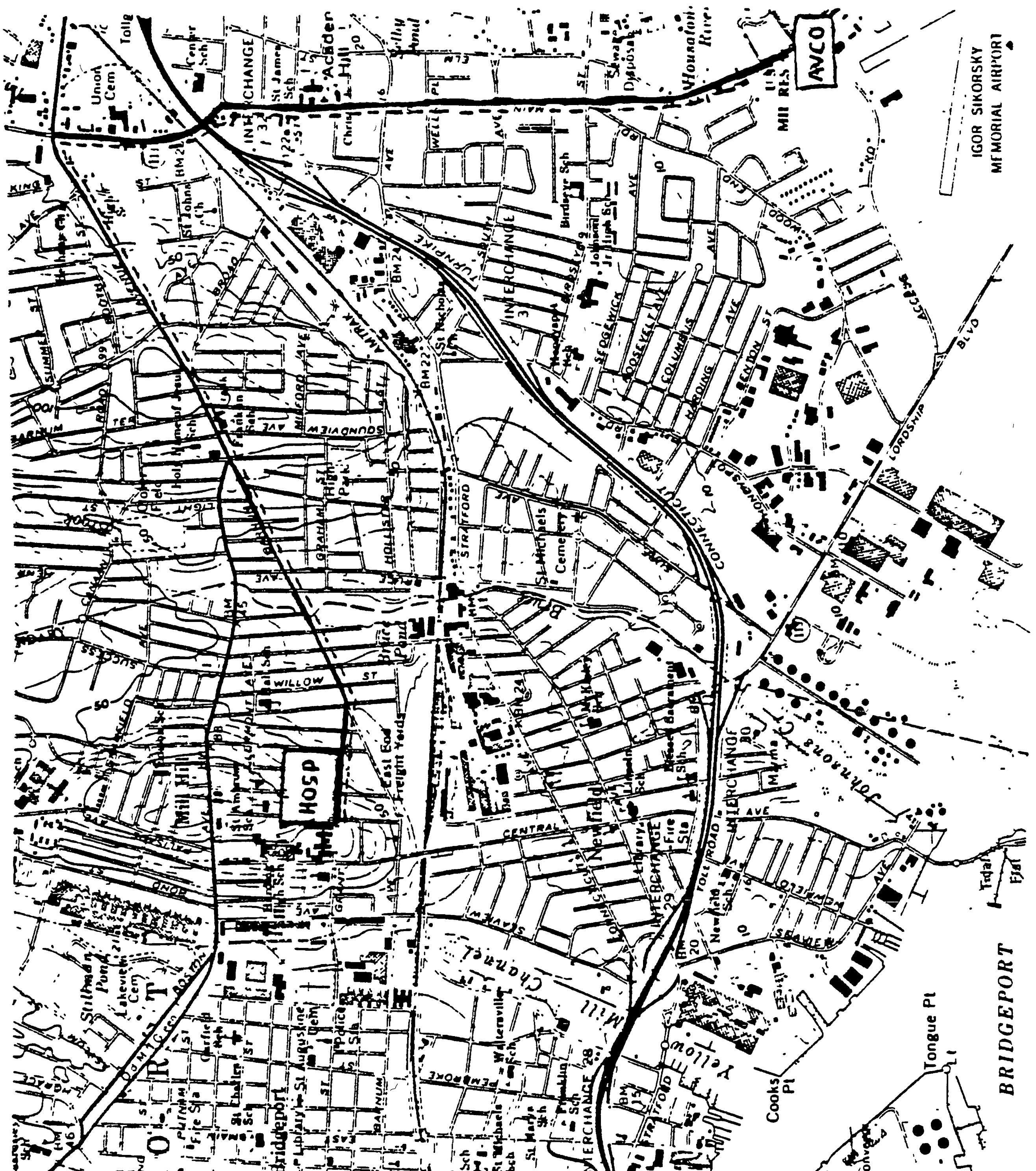
HOSPITAL LOCATION

Bridgeport Hospital
267 Grant Street
Bridgeport, Connecticut
(See Figure 3 for directions)

EMERGENCY CONTACTS

Responsibility	Name	Phone Number
Client Contact (AVCO)		
Project Manager		
Project Foreman		
Site Safety Officer		

FIGURE 3.


AVCO
IGOR SIKORSKY MEMORIAL AIRPORT
HOSP
BRIDGEPORT
Tongue Pt
Cooks Pt
Mill Hill
Newfield
St Michaels Cemetery
East End Freight Yards
Mill Channel
Yellow Mill Channel
Johnsons Cr
Stillman Pond
Lakeview Cem
Union Cem
INTERCHANGE
CONNECTICUT TURNPIKE
LORDSHIP BLVD
CENTRAL AVE
BOSTON AVE
STRATFORD AVE
SEAVIEW AVE
WILLOW ST
NOBLE AVE
BARNUM AVE
PEMBROKE
Housatonic River

APPENDIX A

FIRST AID

COLD STRESS (Frostbite)

Symptoms:

Shivering, numbness, low body temperature, drowsiness and muscular weakness.

Can result in unconsciousness, shock, heart fibrillation and death due to heart failure.

Treatment:

Protect frozen area from injury. Wrap the victim in a blanket and place him/her in a warm vehicle or indoors. Administer warm drinks.

For frostbite, cover the frozen part, bring victim indoors and warm the frozen part quickly in warm water (102°-105°F). DO NOT MASSAGE THE FROZEN PART.

Place sterile gauze between frozen fingers and toes and elevate. GET MEDICAL CARE.

Prevention:

Schedule regular work breaks based on weather conditions.

HEAT STRESS (Stroke, Cramps, Exhaustion)

Symptoms:

. Stroke - high body temperature (106°F), lack of sweating, rapid pulse, unconsciousness.
Can lead to death.
GET MEDICAL CARE

. Cramps - muscular pains and spasms.

. Exhaustion - skin is cool and clammy, body temperature may be slightly elevated, weakness, nausea and dizziness.

Treatment:

Make victim comfortable, loosen clothing, lay victim down and elevate feet, administer drinks with electrolytes (Gator-Aid or water/salt solution). If victim vomits, do not administer any more fluids and GET MEDICAL CARE.

Prevention:

Schedule regular work breaks based on weather and protective clothing use.

EMERGENCY FIRST AID

WOUNDS

1. Control bleeding
   a. direct pressure on wound with a sterile dressing (if available)
   b. elevate injured area if possible
   c. pressure to supplying blood vessel
2. Apply dry sterile dressings and bandages
3. Cleanse minor injuries thoroughly. Use plain soap and water (your hands first)
4. If evidence of infection appears, see a doctor

FRACTURES

1. Do not move the victim
2. Keep the broken bone ends and adjacent joint quiet
3. If a wound is present, control the bleeding
4. Apply splints

SHOCK

1. Limit activity
2. Lay victim down
3. Prevent loss of body heat
4. Shock can be FATAL— send for medical help

Know what to do . . .

IN CASE OF A SERIOUS ACCIDENT:

1. RESCUE: Remove victim from a dangerous situation
2. CHECK BREATHING: give artificial respiration if necessary
3. CONTROL SEVERE BLEEDING: use direct pressure
4. DILUTE POISONS: use large quantities of milk or water
5. CALL FOR HELP— GIVE THIS INFORMATION
   L location of emergency
   I injury (number and type)
   F first aid given
   E equipment needed or available

POISONING

1. Dilute with milk or water
2. Call the poison information center
3. If breathing stops, use artificial respiration
4. Call an ambulance if necessary

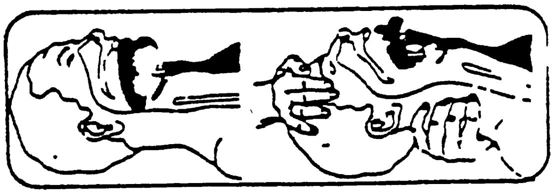
BURNS

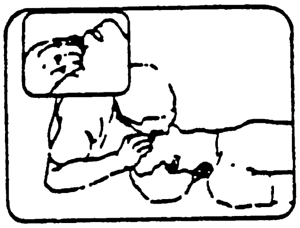
1. Relieve pain and prevent contamination
   a. small minor burns—cold water
   b. large extensive burns—dry sterile dressings
2. Treat for shock
3. Seek medical assistance

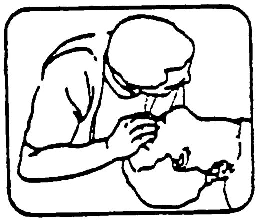
. . . take a free Red Cross course

STOPPAGE OF BREATHING

1. Give artificial respiration
   a. mouth to mouth method
      1. tilt victim's head back, chin pointing up
      2. look, listen and feel for breathing
      3. close victim's nostrils by pinching
      4. inhale
      5. make a tight seal over victim's mouth with your mouth
      6. inflate victim's lungs with 4 quick, full breaths
      7. watch victim's chest while listening for air return
      8. breathe for adults: once every 5 seconds—for children: once every 3 seconds
2. Call an ambulance







Know what to do . . .

HEART ATTACK

Symptoms: chest pain, breathing difficulty, bluish color of face and finger nails

First Aid:

1. Comfortable position
2. Raise head and chest if breathing difficult
3. If breathing stops, apply artificial respiration
4. Get medical aid fast—physician or person trained in CPR . . .

Give CPR (Cardiopulmonary resuscitation) if trained:

A—Airway opened. Look, listen, feel for breathing. Tilt head to open airway.

B—Breathing restored. Give mouth-to-mouth artificial respiration.

C—Circulation restored. Check for pulse. Use external cardiac compression.

Single rescuer: 15 chest compressions @ 80 per minute, alternate with 2 quick lung inflations.

Two rescuers: Chest compression @ 60 per minute, lung inflation every fifth compression without pause.

SIMPLE FAINTING

1. Keep victim lying down with feet elevated until recovery is complete
2. Bathe face gently with cool water

HEAT EXHAUSTION

1. Provide rest
2. Apply cool, wet cloths
3. Give sips of cool water for 1 hour (one tsp. salt per glass)

FROSTBITE

1. Cover the frozen part
2. Provide extra clothing and blankets
3. Quickly immerse chilled part in warm water (102°-105°)
4. Do not rub
5. Give a warm non-alcoholic drink
6. SEEK MEDICAL ASSISTANCE

. . . take a free Red Cross course


UNIVERSAL CHOKING SIGN

FIRST AID FOR CHOKING

If victim can cough, speak, breathe ➧ Do not interfere

If victim <u>cannot</u>
cough
speak
breathe

Have someone call for help.

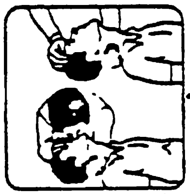
TAKE ACTION: FOR CONSCIOUS VICTIM

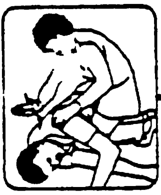

4 QUICK BACK BLOWS

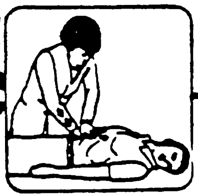

4 MANUAL THRUSTS

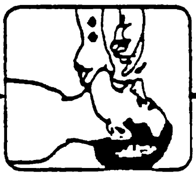
Repeat steps until effective or until victim becomes unconscious.

TAKE ACTION: FOR UNCONSCIOUS VICTIM


TRY TO VENTILATE


4 BACK BLOWS


4 MANUAL THRUSTS


FINGER PROBE

Repeat steps until effective.

Continue artificial ventilation or CPR, as indicated.

Everyone should learn how to perform the above first aid steps for choking and how to give mouth-to-mouth and cardiopulmonary resuscitation. Call your local Red Cross chapter for information on these and other first aid techniques.

Caution: Abdominal thrusts may cause injury. Do not <u>practice</u> on people

AMERICAN RED CROSS

APPENDIX B

DEPARTMENT OF LABOR

cupational Safety and Health
ninistration

29 CFR Part 1910

[Docket No. S-760A]

Hazardous Waste Operations and Emergency Response

AGENCY: Occupational Safety and Health Administration: Labor.

ACTION: Notice of proposed rulemaking and public hearings.

SUMMARY: The Occupational Safety and Health Administration (OSHA) is proposing to amend the OSHA standards for hazardous waste operations and emergency response in 29 CFR 1910.120. OSHA proposes a permanent final standard to replace the interim final rule as required by Congress in the Superfund Amendments and Reauthorization Act of 1986 (SARA) (Pub. L. 99-499). The interim final rule was published in the Federal Register on December 19, 1986 (51 FR 45654).

Employees involved in operations covered by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended (CERCLA or "Superfund" Act) [42 U.S.C. 01 *et seq.*], in certain hazardous waste rations conducted under the source Conservation and Recovery Act of 1976 as amended (RCRA) [42 U.S.C. 6901 *et seq.*], and in any emergency response to incidents involving hazardous substances would be covered by this proposed rule.

The issuance of this proposed rule is mandated by section 126(b) of SARA. The proposed rule will regulate employee safety and health at hazardous waste operations and during emergency response to hazardous substance incidents.

Informal public hearings on the subject of this rulemaking are scheduled to afford interested parties with the opportunity to comment on OSHA's proposals.

DATES: 1. Comments and information on this proposal must be received on or before October 5, 1987.

2. The informal public hearings will begin at 9:30 A.M. daily and are scheduled as follows:

October 13–16 and 20–23, 1987: Washington, DC
October 27–30, 1987; San Francisco, CA

3. Notices of intention to appear at the informal public hearings must be ostmarked September 21, 1987.

. Written comments, testimony, and evidence which will be offered into the informal public hearing record must be postmarked by October 5, 1987. Because of the limited time frame allowed OSHA for development of the final rule as a result of the statutory guidance given in SARA, OSHA does not expect to grant requests for extensions of time for submitting comments in response to this notice.

ADDRESSES: 1. Comments and information on the proposal should be sent in quadruplicate to the Docket Office, Docket No. S-760A, Occupational Safety and Health Administration, Room N-3670, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210. Comments and information received, notices of intention to appear, testimony and evidence may also be inspected and copied in the Docket Office.

2. The informal public hearings will be held at the following locations:

a. Washington, DC—Frances Perkins Department of Labor Building Auditorium, 200 Constitution Avenue NW., Washington, DC 20210,

b. San Francisco, CA—Ramada Renaissance Hotel, 55 Cyril Magnin St. (Market at 5th Street), San Francisco, CA 94102. 415-392-8000.

3. Notices of intention to appear and testimony and documentary evidence which will be introduced into the informal public hearing record must be sent in quadruplicate to Mr. Thomas Hall, U.S. Department of Labor, Occupational Safety and Health Administration, Division of Consumer Affairs, Room N-3649, 200 Constitution Avenue NW., Washington, DC 20210.

FOR FURTHER INFORMATION CONTACT: *Proposed Rule:* Mr. James F. Foster, U.S. Department of Labor, Occupational Safety and Health Administration, Division of Consumer Affairs, Room N-3647, 200 Constitution Avenue, NW., Washington, DC 20210, 202-523-8151.

Public Hearing: Mr. Thomas Hall, U.S. Department of Labor, Occupational Safety and Health Administration, Division of Consumer Affairs, Room N-3647, 200 Constitution Avenue, NW., Washington, DC 20210, 202-523-8615.

SUPPLEMENTARY INFORMATION:

I. Background

The U.S. Environmental Protection Agency estimates that approximately 57 million metric tons of hazardous waste are produced each year in the United States[1]. These wastes must be treated and stored or disposed in a manner that protects the environment from the adverse affects of the various constituents of those wastes.

In response to the need to protect the environment from the improper disposal of these hazardous wastes, Congress, over the years, has enacted several pieces of legislation intended to control the nation's hazardous waste problem. Federal laws passed in 1965 [2] and 1970 [3] initially addressed solid waste disposal. Several other pieces of legislation have been enacted by Congress that have ultimately led to the development of this proposed rule and they are discussed below.

A. The Resource Conservation and Recovery Act of 1976

The first comprehensive, federal effort to deal with the solid waste problem in general, and hazardous waste specifically, came with the passage of the Resource Conservation and Recovery Act of 1976 (RCRA).[4] The act provides for the development of federal and state programs for otherwise unregulated land disposal of waste materials and for the development of resource recovery programs. It regulates anyone engaged in the creation, transportation, treatment, and disposal of "hazardous wastes." It also regulates facilities for the disposal of all solid wastes and prohibits the use of open dumps for solid wastes in favor of requiring sanitary landfills.

There are however many hazardous waste disposal sites that were created prior to the passage of RCRA. These sites are often abandoned and contain unknown quantities of unknown wastes.

B. The Comprehensive, Environmental Response, Compensation and Liability Act of 1980

In response to the need to clean-up and properly reclaim these pre-RCRA sites Congress enacted the Comprehensive, Environmental Response, Compensation and Liability Act of 1980 (CERCLA) [5] commonly known as "Superfund." Superfund established two related funds to be used for the immediate removal of hazardous substances released into the environment. Superfund is intended to establish a mechanism of response for the immediate clean-up of hazardous waste contamination from accidental

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[1] U.S. Environmental Protection Agency. *Everybody's Problem Hazardous Waste* at 1 (1980).

[2] Solid Waste Disposal Act, Pub. L. No. 89-272, 79 Stat 99.

[3] Resource Recovery Act, Pub. L. No. 91-512, 84 Stat 1427 and Pub. L. 93-14, 87 Stat 11.

[4] 42 U.S.C. 6901 *et seq.*

[5] 42 U.S.C. 9601 *et seq.*

spills and from chronic environmental damage such as is associated with abandoned hazardous waste disposal sites.

The treatment and disposal of hazardous wastes under RCRA and CERCLA creates a significant risk to the safety and health of employees who work in treatment and disposal operations. Exposure to hazardous wastes through skin contact, skin absorption and inhalation pose the most significant risks to employees. Employee exposure to these risks occurs when employees respond to hazardous waste emergencies, when they work with hazardous wastes during storage, treatment and disposal operations or when they participate in the clean-up of abandoned-waste sites.

This risk of exposure and the need for protecting employees exposed to hazardous wastes is addressed in the "Superfund Amendments and Reauthorization Act of 1986" (SARA).

C. Superfund Amendments and Reauthorization Act of 1986

On October 17, 1986, the President signed into law the "Superfund Amendments and Reauthorization Act of 1986" (SARA).[6] As part of SARA, in § 126 of Title I, Congress addressed the risk of injury to employees by providing that the Secretary of Labor ("Secretary") issue interim final worker protection regulations within 60 days after the date of enactment of SARA that would provide no less protection for workers engaged in hazardous waste operations than the protections contained in the U.S. Environmental Protection Agency's (EPA) "Health and Safety Requirements for Employees Engaged in Field Activities" manual (EPA Order 1440.2) dated 1981, and the existing OSHA standards under Subpart C of 29 CFR Part 1926. OSHA published those interim final regulations in the Federal Register on December 19, 1986 (51 FR 45654). A correction notice was published on May 4, 1987 (52 FR 16241). With the exception of a few provisions that had delayed start-up dates, OSHA's interim final regulations became effective on December 19, 1986 in accordance with section 126(e), and apply to all regulated workplaces until the final rule developed under sections 126(a)–(d) and proposed today becomes effective.

Section 126(a) of SARA provides that the Secretary shall "... pursuant to section 6 of the Occupational Safety and Health Act of 1970, promulgate standards for the health and safety of employees engaged in hazardous waste operations." These standards must be promulgated within one year after the date of enactment of SARA. This notice initiates the development of those standards by issuing proposed regulations as indicated in section 126(b) of SARA. SARA further provides in section 126(b), that the proposed regulations address, as a minimum, certain worker protection provisions. These are: site analysis, training, medical surveillance, personal protective equipment, engineering controls, maximum exposure limits, informational programs, materials handling, new technology programs, decontamination procedures, and emergency response. While some of these worker protection provisions were addressed in the interim final rule, this proposed rule will address, as a minimum, all provisions under section 126(b) of SARA.

Pursuant to section 126(c) of SARA, the final regulations promulgated under section 126(a) are to take effect one year after the date they are promulgated. Section 126(c) also provides that the final regulations are to include each of the worker protection provisions listed in section 126(b) unless the Secretary determines that the evidence in the public record developed during this rulemaking and considered as a whole does not support inclusion of any such provision.

This proposed rule has been adapted from the language of the interim final rule. Changes have been made to address more fully the provisions which Congress had directed the Agency to cover in the proposal. OSHA utilized the language from the EPA manual entitled "Health and Safety Requirements for Employees Engaged in Field Activities" (1981) and the language of OSHA's safety and health standards in Subpart C of 29 CFR Part 1926 to develop the interim final rule, and much of that same language is also used in this proposal. The interim final rule also contains language taken from various documents issued either jointly or by the EPA, OSHA, the U.S. Coast Guard, and the National Institute for Occupational Safety and Health (NIOSH), and that language has also been used in preparing this proposed rule.

OSHA has specifically used the joint OSHA/EPA/USCG/NIOSH manual entitled, *"Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities"* (Preamble Reference 6), as an outline in preparing the interim rule and this proposal. This manual was developed as a result of the collaborative efforts of professionals representing the four agencies. These professionals, who are knowledgeable in hazardous waste operations, worked with over 100 experts and organizations in the development of the criteria contained in this manual. The manual was published in October 1985 and is public information. The manual is a guidance document for managers responsible for occupational safety and health programs at inactive hazardous waste sites. The manual is intended for use by government officials at all levels and contractors involved in hazardous waste operations. The manual provides general guidance and is intended to be used as a preliminary basis for developing a specific health and safety program for hazardous waste operations. Further, the major subject areas listed in section 126(b) of SARA are nearly identical to the major chapters in the manual. The language of the proposed rule also clarifies some confusion in the interim rule that OSHA has identified since the promulgation of the interim final rule.

II. Summary and Explanation of the Standard

Paragraph (a)—Scope, application, and definitions

In paragraph (a)(1), *Scope*, OSHA proposes to use the scope of the interim final rule for Hazardous Waste Operations and Emergency Response as published in the Federal Register on December 19, 1986 (51 FR 45654) with some modification. The scope of the interim rule included the following:

(i) Hazardous substance response operations under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended (CERCLA), including initial investigations at CERCLA sites before the presence or absence of hazardous substances has been ascertained;

(ii) Major corrective actions taken in clean-up operations under the Resource Conservation and Recovery Act of 1976 as amended (RCRA);

(iii) Operations involving hazardous waste storage, disposal and treatment facilities regulated under 40 CFR Parts 264 and 265 pursuant to RCRA, except for small quantity generators and those employers with less than 90 days accumulation of hazardous wastes as defined in 40 CFR 262.34;

(iv) Hazardous waste operations sites that have been designated for clean-up by state or local governmental authorities; and

(v) Emergency response operations for releases or substantial threats of releases of hazardous substances, and post-emergency response operations to such releases at all workplaces including those not defined in paragraphs (a)(1)(i) through (a)(1)(iv).

OSHA is proposing to modify paragraph (a)(1) of the interim rule by

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[6] Pub. L. 99–499.

oving the exception in paragraph ii) to paragraph (a)(2)(iii) and by ally revising the structure and of the language of the interim rule vithout changing the scope in the roposal. The modifications to the text e to organize the various ubparagraphs on scope into proper roups of coverage.

To further clarify scope, non-nergency response coverage has been eft in paragraph (a)(1) and emergency sponse coverage has been given its wn paragraph in (a)(2). The scope for nergency response has been clarified s well. The change makes clear that it s employers whose employees have a "reasonable possibility" of engaging in emergency response operations are covered. Employers whose employees would not have such a reasonable possibility are not covered.

Who is Covered?

The scope of this rulemaking has been a major issue during the development and promulgation of the interim final rule and this proposal. OSHA is requesting specific comment on whether our interpretation of scope is too broad or too narrow.

The proposed standard would cover the same three basic areas covered by interim final rule.

RCLA Facilities

For the purposes of this proposal, CERCLA sites include hazardous substance response operations at sites regulated under 40 CFR 300, Subpart F, RCRA closure activities conducted under 40 CFR 265, Subpart G, those sites similar to CERCLA sites that have been designated for clean-up by State or local governments.

II. RCRA Facilities

OSHA would also continue to regulate RCRA treatment, storage and disposal (T/S/D) facilities. T/S/D facilities range from the typical generator with a hazardous waste storage area to the large, complex hazardous waste dump. EPA estimates that approximately 80 percent of all generators also treat, store, or dispose of their hazardous wastes and thereby qualify as a T/S/D facility. Over 30,000 T/S/D facilities notified EPA in 1980 that they would qualify for regulation under section 3004 of RCRA.

The term "T/S/D" is commonly used to refer to the three different hazardous waste management activities that are regulated under RCRA section 3004, and which thus require a permit under RCRA tion 3005. For the purposes of this treatment, storage, and disposal ilities are defined as follows:

A "treatment facility" involves any place of employment where any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to recover energy or material resources from the waste, or so as to render such waste non-hazardous, or less hazardous; safer to transport, store or dispose of; or amenable for recovery, amenable for storage, or reduce in volume.[7]

The term "storage facility" refers to any place of employment used to hold hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere.[8]

The term "disposal facility" refers to any place of employment used for the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharge into any water, including ground waters.[9]

The following T/S/D facilities would not be covered by this rulemaking:

1. Facilities that dispose of hazardous waste by means of ocean disposal pursuant to a permit issued under the Marine Protection, Research, and Sanctuaries Act.
2. The disposal of hazardous waste by underground injection pursuant to a permit issued under the Safe Drinking Water Act underground injection control program.
3. A publicly owned treatment work (POTW) which treats or stores hazardous wastes which are delivered to the POTW by a transport vehicle or vessel or through a pipe.
4. T/S/D facilities which operate under a state hazardous waste program authorized pursuant to RCRA section 3006.
5. Facilities authorized by a state to manage industrial or municipal solid waste, if the only hazardous waste handled by such a facility is otherwise excluded from regulation pursuant to the special requirements for small generators (See 40 CFR 261.5).
6. A facility which treats or stores hazardous wastes that are subject to the special requirement for hazardous wastes which are used, reused, recycled or reclaimed. Note, however, that as provided by 40 CFR 261.6(b), a facility must obtain a permit as a storage facility if it stores "listed" hazardous wastes, mixtures including a "listed" hazardous waste, or sludges, prior to use, reuse, recycling, or reclaimation.
7. The accumulation of hazardous waste by generators for 90 days or less.
8. Farmers who dispose of waste pesticides from their own use in compliance with 40 CFR 262.51.
9. Owners or operators of a "totally enclosed treatment facility." A totally enclosed treatment facility is one where the treatment of hazardous waste which is directly connected to an industrial production process which is conducted and operated in a manner which prevents the release of any hazardous waste or any constituent thereof into the environment during treatment. An example is a pipe in which waste acid is neutralized.
10. Owners and operators of elementary neutralization units and waste-water treatment units.
11. Persons taking immediate action to treat and contain spills. Note that after immediate response activities are completed, any hazardous waste spill residue or debris is subject to full regulation.
12. Transporters storing manifested wastes in approved containers at a transfer facility for 10 days or less.
13. The acts of adding absorbent material to hazardous waste in a container and adding hazardous waste to absorbent material in a container, if the materials are added when wastes are first placed in the container.[10]

III. Emergency Response

This proposal would also continue to cover emergency response to releases of hazardous substances at all sites including non-CERCLA and non-RCRA sites.

OSHA believes that Congress intended the proposed rule to have such coverage. This is indicated by the language of SARA as well as the legislative history.

The language of section 126(a) mandates safety and health standards for the protection of employees engaged "in hazardous waste operations." The term "hazardous waste operation" is not limited in the legislation and a response to spills of hazardous substance on the highway or from a railway tank car in order to control and contain the hazardous substance (which has become a waste once it is not contained) is in the common sense meaning a hazardous waste operation.

This interpretation is reinforced by the fact that SARA is a free-standing

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[7] 40 CFR 260.10(a).

[8] *Id.*

[9] *Id.*

[10] 40 CFR 265.1(c), 264.1(c), as amended, 47 FR 8306 (February 25, 1982).

statutory provision and not an amendment to CERCLA. The clear Congressional intent then is to provide protection to employees whenever they deal with hazardous wastes.

In addition section 126(d)(4) discussing training for emergency response personnel utilizes the very broad term "hazardous emergency situation." Section 126 (g)(1) indicates that training grants may be given independently for emergency response training separate from hazardous waste removal training. Section 126(b)(11) also indicates emergency response is an independent concept separate from hazardous waste removal operations. For those and other reasons OSHA believes section 126 is intended to cover emergency response to hazardous substances whether on a CERCLA or RCRA site or elsewhere. However, the clarified language in the scope sections makes it clear the only employers whose employees have the reasonable possibility of engaging in emergency response are covered.

Emergency response employees who respond or will respond to incidents involving hazardous substances are covered by this proposed rule to the extent that they are exposed to hazardous substances. State and local government employees in states that have agreements with OSHA under section 18 of the OSH Act must be regulated by state regulations at least as effective as these to protect public employees. Those state regulations must be issued within six months of the date of promulgation of any final rule resulting from this rulemaking.

Municipal or other sanitary landfills that handle domestic wastes would not normally be regulated by this proposed rulemaking. Similarly, waste paper or scrap metal operations would not normally be regulated because of the type of wastes they handle. However, both types of operations could be regulated if they have clean-ups for or handle hazardous wastes meeting the scope provisions of the standard.

Also, employees at hazardous waste sites who will not be exposed to, or do not have the potential to be exposed to, hazardous substances are not covered by this proposal. The provisions of these regulations are designed to protect employees who have exposures, and would not be needed for those employees who do not.

Operations with no exposure to hazardous substances, i.e., road building for site access, construction of or the setting up of temporary facilities in the clean zone, or the closure of a RCRA site involving the building of a clay cap over hazard wastes, are considered to be construction activities covered by the standards in 29 CFR Part 1926.

The scope and application provisions carry out the intent of Congress and are consistent with good occupational safety and health policy. Employees performing clean-up operations under CERCLA, RCRA (corrective actions) and state or local government designated sites—generally those employees likely to have the highest exposures to hazardous substances over a longer period—would be covered by virtually all the provisions of this proposal. Employees exposed to hazardous wastes in routine RCRA hazardous waste operations, who are regularly exposed to hazardous wastes but in a more controlled environment, would be covered by the more limited requirements of paragraphs (l) and (o) of this proposal. Emergency response workers, exposed usually for short periods to often unknown but possibly high levels of hazardous substances, would have the specific provisions of paragraph (l) directed towards this situation.

How Are They Covered?

In paragraph (a)(3), *Application*, OSHA proposes to designate the specific requirements of the proposal which apply or do not apply to the work activities covered by the proposed rule. In paragraph (a)(3)(i) the employer would have to comply with the standards in 29 CFR Parts 1910 and 1926, as well as with the requirements specifically covered in this proposed rule. If there is a conflict or overlap, the more protective provisions would apply. Since this proposed rule does not cover all of the hazards present at hazardous waste operations, other OSHA standards in Parts 1910 and 1926 would apply. Other OSHA standards regulate many other hazards, and OSHA wants to make clear that the other standards continue to apply. Also, hazardous waste operators who are not within the proposed scope of this standard would continue to be regulated by the Parts 1910 and 1926 standards.

In paragraph (a)(3)(ii) OSHA proposes that all paragraphs of this section except paragraph (o) would apply to hazardous wastes operations at CERCLA sites, at major corrective action at RCRA sites, and at sites designated for clean-up by state and local governments. This part of the proposal has been taken directly from the interim final rule.

In paragraph (a)(3)(iii), OSHA proposes that the requirements set forth in paragraph (o) of this section would specifically apply only to the hazardous waste operations at RCRA sites which are involved in treatment, storage, disposal and handling of hazardous waste. The proposed limited exclusion of small quantity generators and less than 90-day accumulators would exclude from these regulations certain operations, such as dry cleaners and gas stations, which come within the purview of RCRA, but are not hazardous waste operators in the normal meaning of the term. The exclusion would depend upon the employer's decision to provide or not provide emergency response by employees to releases of, or substantial threats of releases of, hazardous substance.

OSHA proposes to exempt totally small quantity generators and less than 90 day accumulators from the rule if they *do not* provide emergency response by their employees to releases of, or substantial threats of releases of, hazardous substances. OSHA further proposes to exempt small quantity generators and less than 90 day accumulators from all parts of the rule except paragraph (l) when they do provide emergency response by their employees to releases of, or substantial threats of releases of, hazardous substances.

OSHA recognizes that many small quantity generators and less than 90 day accumulators consist of smaller businesses with limited employee populations (less than 10 employees). Since most of these establishments rely on the emergency response services of local fire and rescue departments, OSHA is providing relief from these proposed standards when the employer can show that employees will not be exposed to hazardous substances as a result of providing employee emergency response. In cases where such establishments do provide employee emergency response, and thereby expose employees to hazardous substances, OSHA is proposing that such employers meet the emergency response requirements of paragraph (l) of this proposed rule.

Without these exemptions, these proposed regulations could be interpreted to cover gas stations, dry cleaners, and other small businesses which temporarily store small quantities of a hazardous waste. These businesses are not engaged in hazardous waste operations as that term is conceived of normally. In addition, it is not believed that Congress intended such businesses to be covered. They do not present the relatively high exposure to a number of hazardous health risks to employees that hazardous waste sites typically do.

The approximately 4,000 RCRA sites where reasonably large quantities of hazardous wastes are regularly handled.

eated and stored would be covered by e proposed rule. This reflects the islative intent, meets the normal ning of hazardous waste operations covers the type of safety and health hazards that this regulation is designed to control. This limited exclusion reflects an exemption previously contained in paragraph (a)(1)(iii) of the interim final rule.

In paragraph (a)(3)(iv) OSHA proposes that the requirements set forth in paragraph (l) of this section would specifically apply to the work conducted by emergency response personnel when they respond to hazardous substance emergency incidents. Emergency response personnel include non-employees (i.e., firefighters, EMS personnel, and police) as well as employees.

OSHA requests comment on its approach to coverage and its determination of which provisions apply to various types of operations. It also requests comment on whether other operations should be and are intended to be covered by Congress, and whether specific operations should be excluded because of low exposures.

In paragraph (a)(4), *Definitions*, OSHA proposes to define various terms used in this rulemaking. The definitions for hazardous substances and hazardous wastes have been taken from U.S. Environmental Protection ency (EPA) and U.S. Department of ansportation (DOT) regulations and include those used in the interim rule. OSHA is proposing to modify some of the definitions used in the interim rule where some confusion occurred over the meaning of some of the definitions used in the interim rule. For example, the definition for "emergency response" has been modified to indicate more clearly the type of response that OSHA will be regulating. The definition used in the interim rule implied to many readers of that rule that any response to incidental spills would be considered emergency response. The agency did not intend to regulate employee response to incidental spills that could be cleaned-up or stabilized by the employees in the immediate spill area without the need of a coordinated spill-control response from throughout the workplace. Further, the agency did not want to cover releases of hazardous substances that did not expose employees to exposures of hazardous substances above the established permissible exposure limits of this rule.

The term "established exposure levels" is defined to indicate the levels which, if exceeded for 30 or more days per year, trigger medical surveillance of e exposed employees. The term includes not only OSHA established PELs, but also exposure limits suggested by NIOSH and ACGIH. OSHA feels that it is appropriate to go beyound the OSHA established PELs in triggering medical surveillance because of the broadly-worded language in section 126(b)(3), which requires medical surveillance for workers engaged in hazardous waste operations "which would expose them to toxic substances."

The term "permissible exposure limits" is defined as the inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subpart Z. These limits indicate the exposure levels to be achieved by the hierarchy of controls listed in paragraph (g)(1)(i). Employers must set appropriate exposure levels to determine PPE use for substances listed by ACGIH and NIOSH taking into account the levels recommended by those organizations.

The definition in the proposal has been changed from the interim rule. Limits not set by OSHA, NIOSH and ACGIH have been excluded. They would not be generally known and would not have the sanction of an official organization.

OSHA is also incorporating a definition for "qualified individual," a person who has qualifications by training and experience for the task(s) for which the individual is responsible. That definition is rather general, but a detailed requirement for each task would lead to a lengthy and inflexible regulation.

The use of other agency definitions has been proposed to assure consistency and compatibility between this proposed rule and the rules and regulations of the EPA and DOT. The remaining definitions have been taken for the most part from SARA, the four agency manual (Reference 6) or existing OSHA standards.

OSHA requests comment on whether its definitions of hazardous waste, health hazard and hazardous substance are consistent with EPA and DOT practice. OSHA requests comment on whether the term "established permissible exposure limit" achieves its goals.

Paragraph (b)—General Requirements

In paragraph (b)(1)(i) OSHA is proposing to require employers to develop and implement a safety and health program for employees involved in hazardous waste operations. The proposed rule makes it clear that the program is to be in writing. That was implicit in the interim rule. The program needs to be in writing so that employers and employees know clearly what to do to handle hazardous substances. If it were not in writing uncertainty could lead to injury and overexposures.

Such programs are part of the requirements mandated in section 126(b)(7) of SARA. Subpart C of 29 CFR Part 1926 requires such a program in § 1926.20(b), and EPA Order 1440.2, on page 5, further requires training in "safety plan development." OSHA's experience also establishes that a safety and health program is necessary to protect employees so that hazards are assessed and control programs are systematically laid out. OSHA section 6(b) health standards require a compliance plan to set forth a health program to protect employees from regulated hazards.

The proposed employer's safety and health program would have to provide for an organizational structure, a comprehensive workplan, and a site-specific safety and health plan as proposed in paragraph (b)(1)(ii) through (b)(1)(iv). The site-specific safety and health plan would have to address the anticipated safety and health hazards of each work operation or activity, and the means to eliminate the hazards or to effectively control them to prevent injury or illness.

The site-specific safety and health plan is necessary to help protect employee safety and health. There are many hazards at a hazardous waste operation which need to be determined and addressed prior to the exposure of employees. The proposed plan provides that this will be done in a systematic manner so that hazards will not be missed, and so that needed protective action will not be overlooked. The approach used has been adapted from reference 6.

The general requirements found in paragraph (b)(2) through (b)(13) of the interim final rule would be eliminated by this proposal. Those paragraphs of the interim final rule merely directed the reader to the appropriate paragraphs of the interim final rule for the specific regulations on a topic. The paragraphs of the interim final rule served only as an index for the interim final rule and OSHA does not believe such an index is necessary for this proposal. The duty requirement for compliance with specific requirements is implicit in the paragraphs addressing a specific hazard.

Paragraph (b)(2) would require that site excavations be shored or sloped as appropriate and the employers comply with Subpart P of 29 CFR Part 1926 for site excavations created during initial site preparation or during hazardous waste operations. The language of (b)(2) is the same as paragraph (b)(14) of the interim rule. OSHA considers that those provisions already apply, but they are specifically cross referenced because they are particularly important since significant excavation activity often occurs on hazardous waste sites.

Paragraph (b)(3) would require employers to notify contractors and subcontractors of the hazards identified by the employer at hazardous waste operations. The language of (b)(3) is the same as paragraph (b)(15) of the interim rule. Sections 126(b)(2) and 126(e) of SARA indicate Congress's specific interest in protecting employees of contractors, and in involving contractors in the safe operation of hazardous waste sites. This provision would assist the contractor in becoming aware of the operational risks so that the contractor's employees may be better protected.

Paragraph (c)—Site Characterization and Analysis

The employer needs to know the hazards faced by employees in order to develop and implement effective control measures. Site characterization provides the information needed to identify site hazards and to select employee protection methods. The more accurate, detailed, and comprehensive the information available about a site, the more the protective measures can be tailored to the actual hazards that the employees may encounter. Congress clearly intended that such a requirement be included. Section 126(b)(1) of SARA provides that the proposal include "requirements for a formal hazard analysis of the site . . . ." Therefore, OSHA is proposing to use the language from the interim rule as the language for the proposed paragraph (c).

It is important to recognize that site characterization is a continuous process. At each phase of site characterization, information is obtained and evaluated to define the potential hazards of the site. This assessment is to be used to develop a safety and health plan for the next phase of work. In addition to the formal information gathering that takes place during the phases of site characterization described above, all site personnel should be constantly alert for new information about site conditions.

Paragraph (d)—Site Control

This paragraph would require the employer to develop a site control program, as part of the employers' site safety and health plan, to minimize potential contamination of employees. This program would be a part of the safety and health program required by paragraph (b). Several items, such as establishing work zones, need to be considered so that employees know the hazards in different areas, and this will keep out of hazardous areas where their presence is not required.

Site control is especially important in emergency situations. Paragraph (d)(2) would describe the minimum basic components of a program to control the activities and movements of employees and equipment at a hazardous waste site.

The text proposed in this paragraph has been adapted from the interim rule. The need for site control is called for in item 9 of the EPA Order 1440.2. In addition, Subpart C of 29 CFR Part 1926 provides for regular inspection of job sites so hazards on the site can be controlled.

Paragraph (e)—Training

The proposed rule includes specific provisions for initial and routine training of employees before they would be permitted to engage in hazardous waste operations that could expose them to safety and health hazards. Section 126(b)(2) of SARA requires initial and routine training to be included in the proposal. The intent of the proposed training provisions is to provide employees with the knowledge and skills necessary to perform hazardous waste clean-up operations with minimal risk to their safety and health.

The proposed requirements for training in paragraph (e) address the needs of employees who will be working at CERCLA sites, certain RCRA sites, and sites designated for clean-up by state or local governments.

The proposed provisions include a minimum of 40 hours of initial instruction off the site, and a minimum of three days of actual field experience under the direct supervision of a trained and experienced supervisor, at the time of job assignment. Congress has specifically imposed these hour and day requirements under section 126(d) of SARA for the proposed final standard. The proposed requirement is a one-time effort by the employer for each employee covered by this standard. Employees do not need to be retrained for 40 hours at each site at which they work. Employees who have received the required training at one site can use that training to meet this requirement at other sites even if it involves a different employer.

There are often many hazards at a waste site. The employee would be trained to recognize the hazards and appropriate work practices to minimize those hazards. The employee would also be well trained in the use of respirators and other forms of personal protective equipment. Without training, that equipment may not be used effectively and may not provide adequate protection. An extensive training program is necessary to assure that employees can use personal protective equipment effectively. The proposed paragraph would specify the items needed for effective training to avoid hazards.

Managers and supervisors at the waste site who are directly responsible for hazardous waste site operations would require the same training as that of employees under this proposal, and at least eight additional hours of specialized training on managing hazardous waste operations. Since these managers and supervisors are responsible for directing others, it is necessary to enhance their ability to provide guidance and to make informed decisions. Section 126(d)(2) of SARA provides that there shall be eight hours of additional training for supervisors and managers.

The provisions also propose that employees be retrained on an annual basis on relevant matters such as review of health hazards and the use of personal protective equipment. Employees at hazardous waste operations face serious health and safety risks. Reminders are needed of this and of work practices necessary to avoid hazards. Personal protective equipment provides much of this protection. If there is no retraining in the use, care and maintenance of personal protective equipment, such equipment is unlikely to be properly utilized to provide adequate protection. The proposal would provide eight hours of annual retraining. The EPA manual for refresher training (item #10) requires this amount of training.

In all areas of training, whether it be for general site employees, supervisors at the site, or for the use of specific equipment, the level of training provided shall be consistent with the worker's job function and responsibilities. Refresher training shall be supplied to reemphasize the initial training and to update employees on any new policies or procedures.

Section 126(d)(3) of SARA requires that the proposal include provisions for certification that an employee has received the training required by the standard. Section 126(d)(1) provides that the proposal not require training for employees who have already received equivalent training. The proposed standard has provisions to meet this directive.

OSHA requests comment as to whether this or a greater or lesser nt of training is appropriate for operations.

graph (f)—Medical surveillance

The proposed rule includes specific provisions for baseline, periodic and termination medical examinations. Section 126(b)(3) of SARA provides that the proposal include requirements for medical examinations of workers engaged in hazardous waste operations. In addition, the EPA manual referred to in section 126(e) of SARA has more detailed requirements for initial or baseline, periodic and termination medical examinations. The clear Congressional direction is to provide a comprehensive medical surveillance program for employees engaged in hazardous waste operations where it is medically prudent.

In paragraph (f)(1)(i) OSHA proposes that medical surveillance is to be provided to employees who have been or are expected to be exposed to hazardous substances or health hazards above established permissible exposure limits without regard to the use of respirators for 30 or more days in a 12-month period, or who wear respirators 30 days during the year. These are the mployees who will be at a greater ealth risk, and employees who wear irators need to be examined to rmine whether they can safely do so a routine matter. Some dividing line is needed, because employees who might be present on a hazardous waste site only a few days a year, or working in areas such as offices on the periphery of the hazardous area where exposures are low, would not have a special requirement for medical surveillance as a result of their employment. Their likely cumulative exposures to toxic chemicals would be very low, probably not significantly higher than the general population. The EPA manual indicates some dividing line is appropriate because it directs medical surveillance only for employees "routinely" exposed.

It is proposed in paragraph (f)(1)(ii) that wearing respirators for any part of each of 30 days would require medical surveillance because such usage indicates routine exposure to toxic chemicals. There is no requirement that there be 240 hours of respirator use before medical surveillance is required. Similarly being exposed over established safe levels to several chemicals each for less than 30 days, but totalling more than 30 days per year, requires medical surveillance. This exposure indicates routine exposures to ardous substances and also binations of chemicals, and may use synergistic effects creating greater health hazards than exposure to an individual chemical.

For employees who may have been exposed during an emergency incident to hazardous substances at concentrations above the permissible exposure limits without the necessary personal protective equipment being used, and for employees who are injured due to overexposure during an emergency incident, OSHA is proposing in paragraph (f)(1)(iii) that a medical examination or consultation be made available by the employer to affected employees for each incident. A continued medical surveillance program for these employees is not proposed to be required unless they also are covered under the provisions of paragraphs (f)(1)(i) and (f)(1)(ii) as discussed above.

In paragraph (f)(2), OSHA is proposing the frequencies for medical examinations and consultations to be provided to employees.

OSHA's proposal would require an initial or baseline medical examination, either prior to the start-up date for employees who are currently working at hazardous waste sites or prior to initial assignment to an area where medical examinations will be required. The purpose or the intent of baseline medical examinations is to take a detailed medical history, and where possible to develop a health baseline prior to any exposures so as to be able to evaluate changes which may be connected to hazardous substance exposures. In addition, the initial examination would permit evaluation of whether the employee can appropriately wear a respirator, and whether the employee has preexisting conditions which would make exposure to hazardous substances inappropriate. An initial examination has been required by other OSHA health standards, and is recommended in Reference 6 and required by the EPA.

The periodic examinations are required yearly. OSHA's experience in other health standards has been that this is an appropriate period, and it is also recommended by Reference 6. EPA's medical monitoring program guidelines cross-referenced in the EPA manual recommends baseline annual examination generally, as well as a termination examination. It is reasonable to determine periodically whether exposures have induced medical changes and to identify conditions caused by chemicals at an early stage to permit more effective treatment. In some circumstances, the physician may advise more frequent examinations. OSHA requests comment on whether yearly or another frequency for periodic examinations is most appropriate.

Examinations are also to be provided when the employee brings to the employer's attention signs or symptoms indicating possible overexposure to hazardous substances. The employee is to be trained in recognizing what symptoms may indicate that the employee has been exposed to a hazardous substance. Examples of such systems may be dizziness or rashes. Examinations are also required, when medically appropriate, during emergencies when exposure to higher levels is possible. For example, a urinary phenol test is appropriate for employees exposed to high levels of benzene.

Finally, employees who have been required to have medical examinations must also be given an examination upon termination of employment, or upon reassignment to an area where medical examinations are not required. This examination is proposed to detect conditions which have developed prior to departure and is recommended by the EPA program. The proposed provision does not require a termination examination if the employee has had an examination within the prior six months. The EPA guideline has that exception, but qualifies it only if the employee has had no significant exposures in the interval. OSHA requests comments on the appropriate provisions for a termination examination.

In paragraph (f)(3), OSHA would establish the content of medical examinations and consultations provided to employees.

In situations where most of the employees on the site have similar exposures, the protocol may be similar for all employees. Where different groups of employees on the site have substantially different exposures, several different protocols may be appropriate for the site's workers depending on exposures.

There are a number of sources for guidance on specific medical examination protocols. Chapter 5 of Reference 6 provides such guidance by groups of chemicals likely to be present on a site. It references other authorities. The manual should be supplied to the physician. It is also a basis for the medical surveillance program required by this paragraph. In addition, the EPA medical monitoring program guidelines referenced by the EPA manual provides guidance on specific protocols.

In paragraph (f)(4), OSHA proposes that the medical examination would have to be provided under the supervision of a licensed physician. As

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OSHA specifically requests comment on whether these or other criteria are the most appropriate for determining which employees should receive medical surveillance, taking into account both medical and administrative factors.

Paragraph (g)—Engineering Controls, Work Practices, and Personal Protective Equipment

It is proposed that anyone entering a hazardous waste site be protected against potential hazards. The purpose of proposing engineering controls, work practices, and personal protective equipment (PPE) is to shield or isolate employees from the chemical, physical, and biologic hazards that may be encountered at a hazardous waste site. Careful selection and use of appropriate engineering controls, work practices, and PPE should protect any employee from health and other hazards, including hazards to the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing.

Congress required in section 126(b) (4) and (5) of SARA that the proposal have provisions for the use of engineering controls and personal protective equipment. Section 126(b)(6) states that the proposal shall contain "requirements for maximum exposure limitations for workers engaged in hazardous waste operations." In addition existing OSHA regulations which apply in general to hazardous waste operations, in 29 CFR Part 1910, Subpart Z, require exposures to various toxic and hazardous substances to be controlled with engineering controls if feasible, otherwise with PPE.

Paragraph (g)(1) would carry over the existing requirements of the interim rule. It provides that toxic and hazardous substances regulated by OSHA are to be controlled to the permissible exposure limit with engineering controls if feasible. If such control is not feasible, the exposure is to be controlled with PPE.

Paragraph (g)(2) would provide that to achieve as appropriate established exposures levels for substances not regulated by OSHA in Subpart Z, the employer may use an appropriate combination of engineering controls, work practices, and PPE.

OSHA believes that the approach in paragraph (g)(2) accurately reflects Congress' guidance. OSHA requests comment on whether the approach it has followed is appropriate for hazardous waste operations and is protective of workers, taking into account that in some circumstances engineering controls are not available for those operations, and also the large number of chemicals which may be present at such sites.

OSHA is currently considering upgrading its respirator program requirements and is reviewing its current methods of compliance policy to determine if revision would be appropriate. A proposed rule on methods of compliance is scheduled for later in 1987. If as a result of this review the general policy is modified, these modifications would also apply to this standard.

Examples of engineering controls which may be feasible are pressurized cabs on materials handling equipment, or pressurized control rooms in materials handling areas. However, in many cases personal protective equipment will be the only feasible means for providing protection to employees engaged in hazardous waste operations.

It is proposed that the selection of personal protective equipment (PPE) be based on the information obtained during the site characterization and analysis, as is proposed by paragraph (g)(3)(i) of this standard. Once an estimate of the types of hazards and their potential concentration has been obtained, the proper respirators and protective clothing can be selected based on the performance characteristics of the PPE relative to the site hazards and work conditions, as is proposed by paragraph (g)(3)(ii) of the standard. These requirements are derived from Reference 6, and are also supported by a NIOSH document, "Personal Protective Equipment for Hazardous Materials Incidents: A Selection Guide." These two documents also support the proposals of paragraphs (g)(3)(iii) and (g)(3)(iv) which would require positive pressure respirators with escape provisions to be used in IDLH atmospheres, and totally-encapsulating chemical protective suits to be used where skin absorption of the substance would result in an IDLH situation.

Paragraph (g)(3)(v) would require that the level of protection provided by PPE selection be increased when additional information onsite conditions show that increased protection is necessary. The purpose of this regulation is to assure that employees do not become exposed to levels of hazardous substances above what is permitted after initial monitoring has been completed. It is possible that increased protection may become necessary due to unexpected releases of unknown substances or due to new required by paragraph (e). Some of the training time required in paragraph (e) can be allocated to this information so that this provision does not increase training time over that which Congress has directed.

This provision is intended to cover employees who are exposed to greater hazards than the general employee population. Consequently a clerk in an office on the periphery of a site who does not enter the operations part of a site, and is exposed only to background levels of hazardous substance, would not be covered. Employees who regularly enter the operations areas on the site and are exposed to levels significantly over background would be covered.

The information program should concentrate on those substances which will create the greater risk to the employee, either because of their hazardousness or because of the likely higher degree of exposure, and for which precautions are most essential. For example, a level of exposure not higher than background to a general population would not normally require notification. Similarly a level of exposure above background, but well below established permissible exposure limits of chemicals, would not require the specific notification of this provision.

The identification of exposure level provisions are tied in with the monitoring provision of the standard, and do not create requirements to monitor additional to those created elsewhere in this proposed standard. Similarly there is no requirement to make risk estimates or to undertake original research on the degree of risks. The requirement is to inform the employee, contractor, or subcontractor of estimates in the literature or made by authoritative organizations. As the employers here are in the business of handling hazardous wastes, they should be familiar with this literature in order to manage their operations properly. Therefore extensive literature searches should not be necessary.

OSHA requests comments on whether these or other provisions of the proposal are a more effective method than the method used in the interim final rule for informing employees of the hazards they face in a manner that concentrates on the more important hazards and the methods by which they can be controlled.

Paragraph (j)—Handling Drums and Containers

In paragraph (j), OSHA is proposing procedures for the handling of drums and containers. The handling of drums and containers at hazardous waste sites poses one of the greatest dangers to hazardous waste site employees. Hazards include detonations, fires, explosions, vapor generation, and physical injury resulting from moving heavy containers by hand and working around stacked drums, heavy equipment, and deteriorated drums. While these hazards are always present, proper work practices can minimize the risks to site personnel. Section 126(b)(8) of SARA directs that the proposal contain provisions on the handling and storage of hazardous substances and this paragraph addresses that concern.

Containers (less than 30 gallons) are also handled during characterization, removal of their contents and during other operations. Many of the hazards encountered during the handling of drums also occur during the handling of smaller containers. The relative size of a smaller container when compared to the size of a drum is no indication of the degree of hazard posed by the container. They both should be treated in accordance with the level of hazard posed by their contents not by their size. The language used in this paragraph was adapted from Reference 6.

Paragraph (k)—Decontamination

Section 126(b)(10) of SARA provides that the OSHA proposal contain requirements for decontamination procedures. Decontamination is a necessary practice to protect those employees properly who may be exposed to hazardous substances. Decontamination provisions protect an employee from being exposed to hazardous substances which might otherwise be on the employee's PPE when it is removed. OSHA is proposing that a decontamination plan be developed and implemented before any employees or equipment may enter areas on site where potential exists for exposure to hazardous substances.

As proposed in this standard, decontamination procedures and areas must be developed to minimize hazardous exposures to employees whose equipment and PPE are being decontaminated, as well as to employees who are assisting in the decontamination of workers and equipment. These measures are proposed since, without proper procedures and decontamination areas, employees may be unknowingly exposed to hazardous substances which have contacted or otherwise adhered to equipment and clothing. OSHA is also proposing that all employees be decontaminated and that all clothing, equipment and decontamination fluids and equipment be decontaminated or disposed of before leaving a contaminated area. These provisions are proposed so that contaminated persons and materials do not leave the "hot zone" and thereby expose other employees and persons to hazardous substances.

Decontamination methods and cleaning fluids must be matched to the particular hazardous substance at the site in order for the decontamination procedures to be effective in removing the hazards from PPE and other equipment. No one decontamination fluid will be effective for all hazardous substances. As proposed in this standard, the decontamination program must be effective and it must be monitored by the site safety and health supervisor to maintain its effectiveness. These proposals are made so that employees are not exposed to hazardous substances by re-using PPE and other equipment which are still contaminated.

Effective employee decontamination also requires clean change rooms and showers. There must be an area where the employees can remove the contaminated work clothing and where it will not contaminate the employees' street clothing. In addition, the employees must be able to shower after removing contaminated work clothing and then go into a clean area where the employee can put on street clothing. Paragraph (k) contains these decontamination requirements. Somewhat different provisions are required for sites of less than six-month duration because more permanent facilities are not as feasible for short-term operations. The language used in this paragraph was adapted from reference 6.

Paragraph (l)—Emergency Response

Section 126(b)(11) of SARA specifically provides that the proposal contain "requirements for emergency response." In addition, the EPA manual under items 4 and 9, and 29 CFR 1926.23 and 1926.24 require preparations and planning for emergencies. Congress made its intent clear that emergency planning and response is an important part of any employer's safety and health program, and directed that it is to be addressed in the proposed rule.

The Congressional concerns on toxic emergencies is discussed in *Task Force on Toxic Emergencies*, Environmental and Energy Study Conference Special Report, September 18, 1986. This report stresses the need for training of emergency response personnel as well as emergency response planning and related areas.

In paragraph (l)(1)(i), *Emergency Response, General*, OSHA is proposing hat employers who are involved in emergency response to hazardous waste ncidents develop and implement an em[illegible]y response plan for eme[illegible]cies. Employers would have to nform all their employees about the emergency response plan. The plan would also have to be available for use prior to the start of work on the site. It would have to be in writing and available for inspection by employees, their representatives, and OSHA personnel. OSHA proposes to exempt employers from the rest of paragraph (l) if they provide an emergency action plan in accordance with 29 CFR 1910.38 that requires the total and immediate evacuation of employees from the release site.

In paragraph (l)(1)(ii), OSHA is proposing that the emergency response plan include the following elements: (1) Recognition of emergencies; (2) methods or procedures for alerting employees onsite; (3) evacuation procedures and routes to places of refuge or safe distances away from the danger area; (4) means and methods for emergency medical treatment and first aid; (5) line of authority for employees; (6) decontamination procedures; and (7) site control means and methods for evaluating the plan.

Local fire departments, police departments or emergency medical s[illegible]s would also be required to have an [illegible]ergency response plan. These employees which may be called upon to respond to hazardous substance emergency incidents involving a railroad tank car, motor carrier tank truck or to a plant location where they do not regularly work are considered involved in emergency response activities at other than hazardous waste clean-up sites under this section. However, work by maintenance or repair personnel who are called upon to replace a leaking valve or a section of pipe damaged by an unexpected release, or to restore a highway surface or railroad track bed that may have been damaged in an accident causing the release of a hazardous substance, are not considered as being part of the "emergency response" for the purpose of this proposal. Such employees routinely respond to accident sites to restore equipment to a functional level after an accident has occurred. Typically the accident scene will have been declared "non-hazardous" in regards to employee exposure to hazardous substances. Should a health exposure exist, these employees would be covered by OSHA's General Industry health standards in Subpart Z. Safety hazards [illegible]d to their work would be covered by the appropriate Part of Title 29 related to their work (i.e., 1910, 1926, etc.)

The emergency response plan would have to include the incident command system required in paragraph (l)(3) of this section. OSHA believes that a generic emergency response plan is feasible for employers.

In paragraph (l)(3), *Emergency response at hazardous waste clean-up sites*, OSHA is proposing requirements for emergency response at hazardous waste clean-up sites. The title for this paragraph would be changed from the title *"On-site emergency response"* as used in the interim rule to *"Emergency response at hazardous waste clean-up sites"* to clarify the intent of the type of response OSHA is proposing to cover in this paragraph. Further the term "on-site" would be replaced with the phrase "at hazardous waste clean-up site" as appropriate.

An employer's emergency response personnel at hazardous waste clean-up site operations must have the same basic training as for the other employees involved in routine hazardous waste clean-up operations plus the training needed to develop and retain the necessary skills for anticipated emergency response activities. CERCLA sites, major corrective actions at RCRA sites, sites designated for clean-up by state and local governments and other similar hazardous waste clean-up sites require more training because there is the possibility of uncontrolled hazards.

Note.—Emergency response personnel from other places of employment of different employers who respond to the site must comply with the training requirements of paragraph (l)(3).

In paragraph (l)(3), *Emergency response at other than hazardous waste clean-up sites*, OSHA is proposing requirements for emergency response at other than hazardous waste clean-up sites. The title for this paragraph would be changed from the title *"Off-site emergency response"* as used in the interim rule to *"Emergency response at other than hazardous waste clean-up sites"* to clarify the intent of the type of response OSHA is proposing to cover in this paragraph. Further the term "off-site" would be replaced with the phrase "at other than hazardous waste clean-up site" as appropriate.

Fire departments, emergency medical and first-aid squads, fire brigades, and other similar emergency response teams would have to conduct monthly training sessions for their employees, except as provided in (l)(3)(i)(A)(*3*) and (l)(3)(i)(A)(*4*). Regular training is needed so that the employees with responsibility for controlling, containing and extinguishing fires of hazardous substances know the proper techniques and equipment to use. They must also know the appropriate PPE to use and how to wear it and how to coordinate with fellow employees. Without this knowledge their lives would be in jeopardy. The training needs to be recurring because quick decisions will have to be made in the dangerous emergencies of chemical fires, acid spills, poisonous fumes, etc. where there often will not be time to consult manuals and the information needs to be fresh and accurate in the employees' minds.

Some changes have been made in the proposal from the interim rule. The interim rule required 24 hours of training and monthly sessions. OSHA believes that is a reasonable amount of training required and it is retained as an option in the proposal.

However, a prescription of a number of hours does not necessarily indicate proficiency and employees could develop proficiency in fewer hours. Therefore, OSHA is proposing an alternative. The alternative would provide that employees be trained sufficiently so that they demonstrate competency in the relevant areas of their duties.

In addition, the interim rule clarifies that training need be given only to those employees who will be engaged in controlling toxic chemical fires and containing spills. Employees who may be first on the scene, but not expected to engage in response activities, may be trained only in hazard recognition if they are instructed to call others to control hazardous substance spills and fires. Employees for whom there is no reasonable possibility of making an emergency response need not be trained in making such a response.

In addition, the proposal clarifies that the intent of the training requirements is to ensure that fully-trained personnel are available to respond to hazardous substance emergencies. Accordingly, each individual emergency response organization is not required to have a fully-trained hazardous substance response team if arrangements have been made in advance to ensure that such a team is available to respond in a reasonable period if summoned. If any emergency response organization chooses to rely on an outside team for hazardous substance emergencies, then its members must be sufficiently trained to recognize that an emergency situation exists which requires the intervention of the designated hazardous spill response team and to know how the spill response team should be contacted. An example may be a metropolitan area in which an emergency spill team is available to respond immediately to spills anywhere within the area. In such a case, each emergency response organization in the area would not have to train individual member to the degree specified in paragraph (l)(3)(i)(A)(*1*) if the members knew when and how to call in the designated spill response team.

However, the employees fully trained must be sufficient to handle reasonable possible emergency response situations. There are additional requirements for HAZMAT teams because they face the greater hazards of stopping leaks of hazardous chemicals.

It is noted that OSHA does not have direct jurisdiction over state and local government employees. OSHA state plan states must regulate state and local government employees in the state. State and local government employees in non-OSHA state plan states will be covered by EPA. [See section 126(f) of SARA.]

Training sessions on activities such as breathing apparatus use, hose handling and preplanning may be used as training subjects for the monthly sessions, provided hazardous substance incident operations are included in the presentation, discussion or drill. It is proposed that these training sessions and drills contain at least 24 hours of training on an annual basis.

It is also proposed that an incident command system be established by employers for the incidents that will be under their control, and that the system be interfaced with the other organizations or agencies who may respond to such an incident. The National Transportation Safety Board, as a result of its investigation of hazardous materials incidents, has consistently recommended that better state and local emergency response planning be done to reduce the loss of life and property, and that a system using a command post and on-scene commander be implemented. (See *Special Investigation Report. On-scene Coordination Among Agencies at Hazardous Materials Accidents*, NTSB-HZM-79-3, September 13, 1979; and *Multiple Vehicle Collisions and Fire, Caldecott Tunnel near Oakland, California*, NTSB/HAR-83/01, National Transportation Safety Board, Washington, DC, April 7, 1982, for further information.) OSHA is proposing that where available, state and local district emergency response plans would be utilized in developing the incident command system and the emergency response plan to assure compatability with the other emergency responding agencies or employers.

In paragraph (l)(4), *Hazardous materials teams*, OSHA is proposing to require employers, who utilize specially trained teams involved in intimate contact with controlling or handling hazardous substances, to provide special training for the affected employees in such areas as care and use of chemical protective clothing, techniques and procedures for stopping or controlling leaking containers, and decontamination of clothing and equipment after hazardous substance incidents. The employer would have to implement a medical surveillance program in accordance with the proposed requirements of paragraph (f) of this section. It should be noted that employees of employers covered by paragraph (a)(2)(ii) already would receive these protections as a result of other provisions in this proposal. However, this paragraph does not require any employer to form or organize a hazardous materials team. It only applies when such a team has been organized and utilized.

In paragraph (l)(5)(i), OSHA is proposing to require that employers who will be involved in cleaning up hazardous waste after the emergency response activities are concluded, comply with the same requirements that apply to others involved with hazardous waste clean-up operations. These hazardous waste clean-up operations will be typically accomplished by special contractors, and not by those agencies involved in responding to the initial emergency incident.

However, this paragraph does not apply to those employees who clean-up a spill in their work area which did not involve an emergency response by the fire brigade, fire department or similar organization.

After an emergency response incident is brought under control on plant property, and post-emergency clean-up of hazardous materials begins, paragraph (l)(5)(ii) would permit the employer whose facility was affected by the incident to use plant employees to decontaminate the workplace. This provision has been addressed and permitted in the past by specific OSHA health standards such as 29 CFR 1910.1017(h)(2)(i), 29 CFR 1910.1008(d)(2) and others. The employees who may take part in the clean-up would have to have completed the full training program required in 29 CFR 1910.1200, and the respirator training required in 29 CFR 1910.134. Emergency action plans would have to be provided in accordance with § 1910.38(a). Any appropriate safety and health training required by the specific tasks to be completed as part of the clean-up effort would also have to be provided. Employers whose employees will be performing post-emergency cleaning of workplaces would be exempt from paragraph (l)(5)(i) of this section if they comply fully with paragraph (l)(5)(ii) of this section.

OSHA requests comment on whether the proposals it has made and distinctions it has drawn for emergency response are appropriate, or whether improvements can be made.

Paragraph (m)—Illumination

In paragraph (m), *Illumination*, OSHA is proposing to require certain minimum illumination levels for work areas that are occupied by employees. OSHA was mandated by SARA in section 126(e) to include illumination requirements in the interim final rule published in December 1986. OSHA believes that the intent of Congress is to provide coverage concerning illumination, and has therefore proposed to regulate it in this proposed final standard. The provisions come from OSHA's construction industry requirements for illumination at construction sites issued at 29 CFR 1926.56. SARA calls upon OSHA to use the requires of Subpart C in Part 1926. Subpart C references the requirements of Subpart D which contains § 1926.56. OSHA request comment on whether these or other provisions are more appropriate for hazardous waste operations.

Paragraph (n)—Sanitation for Temporary Worksites

In paragraph (n), *Sanitation for temporary worksites*, OSHA is proposing minimum requirements for potable and non-potable water supplies, toilet facilities, and other areas related to sanitation at temporary workplaces. OSHA was mandated by SARA in section 126(e) to include sanitation requirements in the interim final rule. The provisions in this proposed standard come from OSHA's construction industry requirements for sanitation at construction sites issued at 29 CFR 1926.51 with one addition. SARA calls upon OSHA to use the requirements of Subpart C in Part 1926. Subpart C references the requirements of Subpart D which contains § 1926.51. OSHA is proposing to expand the referenced construction standard in this rulemaking with requirements for showers and change rooms. Regulation of these facilities was not a part of the interim final rule. The proposed addition has been made to address the installation and operation of employee showers and change rooms at worksites where clean-up operations are expected o t[illegible] x months or more to complete.

O[illegible] requests comment on whether hese or other provisions are more appropriate for hazardous waste operations.

Paragraph (o)—Operations Conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA)

OSHA is proposing a separate paragraph for operations conducted at worksites involving hazardous waste storage, disposal and treatment operating under the Resource Conservation and Recovery Act of 1976 (RCRA). This separate paragraph of requirements is appropriate because RCRA site operations (not including major corrective actions and their associated hazards which are similar to CERCLA sites, and are covered by the main part of the standard) generally are different from the operations and hazards found on a CERCLA clean-up site. For example, RCRA sites that would be covered by this paragraph tend for the most part to be fixed ongoing operations involving the receiving, processing, storage, treatment, and disposal of hazardous wastes or substance from outside sources. CERCLA sites, on the other hand, are te[illegible]ary emergency clean-up op[illegible]ions involving often undefined and substantial quantities of hazardous substances.

Consequently hazards should be better controlled and more routine and stable for the RCRA sites covered by this paragraph, and therefore less extensive requirements are appropriate. OSHA requests comment on whether the provisions of paragraph (o) are appropriate for general RCRA sites.

In paragraph (p), *New technology programs*, OSHA proposes to address new technology programs. New technology programs are intended to provide employees with means to become aware of new equipment, processes, and procedures that may contribute to improving their safety and health on the job. Paragraph (b)(9) of SARA also requires the agency to address new technology programs as part of this proposal.

III. References

1. Superfund Amendments and Reauthorization Act of 1986 (SARA), Pub. L. 99-499.

2. Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA or "Superfund"), F[illegible] 96-510, December 11, 1980, 94 S[illegible].767.

3. Resource Conservation and Recovery Act of 1976 (RCRA), Pub. L. 94-580, October 21, 1976, 90 Stat. 2795.

4. "Health and Safety Requirements for Employees Engaged in Field Activities," Environmental Protection Agency Order 1440.2, U.S. Environmental Protection Agency, July 12, 1981.

5. Subparts C and D of 29 CFR Part 1926.

6. "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," Occupational Safety and Health Administration, Environmental Protection Agency, U.S. Coast Guard, and National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 85-115, October 1985.

IV. Issues for Comment

OSHA requests comments on all issues raised by this proposal, including the issues specifically raised throughout the preamble. OSHA also requests comment on the following issues:

1. Ninety days after the promulgation of the final OSHA regulations that result from this notice of proposed rulemaking, section 126 (f) of the Superfund Amendment and Reauthorization Act of 1986 (SARA) requires the Administrator of the Environmental Protection Agency (EPA) to promulgate standards identical to those promulgated by OSHA pursuant to this rulemaking for employees of State and local governments in each state which does not have in effect an approved State plan under section 18 of the Occupational Safety and Health Act of 1970. EPA is to provide standards for the health and safety protection of employees engaged in hazardous waste operations. Does the requirement that EPA apply identical standards to employees of State and local governments engaged in hazardous waste operations raise any issues about the substance of the standards that would not be raised by their application to other workers? EPA will conduct its own rulemaking to define those employees to whom the standards will apply.

2. OSHA has defined the term "established permissible exposure limit" to cover the many hazardous substance and health hazards possibly present in hazardous waste operations. Is another definition or term more appropriate and, if so, how should it be defined? Should several terms be used for different purposes, such as site entry or guidance on use of PPE? How should OSHA determine safe levels of exposure for unknown substances or mixtures of substance?

3. In order to perform a Regulatory Impact Analysis and a Regulatory Feasibility Analysis for the final standard, OSHA requests information concerning the following general topics: The type, number, and characteristics of the contractors and other entities involved in hazardous waste operations; the number of potentially affected employees at hazardous waste operations; the available fatality, injury, and illness statistics associated with hazardous waste operations; current industry practices in hazardous waste operations; the potential costs of compliance; and the potential economic impact of the proposed standard upon the economy and upon small entities. In addition to any other information that is supplied on these issues, OSHA is particularly interested in information concerning the specific questions found in Issues 4 through 18. OSHA already has substantial information in these areas, but more information would be helpful in improving the regulation and making more detailed estimates of impacts.

4. What type of contractors and other entities are involved in hazardous waste operations? How many are there? What are their characteristics? What is the typical scale of clean-up operations? Numerous local construction contractors may be employed in clean-up activities at uncontrolled hazardous waste sites. What are the characteristics of these firms? Are they typical of construction firms (particularly excavation contractors) in general or not? Are these contractors able to specialize in work at uncontrolled hazardous waste sites?

5. For investigation and clean-up of uncontrolled hazardous waste sites, can you estimate the split between government and privately funded clean-up work? Can you describe/estimate the components of the privately funded work between (1) private actions in direct response to government enforcement efforts, (2) voluntary private actions (apparently) preceding direct enforcement actions, (3) voluntary private actions in preparation for sale of property, and (4) voluntary private actions without any encouragement from enforcement or other external factors? The government-funded work at uncontrolled hazardous waste sites may continue for a decade or more. Can you estimate the duration of work in the private sector? What are the differences, if any, between clean-up project characteristics of government sponsored activities and private clients?

6. How often do emergency spills occur at a clean-up site, and how often do they occur off the site? How many of

these emergency spills are cleaned up by private contractors? Are these private contractors the same as those contractors performing hazardous waste clean-ups on hazardous waste clean-up sites? How often are emergency spills cleaned up by state and local employees? How many fires occur that require state and local firefighters to enter a hazardous waste site?

7. Do industrial establishments with industrial fire brigades generally ask those brigades to respond to in-house hazardous material spills or releases? If not, who does respond? Are other response groups designated? What provisions do other establishments (i.e., those without brigades) make for responses to hazardous material spills or releases?

8. How may private HAZMAT teams (response groups) are there? Are many of the teams designated for responses for several emergency networks (e.g., for responding to CHEMNET emergencies, Chlorine Institute emergencies and others)? How many HAZMAT specialists, advisors or consultants, or other groups are there that may respond to incidents but who do not physically get involved in the response action?

9. How many employees are exposed to hazardous substances during clean-ups at a typical CERCLA site, at a typical RCRA site; and at an emergency spill? What are the typical hazardous substances found at a CERCLA site and at a RCRA site? What are the typical exposure levels? How many average daily hours of exposure to site hazards would a typical employee face during clean-up operations, and during final site reclamation work? At how many waste sites does the average employee work during a year? What are the training and experience levels of these employees? What is the labor turnover rate? What percentage of these employees have previously worked at CERCLA or RCRA sites?

10. The proposed standard covers employers and employees engaged in operations regulated under 40 CFR Parts 264 and 265 pursuant to RCRA. Are there other RCRA operations involving hazardous waste handling covered by other Parts in Title 40 of the Code of Federal Regulations which OSHA should include in the scope of this standard? Are there any other paragraphs of this proposal not specifically referenced in paragraph (o) for applicability to RCRA sites that should be made applicable to RCRA sites?

11. What are the current industry practices with respect to the provisions in the proposed standard? What actions would be necessary for compliance? Does the current degree of compliance depend upon the type of site? Are there any provisions that would, in some specific situations, be either technologically or economically infeasible? What would those specific situations be?

12. How much training is being provided for various types of employees? Who has provided this training? How often is training repeated? Are truck drivers who haul the hazardous substance from the site trained and, if so, to what extent and by whom? Are monthly drills or other training provided for emergency responders to spills?

13. What preparations are made for emergency situations that may arise at CERCLA or RCRA hazardous waste sites?

14. What are the typical practices concerning air monitoring? How extensive is the information concerning the specific hazardous substances at a CERCLA site and at a RCRA site?

15. Do employees receive medical exams prior to the first site assignment? Are exit exams provided? Are medical exams given annually? Are these exams given to HAZMAT team members? Which tests and analyses are included in the medical exam?

16. Is personal protective equipment used in accordance with the proposed standard? If not, why not? Is a self-contained breathing apparatus worn at all times during emergencies with hazardous substances? If not, what types of instances might not require their use?

17. What sources of fatality, illness, or injury statistics are available for hazardous waste operations? What are the causes of these fatalities and injuries? What types of site characteristics or employee actions have contributed to fatalities and injuries? Are there specific cases of acute or chronic illnesses occurring to employees performing hazardous waste operations? Would specific provisions in the proposed standard have prevented these cases? Which provisions?

18. What would be the unit costs of complying with each of the provisions for which there is current non-compliance? What would be the annual costs by provision and by site? What would be the capital costs? What would be the one-time expenditures? What would be the typical total, annual and capital costs of compliance for a contractor? What would be the typical receipts, profits, and investment of these firms? To what extent would this cost of compliance be passed onto the price of the clean-up operation? What would be the typical impact of compliance upon the price charged to clean-up of a CERCLA site, a RCRA site, and a private site? Would small entities be faced with an adverse impact that would be significantly greater than the adverse impact faced by the larger entities? If so, what particular provisions would cause this impact?

19. OSHA is proposing certain training requirements for employees who are expected to work with hazardous substances. The Agency proposes to require certification to show that training has been completed. Should it set criteria for the persons doing the training? Is the requirement of a written certification upon completion of training given to the employee sufficient to show that training has been completed? With regard to the various training requirements in the standard, should OSHA require specific training courses or curriculum? What should a training certification include? If the employer is allowed to certify that an employee has been trained, what format should this certification follow?

20. In the issue of medical surveillance and the surveillance records necessary to show employee exposures, how should OSHA provide for records transfer when an employee moves from one job site to another job site, or from one employer to another employer?

21. Test methods for evaluating the performance of totally-encapsulating chemical protective suits are included in Appendix A of this standard. A pressure test using compressed air and a qualitative leak test using vapors from concentrated aqueous ammonia are included. Are these test methods adequate for ensuring the integrity of totally-encapsulating chemical protective suits? Are other test methods available which would be more suitable? Is there a danger to employees from the use of such a volume of concentrated aqueous ammonia?

22. The standard and appendices do not contain any test methods for other chemical protective clothing such as overalls, chemical-splash suits and chemical-resistant gloves. Are there any tests methods available which evaluate the performance of these types of protective clothing and gloves as they would perform when worn? Is there a need to include test methods for chemical protective clothing and gloves?

23. The standard requires that clothin and equipment leaving a contaminated area be appropriately disposed of or decontaminated. What methods are available to evaluate the effectiveness of decontamination procedures? What methods are available to determine when decontaminated clothing and

equipment are safe to reuse? What guidelines or procedures are available to en[illegible]roper disposal of contaminated clo[illegible]g and equipment?

24. The practical health benefit of annual medical examinations for workers in hazardous waste operations may be, however, uncertain. Hazardous waste operations often involve exposure to numerous chemicals some of which may be unknown, to which workers may be exposed once, intermittently, or regularly. Consequently, it may not be possible to determine in advance what particular biological markers are relevant in determining over-exposure; which medical tests should be conducted; or even if the same medical tests should be conducted with each yearly examination. One consequence of this uncertainty may be over-testing—the application of a battery of medical tests simply in order to cover the full spectrum of possibilities. Such testing would be costly and in some circumstances of limited health benefit, and would not assure the worker that health effects have not occurred as a result of over-exposure. This situation differs from that in most other activities regulated by OSHA, in which specific exposures have been identified and specific tests can be conducted to determine if workers have been over-[illegible]ed.

[illegible]e, in some circumstances, it may not be possible to determine in advance what doctors should look for in workers engaged in hazardous waste operations, it may be more useful to follow the initial or baseline exam with periodic examinations of those workers who show symptoms indicating sensitivity or possible over-exposure to hazardous substances. Follow-up exams would occur at intervals recommended by the physician. The effectiveness of this approach in identifying workers in need of medical surveillance would be enhanced by worker training on recognition of symptoms indicating possible over-exposures. OSHA solicits comments on the appropriateness and effectiveness of this alternative to annual medical examinations.

V. Regulatory Impact Analysis, Regulatory Flexibility Analysis and Environmental Impact Assessment

Introduction. Executive Order 12291 (46 FR 13197, February 19, 1981) requires that a regulatory impact analysis be conducted for any rule having major economic consequences for the national economy, individual industries, geographical regions, or levels of government. In addition, the Regulatory [illegible]bility Act of 1980 (Pub. L. 96–353, 94 [illegible] 1164 [5 U.S.C. 601 *et seq.*]) requires the Occupational Safety and Health Administration (OSHA) to determine whether a proposed regulation will have a significant economic impact on a substantial number of small entities, and the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321, *et seq.*) requires the agency to assess the environmental consequences of regulatory actions.

In order to comply with these requirements, OSHA has prepared a Preliminary Regulatory Impact and Regulatory Flexibility Analysis (PRIA) for the proposed hazardous waste operations and emergency response standard. This analysis includes a profile of the industries that would be affected, the estimated number of employees who would be at risk from occupational exposures to hazardous wastes, technological feasibility, costs, benefits, and an overall economic impact of the proposed standard. The PRIA is available in the OSHA Docket Office.

Data Sources. The primary sources of information for this analysis are an April 1986 report by The Eastern Research Group (ERG) entitled, "Preparation of Data to Support A Regulatory Analysis and Environmental Assessment of the Proposed Standard for Working at Hazardous Waste Sites." Most of the information contained in this report was gathered from Environmental Protection Agency sources, industry sources, experts in the area of hazardous waste management, etc. OSHA welcomes additional comments and all information supplied will be carefully reviewed and evaluated for incorporation into the Regulatory Impact Analysis (RIA) that will accompany the final rule.

Industry Profile. The proposed standard would affect about 20,000 uncontrolled hazardous waste sites, about 4,000 hazardous waste operations conducted under the Resource Conservation and Recovery Act (RCRA) of 1976, about 13,600 spills of hazardous materials that occur annually outside a fixed facility, and about 11,000 spills of hazardous materials that annually occur inside a fixed facility. The firms that would be affected by this proposed standard are as follows: about 100 contractors that perform hazardous waste cleanups; about 50 engineering or technical services firms that perform hazardous waste preliminary assessments or site investigations and remedial investigations or feasibility studies for hazardous waste site cleanups; about 300 RCRA-regulated commercial treatment, storage and disposal facilities; about 3,700 RCRA-regulated facilities that are operated by a hazardous waste generator; about 28,000 fire departments; about 750 private hazardous materials (HAZMAT) response teams; and about 22,000 manufacturers that use in-house personnel who respond to emergency spills of hazardous material within the facility.

Population at Risk. As many as 1,191,950 employees may be at risk from exposure to hazardous waste. Of these 1,191,950 employees, about 12,100 are employed at government-mandated uncontrolled hazardous waste site cleanups, about 52,700 are employed at RCRA-regulated facilities, about 944,500 are firefighters, about 7,500 are private HAZMAT members, and about 178,000 are members of industrial fire brigades that provide in-plant emergency responses to hazardous materials spills. Most of these employees, however, do not work full-time around hazardous waste. In fact, nearly all of the 1,120,500 firefighters and industrial fire brigade personnel who are at risk are annually exposed to hazardous materials for only a few hours. Virtually all of the public firefighters will be directly regulated by either individual state OSHA standards or the U.S. EPA standard.

Feasibility. The proposed standard does not require the use of any large-scale capital equipment that is not currently used in normal work operations. In addition, each proposed provision requires equipment and work practices that are currently available. Thus, OSHA has preliminarily determined that the proposed standard is technologically feasible.

Benefits. Numerous case studies indicate that exposures to hazardous waste cause adverse health consequences. Compliance with the proposed standard, therefore, would prevent employee fatalities and illnesses resulting from these acute and chronic exposures. OSHA has not quantified the expected reduction in the number of these occupational fatalities and illnesses because time was not sufficient to conduct field data collections on current and future exposures to hazardous waste. The probability that a significant number of excess fatalities and illnesses will occur in the absence of a proposed standard was clearly recognized by Congress in its mandate to OSHA to promulgate a standard within one year from the date that the Superfund Amendments and Regulations Act (SARA) became law. Compliance with the proposed standard will reduce the number of these fatalities and injuries by reducing employee exposures to hazardous waste.

Cost of Compliance. OSHA has used current work practices as its baseline for estimating the cost of full compliance with the proposed standard. This estimated cost does not include any cost that is currently being incurred by employers as part of their work practices because those work practices, and therefore those costs, would continue whether or not the proposed standard were promulgated.

TABLE A—TOTAL ANNUAL COST OF COMPLIANCE FOR THE PROPOSED STANDARD

[Millions of 1986 dollars]

Provision	Government-mandated cleanups of uncontrolled waste sites	RCRA-regulated facilities	Fire departments	Private HAZMAT teams	Fire brigades	Total
Monitoring	2.608					2.608
Medical	1.262	13.886		1.463		16.611
Training:						
(Direct)	(3.148)	(5.929)	(24.052)	(0.317)	(19.526)	(53.962)
(Indirect)	(17.500)	(—)	(—)	(—)	(—)	(17.500)
	20.648	5.929	24.052	0.317	19.526	71.482
Decontamination	2.047		5.687	0.527	3.529	11.890
SCBA	0.225		4.250	0.228	4.979	4.682
Emergency Response Plans		0.157	3.341	0.098	1.819	5.415
Emergency Plan Rehearsal		1.320				1.320
Operating Procedures		0.426				0.426
Plan to Minimize Exposure			5.707	0.153	3.084	8.944
PPE Plan			5.376	0.055	1.840	7.271
TECP			11.200	0.155		11.355
Other	1.362		0.101	0.005		1.468
Total	28.152	22.718	59.714	3.101	34.787	148.472

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, as derived from ERG report [1, Appendix C].

As seen in Table A, OSHA has estimated that the total annualized incremental cost of full compliance with the proposed standard would be about $148.472 million, of which $28.152 million would be spent by contractors on government-mandated uncontrolled hazardous waste site cleanups, $22.718 million would be spent by operators on RCRA-regulated facility cleanups and operations, $59.714 million would be spent by fire departments, $3.101 million would be spent by private HAZMAT teams, and $34.787 million would be spent by industrial fire brigades.

Although OSHA's proposed standard does not directly cover state and local government employees, SARA requires that the U.S. EPA adopt the standard to cover state and local government employees in non-state plan states, and the OSH Act requires that state plan states adopt a comparable standard to cover state and local government employees. Thus, virtually all of the $59.714 million cost to fire departments will be directly mandated by either the individual states or the U.S. EPA.

The provision with the largest annual cost of compliance is the employee training provision ($71.482 million), followed by the medical surveillance provision ($16.611 million), the provision requiring the decontamination of personnel and equipment ($11.890 million), and the provision governing the use of totally encapsulating chemical protective (TECP) suits ($11.355 million).

Economic Impacts. Most of the incremental cost of compliance will be paid by the government or the private firm responsible for the hazardous waste cleanup and OSHA has calculated that it is economically feasible for every affected industry or group to comply with the proposed standard. There may be an impact upon some labor markets as a consequence of the proposed provision that only sufficiently experienced employees, or employees certified to have received a week's training at an appropriate training facility, will be allowed to work on hazardous waste site. This proposed provision would effectively curtail the current practice of using local subcontractors to provide short-term employees for hazardous waste site cleanups and limit the number of employees eligible to work at hazardous waste sites. This, in turn, may increase future wage rates and the cost of hazardous waste site cleanups.

Regulatory Flexibility Analysis

Pursuant to the Regulatory Flexibility Act of 1980, the Assistant Secretary has preliminary assessed the expected impacts of the proposed standard on small entities. Based on the available information, OSHA has determined that the proposed standard may have some impact upon some small entities. The cost of training an employee for five days prior to working at a hazardous waste site cleanup would substantially reduce the use of subcontractor labor on a one-time basis. Thus, some local subcontractors face a potential reduction in hazardous waste site cleanup work. The majority of this subcontracted work will probably be performed by those subcontractors who concentrate upon this type of work. Subcontractors who have performed cleanup work but who do not elect to train employees needed to qualify for future work will probably be excluded from working in this market. OSHA does not have information concerning the importance of this potential loss of future business for some local subcontractors. Therefore, OSHA is soliciting information on this issue and any comments received will be carefully reviewed and evaluated for incorporation into the RIA that will accompany the final rule.

Environmental Impact Assessment—Finding of No Significant Impact

OSHA has reviewed the interim final and proposed standards for hazardous waste operations and emergency response and has concluded that no significant environmental impacts are likely to result from the promulgation of these regulations. OSHA reserves the right to perform additional environmental analyses that may be appropriate as a result of information and comments received in response to this Notice.

In OSHA's December 19, 1986, interim final rule for the protection of workers engaged in hazardous waste and emergency response operations, information was solicited from the public on various issues, including possible environmental impacts on the regulation. To date, no comments have been received on the question of environmental impact. On the basis of the review detailed below, and in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321, *et seq.*), the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Part 1500, *et seq.*), and the Department of Labor's implementing regulations for NEPA compliance (29 CFR Part 11), the Assistant Secretary has determined that the proposed rule will not have a significant impact on the external environment.

The preceding description of the proposed standard and its supporting rationale, together with the following discussion, constitute OSHA's environmental assessment and finding of no significant impact.

In most OSHA regulatory actions, two environments may be affected: (1) the workplace environment, and (2) the general human environment external to the workplace, including impacts on air and water pollution, solid waste, and energy and land use. The proposal for hazardous waste operations, however, is unique in that it focuses on the external environmant because during these operations, the workplace and the external environment are usually one and the same. The proposed rule is also unusual in that it is the first regulation since the passage of the Occupational Safety and Health Act of 1070 (the Act) to be mandated specifically by Congress under Section 126 of the Superfund Amendments and Reauthorization Act of 1986 (SARA). As indicated in earlier sections of this Notice, the provisions of Section 126 detail those protection that OSHA must include for workers at hazardous waste and emergency response operations. For example, Section 126 requires that provisions for site analysis, training, and medical surveillance, among other, be included in the proposed rule. In addition, there is a wide range of CSHA, EPA, and other standards that already apply to some activities that occur at hazardous waste sites and during emergency response operations. For example, there are existing OSHA standards that cover construction activities, onsite machinery and equipment, selection and use of persons protective equipment, handling of toxic and explosive materials, and general environmental and safety issues such as walking-working surfaces, noise, and illumination. Moreover, the interim final and proposed rules, in many instances, either reflect OSHA regulations, procedures adopted by other federal agencies (e.g., EPA), or practices that are commonly used by those knowledgable in hazardous waste and emergency response operations. To illustrate, Subsection (j)(6) of the proposed standard requires special controls for handling laboratory waste packs, and these controls have already become accepted practice during such operations. To the extent that existing standards, rules, or standard operating procedures are incorporated into this rule, no significant change in the environment is anticipated.

As the interim final and proposed rules largely follow current operating practices, and the technology is available to implement the OSHA provisions, compliance is not anticipated to be a difficulty. For example, section (c)(4)(iii) of the interim final rule proposes that if preliminary site evaluation cannot identify hazards or suspected hazards at the site, a Level B ensemble of personal protective equipment shall be used and direct-reading instruments shall also be carried. OSHA analysis indicates that these procedures are already accepted industry practice.

Potential Positive Environmental Effects. While OSHA does not anticipate any significant environmental effects as a result of this proposal, there is a potential for some beneficial impacts. In general, the work practices and procedures requirements of the proposal improve worker effectiveness and reduce the incidence of employee injury. Their indirect result should be to reduce the likelihood of environmental releases of hazardous materials. (Virtually all provisions of the proposed standard can be categorized in this manner, because once they are implemented, they will have a positive influence on worker safety and performance.) Because these requirements also provide guidance for routine reactions to situations encountered in emergencies, they may help to reduce the severity of such emergencies. Additional potentially positive impacts might be categorized as follows: (1) Direct benefits associated with reduced incidences in, or the severity of, the release of hazardous materials, and (2) indirect benefits associated with the improved flow of information and increased worker awareness of hazardous materials or with improved worker preparedness (either for normal site operations or for unexpected accidents). The following discussion highlights those provisions with potentially beneficial environmental effects.

Paragraph (h)—Monitoring

The requirements of this provision will increase the amount of monitoring for airborne hazardous substances at uncontrolled hazardous waste sites. In some cases, hazardous materials will be detected, and steps will be taken to more quickly control the release to the atmosphere, thereby providing an environmental benefit.

Paragraph (j)—Handling Drums and Containers

A number of specific requirements of this paragraph will result in potentially positive environmental impacts. Relevant subsections include those for inspecting drums and containers; making salvage drums or absorbents available; initiating a spill containment program; emptying unsound drums and containers; requiring ground penetrating radar; and decontamination procedures. These are discussed briefly in the following sections.

Inspection of drums/containers before moving [(j)(1)(ii)]. This section would require that drums and containers be inspected for their integrity prior to handling and moving. Under current practices at hazardous waste clean-up sites, drums and containers are often handled with mechanized equipment (e.g., a barrel grapple on a backhoe arm) before being inspected; if unsound drums rupture or leak, any soil contaminated by the rupture or leak is removed for disposal upon completion of drum handling operations. The proposed provision will, through worker awareness, increase the probability of averting ruptures and leakage. In addition, any hazardous materials in containers that cannot be moved without rupturing will have to be transferred to safe containers (as required in (j)(1)(vii)), with obvious positive environmental effect. These procedures should reduce the volume of contaminated soil requiring disposal; they should also lower the possibility that leachate or runoff will carry contaminants offsite. This requirement does not have an impact on emergency response actions because the routines outlined are already standard procedure.

Availability of salvage drums/absorbents [(j)(1)(vii)]. This provision specifies that salvage drums or containers as well as suitable amounts of proper absorbent be kept available for use in areas where spills, leaks, or ruptures might occur. This requirement will result in increased availability of salvage drums and spill absorbents at uncontrolled hazardous waste sites and in emergency response situations where spills are imminent, thereby reducing the environmental consequences related to spills of hazardous materials. In those instances where salvage drums/absorbents would have been inadequate without this requirement, there is a potential benefit to the environment.

Implement a spill containment program [(j)(1)(vii)]. The purpose of this provision is to develop a program to be implemented, in the event of a major spill, that would contain and isolate hazardous materials being transferred into containers and drums. To the extent that this program is implemented, there is a potential for reducing the negative environmental effects that occur as a result of spills, leakage, etc. This requirement should reduce the environmental impact of potential spills at clean-up sites.

Empty unsound drums/containers [(j)(1)(viii)]. Unsound containers often rupture during handling operations. This provision requires that drums and containers that cannot be moved without spillage, leakage, or rupture be emptied into a sound container. This requirement should reduce the incidence of drum and container rupture and would provide concomitant environmental benefits.

Use of ground penetrating radar to estimate depth and location of containers [(j)(1)(ix)]. At present, when preliminary investigations at hazardous waste sites indicate that buried drums or containers may be present, ground penetrating systems are frequently used to determine the depth and location of the drums. The requirements of this provision will very likely cause an increase in the use of these systems, thereby reducing the number of instances in which buried containers would go undetected or where undetected containers would be accidently ruptured during excavation activities. Where it applies, the requirement will help prevent accidental ruptures and spills, improve the thoroughness of remedial actions, and benefit the site environment.

Develop decontamination procedures [(k)]. The requirement to clean and decontaminate equipment, personnel, and personal protective equipment will prevent the migration of hazardous substances out of the worksite, thereby benefitting the surrounding environment. It will also eliminate or minimize the contamination of personnel. Decontamination is already standard practice at most cleanup sites.

Inform Contractors of Existing Hazards [(b)(15)] Under this provision, contractors are to be informed of any "fire, explosion, health or other safety hazards" that are present. By ensuring that contractors know the location and nature of site hazards, this requirement reduces the possibility that contractor activities will result in inadvertent releases or spills of hazardous materials.

Gather Information Before Site Entry [(c)(3)]. Among the various requirements for site evaluation are those for information to be gathered regarding the (a) pathways for hazardous substance dispersion, and (b) status and capability of emergency response teams. These procedural requirements will result in an increased ability to predict and prevent movement offsite of hazardous materials, mitigate emergency situations quickly and effectively, and reduce the possibility or severity of contaminant release. Since the requirements of this section mirror current practices, compliance should be accomplished with little difficulty.

Provide worker training [(e)]. Training is required for all workers who are, or could be, exposed to hazardous substances, health hazardous, or safety hazards. In addition, all managers or supervisors responsible for employees at hazardous waste operations must receive preparatory training. This training assures that site activities will be carried out by qualified personnel, with the knowledge and ability to fulfill their job functions in a safe and responsible manner. To the extent that this occurs, there is a potential benefit to the environment (in emergency response situations, this training should assure a more efficient and effective cleanup of hazardous materials or a quicker response to avert further hazardous material releases).

Informational programs [(i)]. These provisions include requirements for a site safety and health plan, pre-entry briefings, and site inspections. The site plan provides information on key personnel, risk analyses for each site task and operation, employee training assignments, personal protective equipment, medical surveillance, frequency and types of air monitoring, personal monitoring, and environmental sampling techniques, site control measures, decontamination procedures, standard operating procedures, emergency response contingency plans, and entry procedures for confined spaces. These requirements will not directly affect the existing environment; their purpose is to provide workers with the information necessary to carry out their activities safely. To the extent that this occurs, there is a potential benefit to the environment. For example, implementing comprehensive site plans could reduce the incidence of accidental releases of hazardous materials. Similarly, requiring pre-entry briefings will reduce the likelihood of employees unknowingly encountering contaminants or allowing their improper release or disposal.

Emergency response plan [(l)(1)]. The development and implementation of a response plan for emergencies provide for greater worker preparedness. In emergencies, workers should be able to respond more quickly and effectively, thereby benefitting the environment.

Potentially negative impacts. Finally, it is necessary to consider the potential for adverse impacts to the environment that might occur as a result of the proposed standard. In some situations, there may be a potential for negative effects on the environment. Any potential negative impacts, however, are not expected to be significant. To illustrate, negative impacts may occur if there is an increase in the time required to implement specific cleanup and spill response activities, or to implement safe work practices or procedures required by the proposal. Any such effects are likely to be negligible, however. For example, CERCLA sites where site plans have not been developed there could be a potential negative impact as result of the time it might take to develop such a plan. In these cases, however, since site cleanup activities are carried out on a specific EPA timetable, it is not anticipated that OSHA requirements will alter these time frames. In fact, OSHA's intent was expressed clearly in the preamble to the interim final rule: ". . . It is not OSHA's intention that emergency actions necessary to protect the public safety and health be prevented because in a particular circumstance it is not feasible to carry out particular requirements of this standard in the time needed to respond to the emergency." In emergency response situations, therefore, OSHA work practices and procedures should not cause significant delays in response or slow the mitigation of environmental effects because, in most cases, response teams already have established operating procedures similar to those in OSHA's proposed rule.

Another potential negative impact may result from the requirement that salvage drums and absorbents be readily available. This may increase the number of repacked hazardous waste drums and the amount of spent absorbent used, which could add to the amount of material that would require safe disposal. Similarly, the requirement for implementation of proper decontamination procedures for all equipment, personal protective gear, and personnel at hazardous waste emergencies, cleanup sites, and RCRA may result in an increase in the frequency and use of decontamination materials. This, in turn, could generate a larger volume of spent decontamination fluids which would then require proper handling and disposal. Again, any such impact should be negligible since decontamination is largely standard procedure for most hazardous waste operations. A possible exception may be during activities that take place in the early stages of site evaluation before cleanup, or at spill responses, where decontamination procedures are not yet standardized.

Conclusion. To the extent that the proposed work practices and procedures are implemented, increased worker awareness and preparedness will result in a safer and more healthful work environment, which may indirectly benefit the environment. Any negative impacts that may occur as a result of the implementation of these work practices or procedures are expected to be negligible. Based upon this assessment and the information presented earlier in the preamble, OSHA concludes that no significant environmental changes are anticipated as a result of the proposal. OSHA will review any comments or information received in response to this notice and reserves the right to perform additional environmental analysis, if necessary.

VI. International Trade

OSHA has evaluated the potential impact that this proposed standard would have upon international trade. OSHA has determined that the proposed standard would have a minimal potential impact upon the prices of products, so that there would be no effective change in the level of exported or imported products.

VII. Recordkeeping

The proposed standard contains "collection of information" (recordkeeping) requirements pertaining to preparation of a written safety and health plan, site characterization and analysis, site control, training, medical surveillance, emergency controls, work practices, PPE, monitoring, informational programs, handling drums and containers, decontamination, emergency response planning, and emergency response drills. In accordance with 5 CFR Part 1320 (Controlling Paperwork Burdens on the Public), OSHA has submitted the proposed recordkeeping requirements to the Office of Management and Budget (OMB) for review under section 3504(h) of the Paperwork Reduction Act. Comments regarding the proposed recordkeeping requirements may be directed to the Office of Information and Regulatory Affairs, OMB, Attention: Desk Officer of the Occupational Safety and Health Administration, Washington, DC 20503.

VIII. State Plan States

This Federal Register document proposes to amend an interim final rule § 1910.120, "Hazardous Waste Operations and Emergency Response", in Subpart H of 29 CFR Part 1910, OSHA's general industry standards on hazardous materials. The 25 States with their own OSHA approved occupational safety and health plans must develop a comparable standard applicable to both the private and public (State and local government employees) sectors within six months of the publication date of a permanent final rule or show OSHA why there is no need for action, e.g., because an existing state standard covering this area is already "at least as effective" as the new Federal standard. These states are Alaska, Arizona, California, Connecticut (for state and local government employees only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York (for state and local government employees only), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, and Wyoming. After the effective date of a final Federal rule, until such time as a state standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate, in these states.

IX. Public Participation—Public Hearings

Interested persons are invited to submit written data, views, and arguments with respect to OSHA's proposed rule. These comments must be postmarked on or before October 5, 1987 and submitted in quadruplicate to the Docket Officer, Docket S–760A, Room N–3670, U.S. Department of Labor, Washington, DC 20210. Written submissions must clearly identify the specific provisions of the proposal which are addressed and the position taken with respect to each issue.

The data, views, and arguments that are submitted will be available for public inspection and copying at the above address. All timely submissions received will be made a part of the record of this proceeding. The preliminary regulatory impact assessment, regulatory flexibility assessment, and the exhibits cited in this document will be available for public inspection and copying at the above address. OSHA invites comment concerning the conclusions reached in the economic impact assessment.

OSHA recognizes that there may be interested persons who, through their knowledge of safety or their experience in the operations involved, would wish to endorse or support certain provisions of the standard. OSHA welcomes such supportive comments, including any pertinent accident data or cost information which may be available, in order that the record of this rulemaking will present a balanced picture of the public response on the issues involved.

Notice of Intention to Appear at the Informal Hearings

Pursuant to section 6(b)(3) of the OSHA Act, informal public hearings will be held on this proposal as follows (see the beginning of this notice for specific addresses):

October 13–16 and 20–23, 1987; Washington, DC
October 27–30, 1987; San Francisco, CA

Persons desiring to participate at the informal public hearing must file a notice of intention to appear by September 21, 1987. The notice of intention to appear must contain the following information:

1. The name, address, and telephone number of each person to appear;
2. The capacity in which the person will appear;
3. The city where the person intends to appear;
4. The approximate amount of time required for the presentation;
5. The specific issues that will be addressed;
6. A detailed statement of the position that will be taken with respect to each issue addressed; and
7. Whether the party intends to submit documentary evidence and, if so, a detailed summary of the evidence.

Filing of Testimony and Evidence Before the Hearing

Any party requesting more than ten (10) minutes for presentation at the informal public hearing, or who will submit documentary evidence, must provide in quadruplicate, the complete text of testimony including all documentary evidence to be presented at the informal public hearing. These materials must be provided to Mr. Thomas Hall, OSHA Division of Consumer Affairs at the address given in the "ADDRESSES" section of this notice by October 5, 1987.

Each submission will be reviewed in light of the amount of time request in the Notice of Intention to Appear. In instances where the information contained in the submission does not justify the amount of time requested, a more appropriate amount of time will be allocated and the participant will be notified of that fact prior to the informal public hearings.

Any party who has not substantially complied with the above requirement may be limited to a ten-minute presentation and may be requested to return for questioning at a later time.

Any party who has not filed a notice of intention to appear may be allowed to testify, as time permits, at the discretion of the Administrative Law Judge, but will not be allowed to question witnesses.

Notices of intention to appear, testimony and evidence will be available for inspection and copying at the Docket Office, Docket S-760A, U.S. Department of Labor, Occupational Safety and Health Administration, Room N-3670, 200 Constitution Avenue, NW., Washington, DC 20210, (202) 523-7894.

Conduct of Hearings

The informal public hearings will commence at 9:30 a.m. at the scheduled locations with the resolution of any procedural matters relating to the proceeding. The informal public hearing will be presided over by an Administrative Law Judge who will have the power necessary and appropriate to conduct a full and fair informal public hearing as provided in 29 CFR Part 1911, include the power to:

1. Regulate the course of the proceedings;

2. To dispose of procedural requests, objections and comparable matters;

3. To confine the presentation to the matters pertinent to the issues raised;

4. To regulate the conduct of those present at the informal public hearing by appropriate means;

5. In the Judge's discretion, to question and permit questioning of any witness; and

6. In the Judge's discretion, to keep the record open for a reasonable time to receive written information and additional data, views, and arguments from any person who has participated in the oral proceedings.

Following the close of the informal public hearing, the presiding Administrative Law Judge will certify the record of the informal public hearing to the Assistant Secretary of Labor for Occupational Safety and Health. The notice of proposed rulemaking will be reviewed in light of all testimony and written submissions received as part of the record, and the proposed standard will be modified or a determination will be made not to modify the proposed standard based on the entire record of the proceeding.

List of Subjects in 29 CFR Part 1910

Containers, Drums, Emergency response, Flammable and combustible liquids, Hazardous materials, Hazardous substances, Hazardous wastes, Incorporation by reference, Materials handling and storage, Personal protective equipment, Storage areas, Training, Waste disposal.

Authority

This document has been prepared under the direction of John A. Pendergrass, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210. Pursuant to section 126 of the Superfund Amendments and Reauthorization Act of 1986 (Pub. L. 99-499), sections 6 and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 655, 657), section 4 of the Administrative Procedures Act (5 U.S.C. 553), 29 CFR Part 1911 and Secretary of Labor's Order 9-83 (48 FR 35736), it is proposed to amend 29 CFR Part 1910 by revising § 1910.120, Hazardous Waste Operations, as set forth below.

Signed at Washington, DC this 5th day of August 1987.

John A. Pendergrass,

Assistant Secretary of Labor.

For the reasons set out in the preamble, Title 29, Part 1910, of the Code of Federal Regulations is amended as follows:

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1. The authority citation for Subpart H of Part 1910 is proposed to be amended by adding the following citation:

Authority: * * *

Section 1910.120 issued under the authority of Section 126 of the Superfund Amendments and Reauthorization Act of 1986 (Pub. L. 99-499). Sections 6 and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 655, 657), sections 3 and 4 of the Administrative Procedure Act (5 U.S.C. 552(a), 553), 29 CFR Part 1911 and Secretary of Labor's Order 9-83 (48 FR 35736).

2. Section 1910.120 of Title 29 of the Code of Federal Regulations is proposed to be revised to read as follows:

§ 1910.120 Hazardous waste operations and emergency response.

(a) *Scope, application, and definitions*—(1) *Scope for operations other than emergency response.* This section covers employers and employees engaged in the following operations:

(i) Operations involving hazardous substances that are conducted under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended (42 U.S.C. 9601 *et seq.*) (CERCLA), including initial investigations at CERCLA sites before the presence or absence of hazardous substances has been ascertained;

(ii) Clean-up operations involving major corrective actions conducted under the Resource Conservation and Recovery Act of 1976 as amended (42 U.S.C. 6901 *et seq.*) (RCRA);

(iii) Operations at hazardous waste sites that have been designated for clean-up by state or local governmental authorities; and

(iv) Storage, treatment, and disposal facilities involving hazardous wastes regulated under 40 CFR Parts 264 and 265 pursuant to RCRA; and

(2) *Scope for emergency response operations.* This section also covers employers whose employees have a reasonable possibility of engaging in emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

(3) *Application.* (i) All requirements of Part 1910 and Part 1926 of Title 29 of the Code of Federal Regulations apply pursuant to their terms to hazardous waste operations whether covered by this section or not. In addition, the provisions of this section apply to operations covered by this section. If there is a conflict or overlap, the provision more protective of employee safety and health shall apply without regard to 29 CFR 1910.5(c)(1).

(ii) All paragraphs of this section except paragraph (o) apply to operations involving hazardous substances conducted under CERCLA, major corrective actions taken in clean-up operations under RCRA, and hazardous waste operations that have been designated for clean-up by state or local governmental authorities.

(iii) Only the requirements of paragraphs (l) and (o) of this section apply to those operations involving hazardous waste treatment, storage, and disposal facilities regulated under 40 CFR Parts 264 and 265.

Exceptions. For small quantity generators and generators with less than 90 days accumulation of hazardous wastes who have emergency response teams that respond to releases of, or substantial threats of releases of, hazardous substances, only paragraph (l) is applicable. Small quantity generators and generators with less than 90 days accumulation of hazardous wastes who do not have emergency response teams that respond to releases of, or substantial threats ases of, hazardous substances are t from the regulations of this section.

(iv) Paragraph (l) of this section applies to all emergency response operations for releases of, or substantial threats of releases of, hazardous substances including those releases of or substantial threats of releases that occur at worksites other than those sites identified in paragraphs (a)(2)(i) through (a)(2)(iii) of this section.

(4) *Definitions. "Buddy system"* means a system of organizing employees into work groups in such a manner that each employee of the work group is designated to observe the activities of at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to those other employees in the event of an emergency.

"Decontamination" means the removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health affects.

"Emergency response" means a coordinated response effort by employees from outside the immediate release area or by outside responders (i.e., mutual-aid groups, local fire rtments, etc.) to an occurrence h results, or is likely to result, in an uncontrolled release of a hazardous substance. Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where the concentration of a hazardous substance is below the established permissible exposure limits established in this standard are not considered to be emergency responses.

"Established exposure levels" means the inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subpart Z; or if none is specified, the exposure limits in "NIOSH Recommendations for Occupational Health Standards" dated 1986 incorporated by reference, or if neither of the above is specified, the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1986–87" dated 1986 incorporated by reference. The two documents incorporated by reference are available urchase from the following:

NIOSH, Publications Dissemination,
Division of Standards Development and Technology Transfer, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 841–4287

American Conference of Governmental Industrial Hygienists, 6500 Glenway Ave., Building D–7, Cincinnati, OH 45211–4438, (513) 661–7881

and are available for inspection and copying at the OSHA Docket Office, Docket No. S–760, Room N–3671, 200 Constitution Ave., NW., Washington, DC 20210.

"Facility" means (A) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, storage container, motor vehicle, rolling stock, or aircraft, or (B) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any vessel.

"Hazardous materials (HAZMAT) team" means an organized group of employees, designated by the employer, who are knowledgeable and specifically trained and skilled to handle and control leaking containers or vessels, use and select special chemical protective clothing and perform other duties associated with accidental releases of hazardous substances. The team members perform responses to releases of hazardous substances for the purpose of control or stabilization of the release. A HAZMAT team is not a fire brigade nor is a typical fire brigade a HAZMAT team. A HAZMAT team, however, may be a separate component of a fire brigade.

"Hazardous substance" means any substance designated or listed under (A) through (D) below, exposure to which results or may result in adverse affects on the health or safety of employees:

(A) Any substance defined under section 101(14) of CERCLA;

(B) Any biological agent and other disease-causing agent as defined in section 104 (33) of CERCLA;

(C) Any substance listed by the U.S. Department of Transportation as hazardous materials under 49 CFR 172.101 and appendices; and

(D) Hazardous waste.

"Hazardous waste" means (A) a waste or combination of wastes as defined in 40 CFR 261.3, or (B) those substances defined in 49 CFR 171.8.

"Hazardous waste operation" means any operation conducted within the scope of this standard involving employee exposure to hazardous wastes, hazardous substances, or any combination of hazardous wastes and hazardous substances.

"Hazardous waste site" or "site" means any facility or location within the scope of this standard at which hazardous waste operations take place.

"Health hazard" means a chemical, mixture of chemicals or a pathogen for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. Further definition of the terms used above can be found in Appendix A to 29 CFR 1910.1200.

"IDLH" or "Immediately dangerous to life or health" means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

"Oxygen deficiency" means that concentration of oxygen by volume below which air supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

"Permissible exposure limit" means the inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subpart Z.

"Post emergency response" means that portion of an emergency response performed after the immediate threat of a release has been stabilized or eliminated and clean-up of the site has begun. If post emergency response is performed by an employer's own employees as a continuation of initial emergency response, it is considered to be part of the initial response and not post emergency response.

"Qualified person" means a person with specific training, knowledge and experience in the area for which the person has responsibility.

"Site safety and health supervisor (or official)" means the individual located on a hazardous waste site who is responsible to the employer and has the authority and knowledge necessary to implement the site safety and health

plan and verify compliance with applicable safety and health requirements.

"Small quantity generator" means a generator of hazardous wastes who in any calendar month generates no more than 1000 kilograms (2210 pounds) of hazardous waste in that month.

(b) *General requirements*—(1) *Safety and health program*—(i) *General.* Employers shall develop and implement a written safety and health program for their employees involved in hazardous waste operations. The program shall be designed to identify, evaluate, and control safety and health hazards and provide for emergency response for hazardous waste operations. The program shall incorporate as separate chapter the following:

(A) Organizational structure chapter;

(B) A comprehensive workplan chapter; and

(C) A site-specific safety and health plan chapter.

(ii) *Organizational structure chapter.* (A) The organizational structure chapter shall establish the specific chain of command and specify the overall responsibilities of supervisors and employees. It shall include at a minimum, the following elements:

(*1*) A general supervisor who has the responsibility and authority to direct all hazardous waste operations.

(*2*) A site safety and health supervisor who has the responsibility and authority to develop and implement the site safety and health plan and verify compliance.

(*3*) All other personnel needed for hazardous waste site operations and emergency response and their general functions and responsibilities.

(*4*) The lines of authority, responsibility, and communication.

(B) The organizational structure shall be reviewed and updated as necessary to reflect the current status of waste site operations.

(C) The original organizational structure plan and any changes to the overall organizational structure shall be made available to all affected employees.

(iii) *Comprehensive workplan chapter.* The comprehensive workplan chapter shall address the tasks and objectives of site operations and the logistics and resources required to reach those tasks and objectives.

(A) The comprehensive workplan shall address anticipated clean-up activities as well as normal operating procedures.

(B) The comprehensive workplan shall define work tasks and objectives and identify the methods for accomplishing those tasks and objectives.

(C) The comprehensive workplan shall establish personnel requirements for implementing the plan.

(D) The comprehensive workplan shall provide for the implementation of the training required in paragraph (e) of this section.

(E) The comprehensive workplan shall provide for the implementation of the required informational programs required in paragraph (i) of this section.

(F) The comprehensive workplan shall provide for the implementation of the medical surveillance program described in paragraph (f) of this section.

(iv) *Site-specific safety and health plan chapter.* The site safety and health plan, which is part of the overall safety and health program shall be available on the site for inspection by employees, their designated representatives, and OSHA personnel, shall address the safety and health hazards of each phase of site operation; and include the requirements and procedures for employee protection.

(A) The site safety and health plan, as a minimum, shall address the following:

(*1*) Names of key personnel and alternates responsible for site safety and health, including a site safety and health supervisor.

(*2*) A safety and health risk or hazard analysis for each site task and operation found in the workplan.

(*3*) Employee training assignments to assure compliance with paragraph (e) of this section.

(*4*) Personal protective equipment to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment program in paragraph (g)(5) of this section.

(*5*) Medical surveillance requirements in accordance with the program in paragraph (f) of this section.

(*6*) Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used including methods of maintenance and calibration of monitoring and sampling equipment to be used.

(*7*) Site control measures in accordance with the site control program required in paragraph (d) of this section.

(*8*) Decontamination procedures in accordance with paragraph (k) of this section.

(*9*) An emergency response plan meeting the requirements of paragraphs (l)(1)(i) and (l)(1)(ii) of this section for safe and effective responses to emergencies, including the necessary PPE and other equipment.

(*10*) Confined space entry procedures.

(B) Pre-entry briefings shall be held prior to initiating any site activity and at such other times as necessary to ensure that employees are apprised of the site safety and health plan and that this plan is being followed.

(C) Inspections shall be conducted by the site safety and health supervisor or, in the absence of that individual, another individual acting on behalf of the employer as necessary to determine the effectiveness of the site safety and health plan. Any deficiencies in the effectiveness of the site safety and health plan shall be corrected by the employer.

(*11*) When major spills may be anticipated due to the type of work involved, a spill containment program meeting the requirements of paragraph (j)(1) of this section shall be included.

(2) *Site excavation.* Site excavations created during initial site preparation or during hazardous waste operations shall be shored or sloped as appropriate to prevent accidental collapse in accordance with Subpart P of 29 CFR Part 1926.

(3) *Contractors and sub-contractors.* (i) An employer who retains contractor or sub-contractor services for work in hazardous waste operations shall inform those contractors, sub-contractors, or their representatives of any potential fire, explosion, health, safety or other hazards of the hazardous waste operation that have been identified by the employer including the employer's information program.

(ii) The safety and health program required in paragraph (b)(1) of this section shall be made available to any subcontractor or its representative who will be involved with the hazardous waste operation and employees, their designated representatives, and OSHA personnel.

(c) *Site characterization and analysis.* Hazardous waste sites shall be evaluated in accordance with this paragraph to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards.

(1) A preliminary evaluation of a site's characteristics shall be performed prior to site entry by a qualified person in order to aid in the selection of appropriate employee protection methods prior to site entry. Immediately after initial site entry, a more detailed evaluation of the site's specific characteristics shall be performed by a qualified person in order to further identify existing site hazards and to further aid in the selection of the appropriate engineering controls and

personal protective equipment for the tasks to be performed.

(2) All suspected conditions that may pose inhalation or skin absorption ha[illegible]ds that are immediately dangerous t[illegible]r health (IDLH) or other co[illegible]ions that may cause death or serious harm, shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

(3) The following information to the extent available shall be obtained by the employer prior to allowing employees to enter a site:

(i) Location and approximate size of the site.

(ii) Description of the response activity and/or the job task to be performed.

(iii) Duration of the planned employee activity.

(iv) Site topography.

(v) Site accessibility by air and roads.

(vi) Pathways for hazardous substance dispersion.

(vii) Present status and capabilities of emergency response teams that would provide assistance to hazardous waste clean-up site employees at the time of an emergency.

(viii) Hazardous substances and [illegible]h hazards involved or expected at [illegible]e and their chemical and physical properties.

(4) Personal protective equipment (PPE) shall be provided and used during initial site entry in accordance with the following requirements:

(i) Based upon the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below established permissible exposure limits for known or suspected hazardous substances and health hazards, and which will provide protection against other known and suspected hazards identified during the preliminary site evaluation.

(ii) During initial site entry an escape self-contained breathing apparatus of at least five minutes' duration shall be carried by employees or kept available at their immediate work station if positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble.

(iii) If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site, an ensemble providing protection equivalent to Level B PPE shall be provided as minimum protection, and direct reading instruments shall be used as appropriate for identifying IDLH conditions. (See Appendix B for a description of Level B hazards and the requirements for Level B protective equipment.)

(iv) Once the hazards of the site have been identified, the appropriate PPE shall be selected and used in accordance with paragraph (g) of this section.

(5) The following monitoring shall be conducted during initial site entry when the site evaluation produces information that shows the potential for ionizing radiation or IDLH conditions, or when the site information is not sufficient to reasonably eliminate these possible conditions:

(i) Monitoring for hazardous levels of ionizing radiation.

(ii) Monitoring the air with appropriate test equipment for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, toxic substances).

(iii) Visually observing for signs of actual or potential IDLH or other dangerous conditions.

(6) Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified. In situations covered by the Hazard Communication Standard, 29 CFR 1910.1200, training required by that standard need not be duplicated.

Note.—Risks to consider include, but are not limited to:

a. Exposures exceeding the appropriate established Permissible Exposure Limits (PELs), Threshold Limit Values (TLVs), or Recommended Exposure Limits (RELs), etc.

b. IDLH Concentrations.

c. Potential Skin Absorption and Irritation Sources.

d. Potential Eye Irritation Sources.

e. Explosion Sensitivity and Flammability Ranges.

(7) Any information concerning the chemical, physical, and toxicologic properties of each substance known or expected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform shall be made available to the affected employees prior to the commencement of their work activities.

(8) An ongoing air monitoring program in accordance with paragraph (h) of this section shall be implemented after site characterization has determined the site is safe for the start-up of operations.

(d) *Site control.* Appropriate site control procedures shall be implemented before clean-up work begins to control employee exposure to hazardous substances.

(1) A site control program for protecting employees which is part of the employer's safety and health program required in paragraph (b) of this section shall be developed during the planning stages of a hazardous waste operation clean-up and modified as necessary as new information becomes available.

(2) The site control program shall, as a minimum, include: A site map; site work zones; the use of a "buddy system"; site communications; the standard operating procedures or safe work practices; and, identification of the nearest medical assistance.

(e) *Training.* Initial or review training meeting the requirements of this paragraph shall be provided to employees before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances, safety, or health hazards.

(1) All employees (such as but not limited to equipment operators and general laborers) exposed to hazardous substances, health hazards, or safety hazards shall be thoroughly trained in the following:

(i) Names of personnel and alternates responsible for site safety and health;

(ii) Safety, health and other hazards present on the site;

(iii) Use of personal protective equipment;

(iv) Work practices by which the employee can minimize risks from hazards;

(v) Safe use of engineering controls and equipment on the site;

(vi) Medical surveillance requirements including recognition of symptoms and signs which might indicate overexposure to hazards; and

(vii) The contents of paragraphs (7) through (10) of the site safety and health plan set forth in paragraph (b)(1)(iv)(A) of this section.

(2) All employees shall at the time of job assignment receive a minimum of 40 hours of initial instruction off the site, and a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Workers who may be exposed to unique or special hazards shall be provided additional training. The level of training provided shall be consistent with the employee's job function and responsibilities.

(3) On-site management and supervisors directly responsible for, or who supervise employees engaged in

hazardous waste operations shall receive training as provided in paragraph (e)(1) and (e)(2) of this section, and at least eight additional hours of specialized training at the time of job assignment on such topics as, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring techniques.

(4) Trainers shall be qualified to instruct employees about the subject matter that is being presented in training.

Note.—Trainers can show their qualifications by having the knowledge or training equivalent to a level of training higher than the level they are presenting. This may be shown by academic degrees, training courses completed and/or work experience.

(5) Employees shall not be permitted to participate in field activities until they have been trained to a level required by their job function and responsibility.

(6) Employees and supervisors that have received and successfully completed the training and field experience specified in paragraphs (e)(1), (e)(2) and (e)(3) of this section shall be certified by their instructor as having completed the necessary training. A written certificate shall be given to each person so certified. Any person who has not been so certified nor meets the requirements of paragraph (e)(9) of this section shall be prohibited from engaging in hazardous waste operations.

(7) Employees who are engaged in responding to hazardous emergency situations at hazardous waste clean-up sites that may expose them to hazardous substances shall be trained in how to respond to expected emergencies.

(8) Employees specified in paragraph (e)(1), and managers and supervisors specified in paragraph (e)(3) of this section, shall receive eight hours of refresher training annually on the items specified in paragraph (e)(1) and/or (e)(3) of this section and other relevant topics.

(9) Employers who can show that an employee's work experience and/or training has resulted in initial training equivalent to that training required in paragraphs (e)(1), (e)(2), and (e)(3) of this section shall not be required to provide the initial training requirements of those paragraphs. Equivalent training includes the training that existing employees might have already received from actual site work experience.

(f) *Medical surveillance.* Medical surveillance shall be provided in accordance with this paragraph for employees exposed or potentially exposed to hazardous substances or health hazards or who wear respirators.

(1) *Employees covered.* A medical surveillance program which is part of the employer's safety and health program required in paragraph (b) of this section or required in paragraphs (l)(4) or (o)(3) of this section, shall be instituted by the employer for:

(i) All employees who are or may be exposed to hazardous substances or health hazards at or above the established exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year.

(ii) All employees who wear a respirator for 30 days or more a year or as required by § 1910.134.

(iii) All employees who are injured due to overexposure from an emergency incident involving hazardous substances or health hazards.

(2) *Frequency of medical examinations and consultations.* Medical examinations and consultations shall be made available by the employer to each employee covered under paragraph (f)(1) of this section on the following schedules:

(i) For employees covered under paragraphs (f)(1)(i) and (f)(1)(ii):

(A) Prior to assignment.

(B) At least once every twelve months for each employee covered.

(C) At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months.

(D) As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards or that the employee has been exposed above the established exposure levels in an emergency situation.

(E) At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary.

(ii) For employees covered under paragraph (f)(1)(iii) and for all employees who may have been exposed during an emergency incident to hazardous substances at concentrations above the established exposure levels without the necessary personal protective equipment being used:

(A) As soon as possible following the emergency incident.

(B) Additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.

(3) *Content of medical examinations and consultations.* (i) Medical examinations required by paragraph (f)(2) of this section shall include a medical and work history (or updated history if one is in the employee's file) with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) ~~that may be~~ expected at the work site.

(ii) The content of medical examinations or consultations made available to employees pursuant to paragraph (f) shall be determined by the examining physician.

(4) *Examination by a physician and costs.* All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

(5) *Information provided to the physician.* The employer shall provide one copy of this standard and its appendices to the examining physician, and in addition the following for each employee:

(i) A description of the employee's duties as they relate to the employee's exposures.

(ii) The employee's exposure levels or anticipated exposure levels.

(iii) A description of any personal protective equipment used or to be used.

(iv) Information from previous medical examinations of the employee which is not readily available to the examining physician.

(v) Information required by § 1910.134.

(6) *Physician's written opinion.* (i) The employer shall obtain and furnish the employee with a copy of a written opinion from the examining physician containing the following:

(A) The results of the medical examination and tests if requested by the employee.

(B) The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirators use as required by § 1910.134.

(C) The physician's recommended limitations upon the employee's assigned work.

(D) A statement that the employee ha been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(ii) The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to ational exposure.

Recordkeeping. (i) An accurate record of the medical surveillance required by paragraph (f) of this section shall be retained. This record shall be retained for the period specified and meet the criteria of 29 CFR 1910.20.

(ii) The record required in paragraph (f)(7)(i) of this section shall include at least the following information:

(A) The name and social security number of the employee;

(B) Physicians' written opinions, recommended limitations, and results of examinations and tests;

(C) Any employee medical complaints related to exposure to hazardous substances;

(D) A copy of the information provided to the examining physician by the employer, with the exception of the standard and its appendices.

(g) *Engineering controls, work practices, and personal protective equipment for employee protection.* Engineering controls, work practices, personal protective equipment, or a combination of these shall be implemented in accordance with this paragraph to protect employees from exposure to hazardous substances and health hazards.

) *Engineering controls, work practices and PPE for substances regulated in Subpart Z.* (i) Engineering controls and work practices shall be instituted to reduce and maintain employee exposure to or below the permissible exposure limits for substances regulated by 29 CFR Part 1910, Subpart Z, except to the extent that such controls and practices are not feasible.

Note.—Engineering controls which may be feasible include the use of pressurized cabs or control booths on equipment, and/or the use of remotely operated material handling equipment. Work practices which may be feasible are removing all non-essential employees from potential exposure during opening of drums, wetting down dusty operations and locating employees upwind of possible hazards.

(ii) Whenever engineering controls and work practices are not feasible, PPE shall be used to reduce and maintain employee exposures to or below the permissible exposure limits or dose limits for substances regulated by 29 CFR Part 1910, Subparts G and Z.

(iii) The employer shall not implement a schedule of employee rotation as a means of compliance with permissible dose limits except when there is no r feasible way of complying with the airborne or dermal dose limits for ionizing radiation.

(2) *Engineering controls, work practices, and personal protective equipment for substances not regulated in Subpart Z.* An appropriate combination of engineering controls, work practices, and personal protective equipment shall be established to reduce and maintain employee exposure to or below appropriate exposure levels for hazardous substances and health hazards not regulated by 29 CFR Part 1910, Subparts G and Z taking into account the established exposure levels.

(3) *Personal protective equipment selection.* (i) Personal protective equipment (PPE) shall be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis.

(ii) Personal protective equipment selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

(iii) Positive pressure self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply, shall be used in IDLH conditions.

(iv) Totally-encapsulating chemical protective suits (Protection equivalent to Level A protection as specified in Appendix B) shall be used in conditions where skin absorption of a hazardous substance may result in an IDLH situation.

(v) The level of protection provided by PPE selection shall be increased when additional information on site conditions show that increased protection is necessary to reduce employee exposures below established permissible exposure limits for hazardous substances and health hazards. (See Appendix B for guidance on selecting PPE ensembles.)

Note.—The level of employee protection provided may be decreased when additional information or site conditions show that decreased protection will not result in increased hazardous exposures to employees.

(vi) Personal protective equipment shall be selected and used to meet the requirements of 29 CFR Part 1910, Subpart I, and additional requirements specified in this section.

(4) *Totally-encapsulating chemical protective suits.* (i) Totally-encapsulating suit materials used for Level A protection shall protect employees from the particular hazards which are identified during site characterization and analysis.

(ii) Totally-encapsulating suits shall be capable of maintaining positive air pressure. (See Appendix A.)

(iii) Totally-encapsulating suits shall be capable of preventing inward test gas leakage of more than 0.5 percent. (See Appendix A.)

(5) *Personal protective equipment (PPE) program.* A written personal protective equipment program, which is part of the employer's safety and health program required in paragraph (b) of this section or required in paragraph (1)(4) of this section, shall be established for hazardous waste operations which shall be part of the site-specific safety and health plan. The PPE program shall address the following elements:

(i) Site hazards,

(ii) PPE selection,

(iii) PPE use,

(iv) Work mission duration,

(v) PPE maintenance and storage,

(vi) PPE decontamination,

(vii) PPE training and proper fitting,

(viii) PPE donning and doffing procedures,

(ix) PPE inspection,

(x) PPE in-use monitoring,

(xi) Evaluation of the effectiveness of the PPE program, and

(xii) Limitations during temperature extremes, and other appropriate medical considerations.

(h) *Monitoring.* Monitoring shall be performed in accordance with this paragraph to assure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed established permissible exposure limits for hazardous substances.

(1) Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of employee protection needed on site.

(2) Upon initial entry, representative air monitoring shall be conducted to identify any IDLH condition, exposure over established exposure levels, exposure over a radioactive material's dose limits or other dangerous condition such as the presence of flammable atmospheres or oxygen-deficient environments.

(3) Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposures may have risen since prior monitoring. Situations where it shall be considered

whether the possibility that exposures have risen are when:

(i) Work begins on a different portion of the site.

(ii) Contaminants other than those previously identified are being handled.

(iii) A different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling).

(iv) Employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon).

(v) A sufficient reasonable interval has passed so that exposures may have significantly increased.

(4) After hazardous waste clean-up operations commence, the employer shall monitor those employees likely to have the highest exposures to hazardous substances and health hazards likely to be present above established permissible exposure limits by using personal sampling frequently enough to characterize employee exposures. The employer may utilize a representative sampling approach by documenting that the employees and chemicals chosen for monitoring are based on the criteria stated above.

Note.—It is not required to monitor employees engaged in site characterization operations covered by paragraph (c) of this section.

(l) *Informational programs.* Employers shall develop and implement a program, which is part of the employer's safety and health program required in paragraph (b) of this section, to inform employees, contractors, and subcontractors (or their representative) actually engaged in hazardous waste operations of the nature, level and degree of exposure likely as a result of participation in such hazardous waste operations. Employees, contractors and subcontractors working outside of the operations part of a site are not covered by this standard.

(j) *Handling drums and containers.* Hazardous substances and contaminated soils, liquids, and other residues shall be handled, transported, labeled, and disposed of in accordance with this paragraph.

(1) *General.* (i) Drums and containers used during the clean-up shall meet the appropriate DOT, OSHA, and EPA regulations for the wastes that they contain.

(ii) When practical, drums and containers shall be inspected and their integrity shall be assured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions (i.e., buried beneath the earth, stacked behind other drums, stacked several tiers high in a pile, etc.) shall be moved to an accessible location and inspected prior to further handling.

(iii) Unlabelled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

(iv) Site operations shall be organized to minimize the amount of drum or container movement.

(v) Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers.

(vi) U.S. Department of Transportation specified salvage drums or containers and suitable quantities of proper absorbent shall be kept available and used in areas where spills, leaks, or ruptures may occur.

(vii) Where major spills may occur, a spill containment program, which is part of the employer's safety and health program required in paragraph (b) of this section, shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

(viii) Drums and containers that cannot be moved without rupture, leakage, or spillage shall be emptied into a sound container using a device classified for the material being transferred.

(ix) A ground-penetrating system or other type of detection system or device shall be used to estimate the location and depth of buried drums or containers.

(x) Soil or covering material shall be removed with caution to prevent drum or container rupture.

(xi) Fire extinguishing equipment meeting the requirements of 29 CFR Part 1910, Subpart L, shall be on hand and ready for use to control incipient fires.

(2) *Opening drums and containers.* The following procedures shall be followed in areas where drums or containers are being opened:

(i) Where an airline respirator system is used, connections to the bank of air cylinders shall be protected from contamination and the entire system shall be protected from physical damage.

(ii) Employees not actually involved in opening drums or containers shall be kept a safe distance from the drums or containers being opened.

(iii) If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation shall be placed between the employee and the drums or containers being opened to protect the employee in case of accidental explosion.

(iv) Controls for drum or container opening equipment, monitoring equipment, and fire suppression equipment shall be located behind the explosion-resistant barrier.

(v) When there is a reasonable possibility of flammable atmospheres being present, material handling equipment and hand tools shall be of the type to prevent sources of ignition.

(vi) Drums and containers shall be opened in such a manner that excess interior pressure will be safely relieved. If pressure cannot be relieved from a remote location, appropriate shielding shall be placed between the employee and the drums or containers to reduce the risk of employee injury.

(vii) Employees shall not stand upon or work from drums or containers.

(3) *Material handling equipment.* Material handling equipment used to transfer drums and containers shall be selected, positioned and operated to minimize sources of ignition related to the equipment from igniting vapors released from ruptured drums or containers.

(4) *Radioactive wastes.* Drums and containers containing radioactive wastes shall not be handled until such time as their hazard to employees is properly assessed.

(5) *Shock sensitive wastes.*

Caution.—Shipping of shock sensitive wastes may be prohibited under U.S. Department of Transportation regulations. Employers and their shippers should refer to 49 CFR 173.21 and 173.50.

As a minimum, the following special precautions shall be taken when drums and containers containing or suspected of containing shock-sensitive wastes are handled:

(i) All non-essential employees shall be evacuated from the area of transfer.

(ii) Material handling equipment shall be provided with explosive containment devices or protective shields to protect equipment operators from exploding containers.

(iii) An employee alarm system capable of being perceived above surrounding light and noise conditions shall be used to signal the commencement and completion of explosive waste handling activities.

(iv) Continuous communications (i.e., portable radios, hand signals, telephones, as appropriate) shall be maintained between the employee-in-charge of the immediate handling area and the site safety and health supervisor or command post until such time as the handling operation is completed. Communication equipment or methods that could cause shock sensitive materials to explode shall not be used.

[illegible] Drums and containers under pressure, as evidenced by bulging or swelling, shall not be moved until such time as the cause for excess pressure is determined and appropriate containment procedures have been implemented to protect employees from explosive relief of the drum.

(vii) Drums and containers containing packaged laboratory wastes shall be considered to contain shock-sensitive or explosive materials until they have been characterized.

(6) *Laboratory waste packs.* In addition to the requirements of paragraph (j)(5) of this section, the following precautions shall be taken, as a minimum, in handling laboratory waste packs (lab packs):

(i) Lab packs shall be opened only when necessary and then only by an individual knowledgable in the inspection, classification, and segregation of the containers within the pack according to the hazards of the wastes.

(ii) If crystalline material is noted on any container, the contents shall be handled as a shock-sensitive waste until the contents are identified.

(7) *Sampling drums and containers.* Sampling of containers and drums shall be done in accordance with a sampling procedure which is part of the site safety and health plan developed for and available to employees and others at the specific worksite.

(8) *Shipping and transport.* (i) Drums and containers shall be identified and classified prior to packaging for shipment.

(ii) Drum or container staging areas shall be kept to the minimum number necessary to identify and classify materials safely and prepare them for transport.

(iii) Staging areas shall be provided with adequate access and egress routes.

(iv) Bulking of hazardous wastes shall be permitted only after a thorough characterization of the materials has been completed.

(9) *Tank and vault procedures.* (i) Tanks and vaults containing hazardous substances shall be handled in a manner similar to that for drums and containers, taking into consideration the size of the tank or vault.

(ii) Appropriate tank or vault entry procedures meeting paragraph (b)(1)(iv)(A)(*10*) of this section shall be followed whenever employees must enter a tank or vault.

(k) *Decontamination.* Procedures for all phases of decontamination shall be developed and implemented in accordance with this paragraph.

(1) A decontamination procedure shall be developed, communicated to employees and implemented before any employees or equipment may enter areas on site where potential for exposure to hazardous substances exists.

(2) Standard operating procedures shall be developed to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances.

(3) Decontamination shall be performed in geographical areas that will minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment.

(4) All employees leaving a contaminated area shall be appropriately decontaminated; all clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated.

(5) Decontamination procedures shall be monitored by the site safety and health supervisor to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies.

(6) All equipment and solvents used for decontamination shall be decontaminated or disposed of properly.

(7) Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.

(8) Employees whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.

(9) Unauthorized employees shall not remove protective clothing or equipment from change rooms.

(10) Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances.

(11) Where the decontamination procedure indicates a need for regular showers and change rooms outside of a contaminated area, they shall be provided and meet the requirements of 29 CFR 1910.141. If temperature conditions prevent the effective use of water then other effective means for cleansing shall be provided and used.

(l) *Emergency response.* Emergency response at hazardous waste operation incidents shall be conducted in accordance with this paragraph.

(1) *General*—(i) *Emergency response plan.* An emergency response plan shall be developed and implemented by all employers within the scope of this section to handle anticipated emergencies prior to the commencement of hazardous waste operations. The plan shall be in writing and available for inspection and copying by employees, their representatives and OSHA personnel. Employers who will evacuate their employees from the workplace when an emergency occurs and who do not permit any of their employees to respond to assist in handling the emergency are exempt from the requirements of this paragraph if they provide an emergency action plan complying with section 1910.38(a) of this part.

(ii) *Elements of an emergency response plan.* The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following:

(A) Pre-emergency planning.

(B) Personnel roles, lines of authority, training, and communication.

(C) Emergency recognition and prevention.

(D) Safe distances and places of refuge.

(E) Site security and control.

(F) Evacuation routes and procedures.

(G) Decontamination.

(H) Emergency medical treatment and first aid.

(I) Emergency alerting and response procedures.

(J) Critique of response and follow-up.

(K) PPE and emergency equipment.

(2) *Emergency response at hazardous waste clean-up sites*—(i) *Training.* (A) Training for emergency response employees at clean-up operations shall be conducted in accordance with paragraph (e) of this section for employers covered by paragraph (a)(1)(i) through (iii) of this section and in accordance with paragraph (o)(5) of this section for those employers covered by paragraph (a)(1)(iv) of this section.

(B) Employers who can show that an employee's work experience and/or training has resulted in training equivalent to that training required in paragraph (l)(2)(i)(A) of this section shall not be required to provide the initial training requirements of those paragraphs. Equivalent training includes the training that existing employees might have already received from actual site work experience.

(ii) *Procedures for handling emergency incidents.* (A) In addition to the elements for the emergency response plan required in paragraph (l)(1)(ii) of this section, the following elements shall be included for emergency response plans:

(*1*) Site topography, layout, and prevailing weather conditions.

(*2*) Procedures for reporting incidents to local, state, and federal governmental agencies.

(B) The emergency response plan shall be a separate section of the Site Safety and Health Plan.

(C) The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

(D) The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

(E) The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.

(F) An employee alarm system shall be installed in accordance with 29 CFR 1910.165 to notify employees of an emergency situation: to stop work activities if necessary; to lower background noise in order to speed communication; and to begin emergency procedures.

(G) Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.

(3) *Emergency response at sites other than hazardous waste clean-up sites*—(i) *Training.* Employers shall provide the training specified by this paragraph for those employees for whom there exists the reasonable possibility of responding to emergencies at sites other than hazardous waste clean-up sites.

(A) *Emergency response organizations or teams.* Employees on emergency response organizations or teams such as fire brigades, fire departments, plant emergency organizations, hazardous materials teams, spill response teams and similar groups with responsibility for emergency response shall be trained to a level of competence to protect themselves and other employees in the recognition of health and safety hazards, methods to minimize the risk from safety and health hazards, safe use of control equipment, selection and use of appropriate personal protective equipment, safe operating procedures to be used at the incident scene, techniques of coordination with other employees to minimize risks, appropriate response to over exposure from health hazards or injury to themselves and other employees and recognition of subsequent symptoms which may result from over exposures.

(*1*) Competency may be demonstrated by 24 hours of training annually in those areas with training sessions at least monthly or by demonstrations by the employee of competency in those areas at least quarterly.

(*2*) A certification shall be made of the training or competency and if certification of competency is made, the employer shall keep a record of the methodology used to demonstrate competency.

(*3*) An employer of employees for whom the reasonable possibility of responding to emergencies at other than hazardous waste clean-up sites exists need not train all such employees to the degree specified in paragraph (l)(3)(i)(A)(*1*) of this section if the employer divides the work force such that sufficient employees who have responsibility to control the emergency have the training specified in this paragraph and other employees who may first respond to the incident have sufficient awareness training to recognize that an emergency response situation exists and are instructed in that case to summon the employees who are fully trained and not attempt control activities for which they are not trained.

(*4*) An employer of employees for whom the reasonable possibility exists of responding to emergencies at other than hazardous waste clean-up sites need not train such employees to the degree specified in paragraph (l)(3)(i)(A)(*1*) of this section if:

(*i*) arrangements have been made in advance for a fully-trained emergency response team to respond in a reasonable period; and

(*ii*) employees who may come to the incident first have sufficient awareness training to recognize that an emergency response situation exists and are instructed to call the designated fully-trained emergency response team for assistance.

(B) *Specialist employees.* Employees who, in the course of their regular job duties, work with and are trained in the hazards of specific materials covered by this standard, and who will be called upon to provide technical advice or assistance at a hazardous substance release incident, are exempt from the monthly training sessions required in paragraph (l)(3)(i)(A) of this section. They must, pursuant to paragraph (l)(3)(i)(A) however, receive at least 24 hours of training annually or demonstrate competency in the area of their specialization.

(C) *Skilled support personnel.* Personnel, not necessarily an employer's own employees, who are needed to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by an employer's own employees, and who will be or may potentially be exposed to the hazards at an emergency response scene, are not required to have the 24 hours of annual training or demonstrate the competency required for the employer's regular employees. However, the senior official cited in paragraph (l)(3)(ii) of this section shall ensure that these personnel are given an initial briefing at the site of emergency response prior to their participation in that response that shall include instruction in the wearing of appropriate personal protective equipment, what chemical hazards are involved, and what duties are to be performed. All appropriate safety and health precautions provided to the employer's own employees shall be used to assure the safety and health of these personnel.

(ii) *Procedures for handling emergency response.* (A) The senior official responding to an emergency at other than hazardous waste clean-up sites involving a hazardous substance or health hazard shall establish and become the individual in charge of a site-specific Incident Command System (ICS). All emergency responders and their communications shall be coordinated and controlled through the individual in charge of the ICS assisted by the senior official present for each employer.

Note: The "senior official" at an off-site emergency response is the most senior official on the site who has the responsibility for controlling the operations at the site. Initially it is the senior officer on the first-due piece of responding emergency apparatus to arrive on the incident scene. As more senior officers arrive (i.e., fire chief, battalion chief, site coordinator, etc.) the position is passed up the line of authority.

(B) The individual in charge of the ICS shall identify, to the extent possible, all hazardous substances or conditions present and shall address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance handling procedures, and use of any new technologies.

(C) Based on the hazardous substances and/or conditions present, the individual in charge of the ICS shall implement appropriate emergency operations, and assure that the personal protective equipment worn is appropriate for the hazards to be encountered. However, personal protective equipment shall meet, at a minimum, the criteria contained in 29

CFR 1910.156(e) when worn while performing fire fighting operations [illegible] the incipient stage.

[illegible] Employees engaged in emergency response and exposed to hazardous substances shall wear positive pressure self-contained breathing apparatus while engaged in emergency response until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees.

(E) The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site to those who are actively performing emergency operations. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more.

(F) Back-up personnel shall stand by with equipment ready to provide assistance or rescue. Qualified basic life support personnel, as a minimum, shall also stand by with medical equipment and transportation capability.

(G) The individual in charge of the ICS shall designate a safety official, who is knowledgable in the operations being implemented at the emergency response site, with specific responsibility to identify and evaluate hazards and to [illegible] direction with respect to the [illegible] of operations for the emergency at hand.

(H) When activities are judged by the safety official to be an IDLH condition and/or to involve an imminent danger condition, the safety official shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions taken to correct these hazards at an emergency scene.

(I) After emergency operations have terminated, the individual in charge of the ICS shall implement appropriate decontamination procedures.

(J) When deemed necessary for meeting the tasks at hand, approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus shall meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.

(4) *Hazardous materials teams (HAZMAT).* (i) Employees who are [illegible] of a HAZMAT team shall be [illegible] training in accordance with paragraph (l)(3) of this section that includes the care and use of chemical protective clothing, and procedures to be followed when working on leaking drums, containers, tanks, or bulk transport vehicles.

(ii) Members of HAZMAT teams shall receive a base line physical exam and have medical surveillance as required in paragraph (f) of this section.

(iii) Chemical personal protective clothing and equipment to be used by HAZMAT team members shall meet the requirements of paragraph (g) of this section.

(5) *Post-emergency response operations.* Upon completion of the emergency response, if it is determined that it is necessary to remove hazardous substances, health hazards, and materials contaminated with them (such as contaminated soil or other elements of the natural environment) from the site of the incident the employer conducting the clean-up shall comply with one of the following:

(i) Meet all of the requirements of paragraphs (b) through (n) of this section; or

(ii) Where the clean-up is done on plant property using plant or workplace employees, such employees shall have completed the training requirements of the following: 29 CFR 1910.38(a); 1910.134; 1910.1200, and other appropriate safety and health training made necessary by the tasks that they are expected to be performed. All equipment to be used in the performance of the clean-up work shall be in serviceable condition and shall have been inspected prior to use.

(m) *Illumination.* Areas accessible to employees shall be lighted in accordance with the requirements of this paragraph.

(1) Work areas shall be lighted to not less than the minimum illumination intensities listed in the following Table H-102.1 while any work is in progress:

TABLE H-102.1—MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

Foot-candles	Area or operations
5	General site areas.
3	Excavation and waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways.
5	Tunnels, shafts, and general underground work areas. (Exception: Minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Mine Safety and Health Administration approved cap lights shall be acceptable for use in the tunnel heading.)
10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.)

TABLE H-102.1—MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES—Continued

Foot-candles	Area or operations
30	First aid stations, infirmaries, and offices.

(n) *Sanitation at temporary workplaces.* Facilities for employee sanitation shall be provided in accordance with this paragraph.

(1) *Potable water.* (i) An adequate supply of potable water shall be provided on the site.

(ii) Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers.

(iii) Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.

(iv) Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

(2) *Nonpotable water.* (i) Outlets for nonpotable water, such as water for firefighting purposes shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.

(ii) There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing nonpotable water.

(3) *Toilets facilities.* (i) Toilets shall be provided for employees according to the following Table H-102.2.

TABLE H-102.2—TOILET FACILITIES

Number of employees	Minimum number of facilities
20 or fewer	One.
More than 20, fewer than 200.	One toilet seat and 1 urinal per 40 employees.
More than 200	One toilet seat and 1 urinal per 50 employees.

(ii) Under temporary field conditions, provisions shall be made to assure that at least one toilet facility is available.

(iii) Hazardous waste sites not provided with a sanitary sewer shall be provided with the following toilet facilities unless prohibited by local codes:

(A) Chemical toilets;

(B) Recirculating toilets;

(C) Combustion toilets; or

(D) Flush toilets.

(iv) The requirements of this paragraph for sanitation facilities shall not apply to mobile crews having transportation readily available to nearby toilet facilities.

(v) Doors entering toilet facilities shall be provided with entrance locks controlled from inside the facility.

(4) *Food handling.* All food service facilities and operations for employees shall meet the applicable laws, ordinances, and regulations of the jurisdictions in which they are located.

(5) *Temporary sleeping quarters.* When temporary sleeping quarters are provided, they shall be heated, ventilated, and lighted.

(6) *Washing facilities.* The employer shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees. Such facilities shall be in near proximity to the worksite; in areas where exposures are below established permissible exposure limits and which are under the controls of the employer; and shall be so equipped as to enable employees to remove hazardous substances for themselves.

(7) *Showers and change rooms.* When hazardous waste clean-up or removal operations commence on a site and the duration of the work will require six months or greater time to complete, the employer shall provide showers and change rooms for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations.

(i) Showers shall be provided and shall meet the requirements of 29 CFR 1910.141(d)(3).

(ii) Change rooms shall be provided and shall meet the requirements of 29 CFR 1910.141(1). Change rooms shall consist of two separate change areas separated by the shower area required in paragraph (n)(7)(i). One change area, with an exit leading off the worksite, shall provide employees with a clean area where they can remove, store, and put on street clothing. The second area, with an exit to the worksite, shall provide employees with an area where they can put on, remove and store work clothing and personal protective equipment.

(iii) Showers and change rooms shall be located in areas where exposures are below the established permissible exposure limits. If this cannot be accomplished, then a ventilation system shall be provided that will supply air that is below the established permissible exposure limits.

(iv) Employers shall assure that employees shower at the end of their work shift and when leaving the hazardous waste site.

(o) *Certain Operations Conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA).* Employers conducting operations specified in paragraph (a)(2)(iii) of this section shall:

(1) Develop and implement a written safety and health program for employees involved in hazardous waste operations which shall be available for inspection by employees, their representatives and OSHA personnel. The program shall be designed to identify, evaluate and control safety and health hazards in their facilities for the purpose of employee protection, and provide for emergency response meeting the requirements of paragraph (l) of this section and it shall address as appropriate site analysis, engineering controls, maximum exposure limits, hazardous waste handling procedures and uses of new technologies;

(2) Implement a hazard communication program as part of the employer's safety and program meeting the requirements of 29 CFR 1910.1200.

Note.—The exemptions provided in § 1910.1200 are applicable to this section.

(3) Implement a medical surveillance program meeting the requirements of paragraph (f) of this section;

(4) Develop and implement a decontamination procedure in accordance with paragraph (k) of this section, and

(5)(i) Develop and implement a training program, which is part of the employer's safety and health program, for employees involved with hazardous waste operations to enable each employee to perform their assigned duties and functions in a safe and healthful manner so as not to endanger themselves or other employees. The initial training shall be for 24 hours and refresher training shall be for eight hours annually.

(ii) Employers who can show by an employee's previous work experience and/or training that the employee has had training equivalent to the initial training required by this paragraph, shall be considered as meeting the initial training requirements of this paragraph as to that employee. Equivalent training includes the training that existing employees might have already received from actual site work experience. Employees who have received the initial training required by this paragraph shall be given a written certificate attesting that they have successfully completed the necessary training.

(p) *New technology programs.* (1) The employer shall develop and implement procedures for the introduction of effective new technologies and equipment developed for the improved protection of employees working with hazardous waste clean-up operations, and the same shall be implemented as part of the site safety and health program to assure that employee protection is being maintained.

(2) New technologies, equipment or control measures available to the industry, such as the use of foams or other means to suppress the level of air contaminates while excavating the site or for spill control, shall be evaluated by employers or their representatives to determine their effectiveness before implementing their use on a large scale for employee protection. Such evaluations shall be made available to OSHA upon request.

Appendices to § 1910.120—Hazardous Waste Operations and Emergency Response

Note.—*The following appendices serve as non-mandatory guidelines to assist employees and employers in complying with the appropriate requirements of this section. However paragraph 1910.120(g) makes mandatory in certain circumstances the use of Level A and Level B PPE protection.*

Appendix A—Personal Protective Equipment Test Methods

This appendix sets forth the non-mandatory examples of tests which may be used to evaluate compliance with paragraphs 1910.120 (g)(4)(ii) and (iii). Other tests and other challenge agents may be used to evaluate compliance.

A. *Totally-encapsulating chemical protective suit pressure test.*

1.0—*Scope.*

1.1 This practice measures the ability of a gas tight totally-encapsulating chemical protective suit material, seams, and closures to maintain a fixed positive pressure. The results of this practice allow the gas tight integrity of a total-encapsulating chemical protective suit to be evaluated.

1.2 Resistance of the suit materials to permeation, penetration, and degradation by specific hazardous substances is not determined by this test method.

2.0—*Definition of terms.*

2.1 *"Totally-encapsulated chemical protective suit (TECP suit)"* means a full body garment which is constructed of protective clothing materials, covers the wearer's torso, head, arms, and legs; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer by itself or in combination with the wearer's respiratory equipment, gloves, and boots.

2.2 *"Protective clothing material"* means any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.

2.3 *"Gas tight"* means, for the purpose of this test method, the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.

3.0—*Summary of test method.*

3.1 The TECP suit is visually inspected and modified for the test. The test apparatus is attached to the suit to permit inflation to the pre-test suit expansion pressure for [illegible] of suit wrinkles and creases. The [illegible] is lowered to the test pressure and monitored for three minutes. If the pressure drop is excessive, the TECP suit fails the test and is removed from service. The test is repeated after leak location and repair.

4.0—*Required Supplies.*

4.1 Source of compressed air.

4.2 Test apparatus for suit testing, including a pressure measurement device with a sensitivity of at least 1/4 inch water gauge.

4.3 Vent valve closure plugs or sealing tape.

4.4 Soapy water solution and soft brush.

4.5 Stop watch or appropriate timing device.

5.0—*Safety Precautions.*

5.1 Care shall be taken to provide the correct pressure safety devices required for the source of compressed air used.

6.0—*Test Procedure.*

6.1 Prior to each test, the tester shall perform a visual inspection of the suit. Check the suit for seam integrity by visually examining the seams and gently pulling on the seams. Ensure that all air supply lines, fittings, visor, zippers, and valves are secure and show no signs of deterioration.

6.1.1 Seal off the vent valves along with any other normal inlet or exhaust points (such as umbilical air line fittings or face piece opening) with tape or other appropriate means (caps, plugs, fixture, etc.). Care should be exercised in the sealing process not to [illegible] any of the suit components.

[illegible] Close all closure assemblies.

[illegible]3 Prepare the suit for inflation by providing an improvised connection point on the suit for connecting an airline. Attach the pressure test apparatus to the suit to permit suit inflation from a compressed air source equipped with a pressure indicating regulator. The leak tightness of the pressure test apparatus should be tested before and after each test by closing off the end of the tubing attached to the suit and assuring a pressure of three inches water gauge for three minutes can be maintained. If a component is removed for the test, that component shall be replaced and a second test conducted with another component removed to permit a complete test of the ensemble.

6.1.4 The pre-test expansion pressure (A) and the suit test pressure (B) shall be supplied by the suit manufacturer, but in no case shall they be less than: A = three inches water gauge and B = two inches water gauge. The ending suit pressure (C) shall be no less than 80 percent of the test pressure (B); i.e., the pressure drop shall not exceed 20 percent of the test pressure (B).

6.1.5 Inflate the suit until the pressure inside is equal to pressure "A", the pre-test expansion suit pressure. Allow at least one minute to fill out the wrinkles in the suit. Release sufficient air to reduce the suit pressure to pressure "B", the suit test pressure. Begin timing. At the end of three minutes, record the suit pressure as pressure "C" the ending suit pressure. The difference [illegible] the suit test pressure and the ending [illegible] pressure (B-C) shall be defined as the [illegible] pressure drop.

6.1.6 If the suit pressure drop is more than 20 percent of the suit test pressure B during the three-minute test period, the suit fails the test and shall be removed from service.

7.0—*Retest Procedure.*

7.1 If the suit fails the test check for leaks by inflating the suit to pressure A and brushing or wiping the entire suit (including seams, closures, lens gaskets, glove-to-sleeve joints, etc.) with a mild soap and water solution. Observe the suit for the formation of soap bubbles, which is an indication of a leak. Repair all identified leaks.

7.2 Retest the TECP suit as outlined in Test procedure 6.0.

8.0—*Report.*

8.1 Each TECP suit tested by this practice shall have the following information recorded:

8.1.1 Unique identification number, identifying brand name, date of purchase, material of construction, and unique fit features, e.g., special breathing apparatus.

8.1.2 The actual values for test pressures A, B, and C shall be recorded along with the specific observation times. If the ending pressure (C) is less than 80 percent of the test pressure (B), the suit shall be identified as failing the test. When possible, the specific leak location shall be identified in the test records. Retest pressure data shall be recorded as an additional test.

8.1.3 The source of the test apparatus used shall be identified and the sensitivity of the pressure gauge shall be recorded.

8.1.4 Records shall be kept for each pressure test even if repairs are being made at the test location.

Caution

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked.

Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.

B. *Totally-encapsulating chemical protective suit qualitative leak test.*

1.0—*Scope.*

1.1 This practice semi-qualitatively tests gas tight totally-encapsulating chemical protective suit integrity by detecting inward leakage of ammonia vapor. Since no modifications are made to the suit to carry out this test, the results from this practice provide a realistic test for the integrity of the entire suit.

1.2 Resistance of the suit materials to permeation, penetration, and degradation is not determined by this test method.

2.0—*Definition of terms.*

2.1 *"Totally-encapsulated chemical protective suit (TECP suit)"* means a full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, and legs; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer by itself or in combination with the wearer's respiratory equipment, gloves, and boots.

2.2 *"Protective clothing material"* means any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.

2.3 *"Gas tight"* means, for the purpose of this test method, the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.

2.4 *"Intrusion Coefficient"* means a number expressing the level of protection provided by a gas tight totally-encapsulating chemical protective suit. The intrusion coefficient is calculated by dividing the test room challenge agent concentration by the concentration of challenge agent found inside the suit. The accuracy of the intrusion coefficient is dependent on the challenge agent monitoring methods. The larger the intrusion coefficient the greater the protection provided by the TECP suit.

3.0—*Summary of recommended practice.*

3.1 The volume of concentrated aqueous ammonia solution (ammonia hydroxide NH_4OH) required to generate the test atmosphere is determined using the directions outlined in 6.1. The suit is donned by a person wearing the appropriate respiratory equipment (either a self-contained breathing apparatus or a supplied air respirator) and worn inside the enclosed test room. The concentrated aqueous ammonia solution is taken by the suited individual into the test room and poured into an open plastic pan. A two-minute evaporation period is observed before the test room concentration is measured, using a high range ammonia length of stain detector tube. When the ammonia vapor reaches a concentration of between 1000 and 1200 ppm, the suited individual starts a standardized exercise protocol to stress and flex the suit. After this protocol is completed, the test room concentration is measured again. The suited individual exits the test room and his stand-by person measures the ammonia concentration inside the suit using a low range ammonia length of stain detector tube or other more sensitive ammonia detector. A stand-by person is required to observe the test individual during the test procedure; aid the person in donning and doffing the TECP suit, and monitor the suit interior. The intrusion coefficient of the suit can be calculated by dividing the average test area concentration by the interior suit concentration. A colorimetric indicator strip of bromophenol blue is placed on the inside of the suit face piece lens so that the suited individual is able to detect a color change and know if the suit has a significant leak. If a color change is observed the individual shall leave the test room immediately.

4.0—*Required supplies.*

4.1 A supply of concentrated aqueous ammonia (58 percent ammonium hydroxide by weight).

4.2 A supply of bromophenol/blue indicating paper, sensitive to 5–10 ppm ammonia or greater over a two-minute period of exposure. [(pH 3.0 (yellow) to pH 4.6 (blue)]

4.3 A supply of high range (0.5–10 volume percent) and low range (5–700 ppm) detector tubes for ammonia and the corresponding sampling pump. More sensitive ammonia detectors can be substituted for the low range detector tubes to improve the sensitivity of this practice.

4.4 A shallow plastic pan (PVC) at least 12":14":1" and a half pint plastic container (PVC) with tightly closing lid.

4.5 A graduated cylinder or other volumetric measuring device of at least 50 milliliters in volume with an accuracy of at least ±1 milliliters.

5.0—*Safety precautions.*

5.1 Concentrated aqueous ammonium hydroxide, NH_4OH, is a corrosive volatile liquid requiring eye, skin, and respiratory protection. The person conducting the test shall review the MSDS for aqueous ammonia.

5.2 Since the established permissible exposure limit for ammonia is 50 ppm, only persons wearing a self-contained breathing apparatus or a supplied air respirator shall be in the chamber. Normally only the person wearing the total-encapsulating suit will be inside the chamber. A stand-by person shall have a self-contained breathing apparatus, or a supplied air respirator available to enter the test area should the suited individual need assistance.

5.3 A method to monitor the suited individual must be used during this test. Visual contact is the simplest but other methods using communication devices are acceptable.

5.4 The test room shall be large enough to allow the exercise protocol to be carried out and then to be ventilated to allow for easy exhaust of the ammonia test atmosphere after the test(s) are completed.

5.5 Individuals shall be medically screened for the use of respiratory protection and checked for allergies to ammonia before participating in this test procedure.

6.0—*Test procedure.*

6.1.1 Measure the test area to the nearest foot and calculate its volume in cubic feet. Multiply the test area volume by 0.2 milliliters of concentrated aqueous ammonia solution per cubic foot of test area volume to determine the approximate volume of concentrated aqueous ammonia required to generate 1000 ppm in the test area.

6.1.2 Measure this volume from the supply of concentrated aqueous ammonia and place it into a closed plastic container.

6.1.3 Place the container, several high range ammonia detector tubes, and the pump in the clean test pan and locate it near the test area entry door so that the suited individual has easy access to these supplies.

6.2.1 In a non-contaminated atmosphere, open a pre-sealed ammonia indicator strip and fasten one end of the strip to the inside of the suit face shield lens where it can be seen by the wearer. Moisten the indicator strip with distilled water. Care shall be taken not to contaminate the detector part of the indicator paper by touching it. A small piece of masking tape or equivalent should be used to attach the indicator strip to the interior of the suit face shield.

6.2.2 If problems are encountered with this method of attachment, the indicator strip can be attached to the outside of the respirator face piece being used during the test.

6.3 Don the respiratory protective device normally used with the suit, and then don the TECP suit to be tested. Check to be sure all openings which are intended to be sealed (zippers, gloves, etc.) are completely sealed. DO NOT, however, plug off any venting valves.

6.4 Step into the enclosed test room such as a closet, bathroom, or test booth, equipped with an exhaust fan. No air should be exhausted from the chamber during the test because this will dilute the ammonia challenge concentrations.

6.5 Open the container with the pre-measured volume of concentrated aqueous ammonia within the enclosed test room, and pour the liquid into the empty plastic test pan. Wait two minutes to allow for adequate volatilization of the concentrated aqueous ammonia. A small mixing fan can be used near the evaporation pan to increase the evaporation rate of the ammonia solution.

6.6 After two minutes a determination of the ammonia concentration within the chamber should be made using the high range colorimetric detector tube. A concentration of 1000 ppm ammonia or greater shall be generated before the exercises are started.

6.7 To test the integrity of the suit the following four minute exercise protocol should be followed:

6.7.1 Raising the arms above the head with at least 15 raising motions completed in one minute.

6.7.2 Walking in place for one minute with at least 15 raising motions of each leg in a one-minute period.

6.7.3 Touching the toes with a least 10 complete motions of the arms from above the head to touching of the toes in a one-minute period.

6.7.4 Knee bends with at least 10 complete standing and squatting motions in a one-minute period.

6.8 If at any time during the test the colorimetric indicating paper should change colors, the test should be stopped and sections 6.10 and 6.12 initiated (See ¶ 4.2).

6.9 After completion of the test exercise, the test area concentration should be measured again using the high range colorimetric detector tube.

6.10 Exit the test area.

6.11 The opening created by the suit zipper or other appropriate suit penetration should be used to determine the ammonia concentration in the suit with the low range length of stain detector tube or other ammonia monitor. The internal TECP suit air should be sampled far enough from the enclosed test area to prevent a false ammonia reading.

6.12 After completion of the measurement of the suit interior ammonia concentration the test is concluded and the suit is doffed and the respirator removed.

6.13 The ventilating fan for the test room should be turned on and allowed to run for enough time to remove the ammonia gas. The fan shall be vented to the outside of the building.

6.14 Any detectable ammonia in the suit interior (five ppm ammonia (NH_3) or more for the length of stain detector tube) indicates that the suit has failed the test. When other ammonia detectors are used a lower level of detection is possible, and it should be specified as the pass/fail criteria.

6.15 By following this test method, an intrusion coefficient of approximately 200 or more can be measured with the suit in a completely operational condition.

7.0—*Retest procedures*

7.1 If the suit fails this test, check for leaks by following the pressure test in test A above.

7.2 Retest the TECP suit as outlined in the test procedure 6.0.

8.0—*Report*

8.1 Each gas tight totally-encapsulating chemical protective suit tested by this practice shall have the following information recorded.

8.1.1 Unique identification number, identifying brand name, date of purchase, material of construction, and unique suit features; e.g., special breathing apparatus.

8.1.2 General description of test room used for test.

8.1.3 Brand name and purchase date of ammonia detector strips and color change data.

8.1.4 Brand name, sampling range, and expiration date of the length of stain ammonia detector tubes. The brand name and model of the sampling pump should also be recorded. If another type of ammonia detector is used, it should be identified along with its minimum detection limit for ammonia.

8.1.5 Actual test results shall list the two test area concentrations, their average, the interior suit concentration, and the calculated intrusion coefficient. Retest data shall be recorded as an additional test.

8.2 The evaluation of the data shall be specified as "suit passed" or "suit failed", and the date of the test. Any detectable ammonia (five ppm or greater for the length of stain detector tube) in the suit interior indicates the suit has failed this test. When other ammonia detectors are used, a lower level of detection is possible and it should be specified as the pass fail criteria.

Caution

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked.

Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.

Appendix B—General Description and Discussion of the Levels of Protection and Protective Gear

This appendix sets forth information about personal protective equipment (PPE) protection levels which may be used to assist employers in complying with the PPE requirements of this section.

As required by the standard, PPE must be selected which will protect employees from the specific hazards which they are likely to encounter during their work on-site.

Selection of the appropriate PPE is a complex process which must take into consideration a variety of factors. Key factors involved in this process are identification of the hazards, or suspected hazards; their routes of potential hazard to employees (inhalation, skin absorption, ingestion, and eye or skin contact), and the performance of th PPE *materials* (and seams) in providing a r to these hazards. The amount of ction provided by PPE is material-hazard specific. That is, protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, protective equipment materials cannot be found which will provide continuous protection from the particular hazardous substance. In these cases the breakthrough time of the protective material should exceed the work durations, or the exposure after breakthrough must not pose a hazardous level.

Other factors in this selection process to be considered are matching the PPE to the employee's work requirements and task-specific conditions. The durability of PPE materials, such as tear strength and seam strength, must be considered in relation to the employee's tasks. The effects of PPE in relation to heat stress and task duration are a factor in selecting and using PPE. In some cases layers of PPE may be necessary to provide sufficient protection, or to protect expensive PPE inner garments, suits or equipment.

The more that is known about the hazards at the site, the easier the job of PPE selection becomes. As more information about the hazards and conditions at the site becomes available, the site supervisor can make decisions to up-grade or down-grade the level of PPE protection to match the tasks at hand.

he following are guidelines which an loyer can use to begin the selection of the ppropriate PPE. As noted above, the site information may suggest the use of combinations of PPE selected from the different protection levels (i.e., A, B, C, or D) as being more suitable to the hazards of the work. It should be cautioned that the listing below does not fully address the performance of the specific PPE material in relation to the specific hazards at the job site, and that PPE selection, evaluation and re-selection is an ongoing process until sufficient information about the hazards and PPE performance is obtained.

Part A. Personal protective equipment is divided into four categories based on the degree of protection afforded. (See Part B of this appendix for further explanation of Levels A, B, C, and D hazards.)

I. *Level A*—To be selected when the greatest level of skin, respiratory, and eye protection is required.

The following constitute Level A equipment; it may be used as appropriate:

1. Pressure-demand, full face-piece self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Totally-encapsulating chemical-protective suit.
3. Coveralls.*
4. Long underwear.
5. Gloves, outer, chemical-resistant.
6. Gloves, inner, chemical-resistant.
7. Boots, chemical-resistant, steel toe and shank.
8. Hard hat (under suit).*
9. Disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally-encapsulating suit).
10. Two-way radios (worn inside encapsulating suit).

II. *Level B*—The highest level of respiratory protection is necessary but a lesser level of skin protection is needed.

The following constitute Level B equipment; it may be used as appropriate.

1. Pressure-demand, full-facepiece self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots, outer, chemical-resistant steel toe and shank.
7. Boot-covers, outer, chemical-resistant (disposable).*
8. Hard hat.
9. Two-way radios (worn inside encapsulating suit).
10. Face shield.*

III. *Level C*—The concentration(s) and type(s) of airborne substance(S) is known and the criteria for using air purifying respirators are met.

The following constitute Level C equipment; it may be used as appropriate

1. Full-face or half-mask, air purifying respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots (outer), chemical-resistant steel toe and shank.*
7. Boot-covers, outer, chemical-resistant (disposable)*.
8. Hard hat.
9. Escape mask.*
10. Two-way radios (worn under outside protective clothing).
11. Face shield.*

IV. *Level D*—A work uniform affording minimal protection, used for nuisance contamination only.

The following constitute Level D equipment; it may be used as appropriate:

1. Coveralls.
2. Gloves.*
3. Boots/shoes, chemical-resistant steel toe and shank.
4. Boots, outer, chemical-resistant (disposable).*
5. Safety glasses or chemical splash goggles*.
6. Hard hat.
7. Escape mask.*
8. Face shield.*

Part B. The types of hazards for which levels A, B, C, and D protection are appropriate are described below:

I. *Level A*—Level A protection should be used when:

1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin;
2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible; or
3. Operations must be conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A have not yet been determined.

II. Level B protection should be used when:

1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection;

Note.—This involves atmospheres with IDLH concentrations of specific substances that do not represent a severe skin hazard; or that do not meet the criteria for use of air-purifying respirators.

2. The atmosphere contains less than 19.5 percent oxygen; or
3. The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

III. Level C protection should be used when:

1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;
2. The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove the contaminants; and
3. All criteria for the use of air-purifying respirators are met.

IV. Level D protection should be used when:

1. The atmosphere contains no known hazard; and
2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Note.—As stated before, combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

Appendix C—Compliance Guidelines

1. *Occupational Safety and Health Program.* Each hazardous waste site clean-up effort will require an occupational safety and health program headed by the site

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ptional, as applicable.

coordinator or the employer's representative. The program will be designed for the protection of employees at the site. The purpose of the program will need to be developed before work begins on the site and implemented as work proceeds. The program is to facilitate coordination and communication among personnel responsible for the various activities which will take place at the site. It will provide the overall means for planning and implementing the needed safety and health training and job orientation of employees who will be working at the site. The program will provide the means for identifying and controlling worksite hazards and the means for monitoring program effectiveness. The program will need to cover the responsibilities and authority of the site coordinator or the employer's manager on the site for the safety and health of employees at the site, and the relationships with contractors or support services as to what each employer's safety and health responsibilities are for their employees on the site. Each contractor on the site needs to have its own safety and health program so structured that it will smoothly interface with the program of the site coordinator.

Also those employers involved with treating, storing or disposal of hazardous waste as covered in paragraph (o) must have implemented a safety and health plan for their employees. This program is to include the hazard communication program required in paragraph (o)(1) and the training required in paragraph (o)(5) as parts of the employers comprehensive overall safety and health program. This program is to be in writing.

Each site or workplace safety and health program will need to include the following: (1) Policy statements of the line of authority and accountability for implementing the program, the objectives of the program and the role of the site safety and health supervisor or manager and staff; (2) means or methods for the development of procedures for identifying and controlling workplace hazards at the site; (3) means or methods for the development and communication to employees of the various plans, work rules, standard operating procedures and practices that pertain to individual employees and supervisors; (4) means for the training of supervisors and employees to develop the needed skills and knowledge to perform their work in a safe and healthful manner; (5) means to anticipate and prepare for emergency situations and, (6) means for obtaining information feedback to aid in evaluating the program and for improving the effectiveness of the program. The management and employees should be trying continually to improve the effectiveness of the program thereby enhancing the protection being afforded those working on the site.

Accidents on the site or workplace should be investigated to provide information on how such occurrences can be avoided in the future. When injuries or illnesses occur on the site or workplace, they will need to be investigated to determine what needs to be done to prevent this incident from occurring again. Such information will need to be used as feedback on the effectiveness of the program and the information turned into positive steps to prevent any reoccurrence. Receipt of employee suggestions or complaints relating to safety and health issues involved with site or workplace activities is also a feedback mechanism that can be used effectively to improve the program and may serve in part as an evaluative tool(s).

2. *Training.* The employer is encouraged to utilize those training programs that have been recognized by the National Institute of Environmental Health Sciences through its training grants program. These training and educational programs are being developed for employees who work directly with hazardous substances. For further information about these programs contact: National Institute of Environmental Health Sciences, P.O. Box 12233, Research Triangle Park, NC 27709.

The training programs for employees subject to the requirements of paragraph (q) of this standard are expected to address: the safety and health hazards employees should expect to find on sites, what control measures or techniques are effective for those hazards, what monitoring procedures are effective in characterizing exposure levels, what makes an effective employer's safety and health program, what a site safety and health plan should include; and employee's responsibilities under OSHA and other regulations. Supervisors will need training in their responsibilities under the safety and health program and its subject areas such as the spill containment program, the personal protective equipment program, the medical surveillance program, the emergency response plan and other areas.

Training programs for emergency service organizations are available from the U.S. National Fire Academy, Emmitsburg, MD and the various state fire training schools. The International Society of Fire Service Instructors, Ashland, MA is another resource.

The training programs for employees covered by the requirements of paragraph (l)(3) of this standard are expected to address the need for and use of personal protective equipment including respirators; the decontamination procedures to be used; preplanning activities for hazardous substance incidents including the emergency response plan; company standard operating procedures for hazardous substance emergency responses, the use of the incident command system and other subjects. Hands-on training should be stressed whenever possible. Critiques done after an incident which include any evaluation of what worked and what did not and how can we do better the next time may be counted as training time.

For hazardous materials teams, the training will need to address the care, use and/or testing of chemical protective clothing including totally encapsulating suits, the medical surveillance program, the standard operating procedures for the use of plugging and patching equipment and other subject areas.

Officers and leaders who may be expected to be in charge at an incident will need to be fully knowledgeable of their company's incident command system. They will need to know where and how to obtain additional assistance and be familiar with the local district's emergency response plan.

Technical experts or medical experts or environmental experts that work with hazardous materials in their regular jobs, who may be sent to the incident scene by the shipper, manufacturer or governmental agency to advise and assist the person in charge of the incident need not have monthly training sessions, however, they will be required to have the 24 hours of training on an annual basis. Their training must include the care and use of personal protective equipment including respirators; knowledge of the incident command system, and those areas needed to keep them current in their respective field as it relates to safety and health involving specific hazardous substances.

Those employees who work for public works departments or special equipment operators who operate bulldozers, sand trucks, backhoes, etc., who may be called to the incident scene to provide emergency support assistance, will need at least a safety and health briefing before entering the area of potential or actual exposure. These specially skilled persons, who have not been a part of the emergency plan and do not meet the required training hours, must be made aware of the hazards they face and be provided all necessary protective clothing and equipment required for their tasks. If respirators are to be worn, the specially skilled person shall be trained in accordance with § 1910.134 before proceeding into the hazardous area to do their assigned job.

3. *Decontamination.* Decontamination procedures should be tailored to the specific hazards of the site, and will vary in complexity and number of steps, depending on the level of hazard and the employee's exposure to the hazard. Decontamination procedures and PPE decontamination methods will vary depending upon the specific substance, since one procedure or method will not work for all substances. Evaluation of decontamination methods and procedures should be performed, as necessary, to assure that employees are not exposed to hazards by re-using PPE. References in Appendix D may be used for guidance in establishing an effective decontamination program.

4. *Emergency response plans.* States, along with designated districts within the states, will be developing or have developed emergency response plans. These state and district plans are to be utilized in the emergency response plans called for in this standard. Each employer needs to assure that its emergency response plan is compatible with the local plan. In addition, the Chemical Manufacturers' Association (CMA) is another helpful resource in formulating an effective emergency response plan. Also the current Emergency Response Guidebook from the U.S. Department of Transportation, CMA's CHEMTREC and the Fire Service Emergency Management Handbook should be used as resources.

Appendix D—References

The following references may be consulted for further information on the subject of this no[illegible]

[illegible]A Instruction DFO CPL 2.70—Jan[illegible] 29, 1986. *Special Emphasis Program: Hazardous Waste Sites.*

2. OSHA Instruction DFO CPL 2-2.37A—January 29, 1986. *Technical Assistance and Guidelines for Superfund and Other Hazardous Waste Site Activities.*

3. OSHA Instruction DTS CPL 2.74—January 29, 1986. *Hazardous Waste Activity Form, OSHA 175.*

4. *Hazardous Waste Inspections Reference Manual.* U.S. Department of Labor, Occupational Safety and Health Administration, 1986.

5. Memorandum of Understanding Among the National Institute for Occupational Safety and Health, the Occupational Safety and Health Administration, the United States Coast Guard, and the United States Environmental Protection Agency. *Guidance for Worker Protection During Hazardous Waste Site Investigations and Clean-up and Hazardous Substance Emergencies.* December 18, 1980.

6. *National Priorities List,* 1st Edition, October 1984; U.S. Environmental Protection Agency. Revised periodically.

7. *The Decontamination of Response Personnel.* Field Standard Operating Procedures (F.S.O.P.) 7; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, December 1984.

8. *Preparation of a Site Safety Plan.* Field Standard Operating Procedures (F.S.O.P.) 9; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, April, 1985.

9. *Standard Operating Safety Guidelines;* U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, Environmental Response Team; November 1984.

10. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities,* National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), and Environmental Protection Agency (EPA); October 1985.

11. *Protecting Health and Safety at Hazardous Waste Sites: An Overview,* U.S. Environmental Protection Agency, EPA/625/9-85/006; September 1985.

12. *Hazardous Waste Sites and Hazardous Substance Emergencies,* NIOSH Worker Bulletin, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health; December 1982.

13. *Personal Protective Equipment for Hazardous Materials Incidents: A Selection Guide;* U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health; October 1984.

14. *Fire Service Emergency Management Handbook,* International Association of Fire Chiefs Foundation, 101 East Holly Avenue, Unit 10B, Sterling, VA 22170, January 1985.

15. *Emergency Response Guidebook,* U.S. Department of Transportation, Washington, DC, 1983.

16. *Report to the Congress on Hazardous Materials Training, Planning and Preparedness,* Federal Emergency Management Agency, Washington, DC, July 1986.

17. *Workbook for Fire Command,* Alan V. Brunacini and J. David Beageron, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, 1985.

18. *Fire Command,* Alan V. Brunacini, National Fire Protection, Batterymarch Park, Quincy, MA 02269, 1985.

19. *Incident Command System,* Fire Protection Publications, Oklahoma State University, Stillwater, OK 74078, 1983.

20. *Site Emergency Response Planning,* Chemical Manufacturers Association, Washington, DC 20037, 1986.

[FR Doc. 87-18118 Filed 8-6-87; 10:14 am]

BILLING CODE [illegible]

Appendix I-2

Addendum to Surface Impoundment Closure Plan September 30, 1987

Addendum to Surface Impoundment Closure Plan

Avco - Lycoming TEXTRON

September 30, 1987

The following text contains responses to comments made by Mr. Robert Leger of EPA Region I and Mr. Kenneth Feathers of Connecticut DEP. All responses shall be incorporated into the report.

Section 2 - Closure Plan

Delete Figure 2.1, add attached Figure 2.1

Section 4 - Decontamination of Equipment/Personnel

Insert after the second paragraph:

"General equipment types to be decontaminated include:
- *Pumps, piping, dewatering equipment
- *Backhoes, Loaders
- *HDP Lined Trucks
- *Respirator cartridge, splash suits, deconsprayer, tyvek coveralls, decon. brush and basin, plastic sheets, trash barrel, plastic trash bags, decon. soap, disposable gloves, cotton gloves, hard hats, safety goggles, first aid kit, eye wash station, boots and duct tape.

This equipment shall be decontaminated according to US EPA Region IV, April 1986 Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, Environmental Services Division, Athens, Georgia, Appendix B. Methods to determine whether equipment is decontaminated are also listed in this manual.

Landfill Cap - General Comments

Design calculations for the drainage swale are not available at this time. They will be available during final design of the cap. (Note: this is a response to a comment and shall not be incorporated into the report).

Design calculations for the drainage swale will also not be provided at this time, however ASTM C33 and ASTM D1557 design standards will be added as Appendix H. (As per request of EPA). Therefore, insert attached Appendix H.

Section I - Paragraph 4

After paragraph 4 ("Figure 4.3 shows a typical section...) insert the following paragraphs.

"The final cover design will use the potential for soil erosion from side slopes. Application of this method is presented in the July 1982 Draft RCRA Guidance Document Landfill Designer, Liner System and Final Cover, US EPA, page 28.

Construction QA/QC for backfill control, membrane placement and slope verification will be conducted according to procedures outlined in the October 1986 Technical Guidance Document Construction Quality Assurance for Hazardous Waste Land Disposal Facilities, USEPA, OSWER Report No. EPA 1, 530-SW-86-031."

Section 7A-Groundwater Monitoring

Second paragraph, third sentence. "As part of the construction...". Delete last two sentences and replace with "As part of the construction of the final cap, these wells will be replaced outside the limit of the landfill cap with screens at the same elevations as the previous wells. The objective will be to make little or no changes in the well locations so that the time series of groundwater data remains comparable with past data."

Section 8 - Post Closure Cost Estimate

Delete section 8 and replace with the following:

C) The annual operating and Maintenance Costs for the post closure care period include:

1. Quarterly sampling and analyses -

pH	$ 5.
Specific Conductance	5.
Metals	145.
Cyanides (total & amenable)	60.
Hexvalent Chrom~~inim~~ ium	25.
	$240.

Sampling eight wells plus 2
QA/QC samples
$240. x 10 samples x 4 per year = 9600/yr

Personnel: 2 engineers for 1 day
at $50/hr x 4 = $4000/yr

Subtotal $13,000/yr

2. Semi annual sampling and analyses -

TOC	$ 25.
TOX	85.
Methods 8010 & 8020	225.
	$335.

$335 x 10 samples x 2 per year =

Subtotal $6700/yr

Annual Inspections -

2 engineers for 2 days at
$50 per hour plus $400 per

Subtotal $2000/yr

4. Annual Reporting -

- analytic data: 1 engineer, 1 day at $50/hr
- inspection report: 1 engineer, 3 days at $50/hr

Subtotal $2100/yr

5. Annual Operation and Maintenance Costs -

Lawn mowing, erosion filling clear drainage, repair cap

Subtotal $10,000/yr

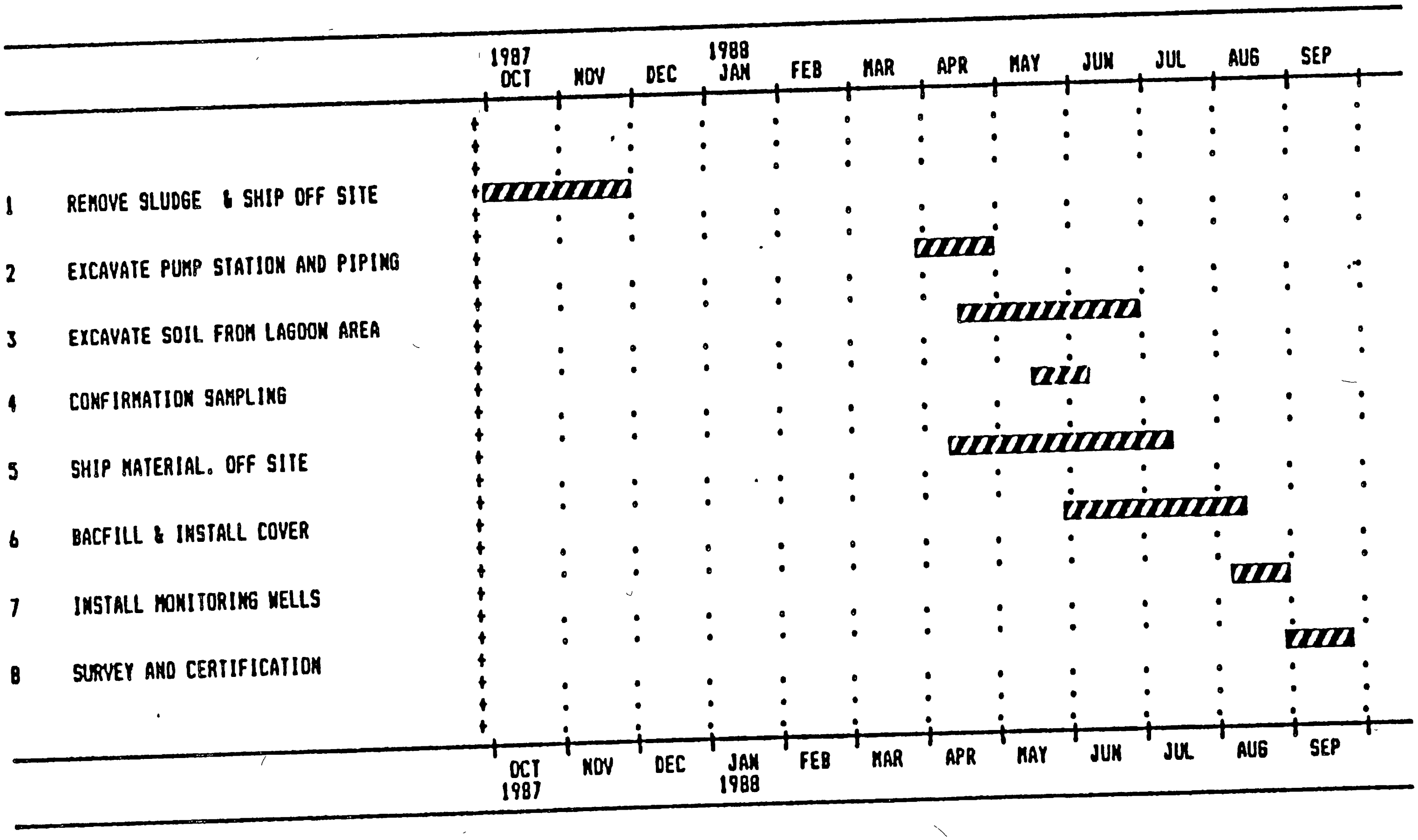
The total annual cost for the above activities is approximately $35,000 (1987 dollars).

Landfill Design References

emove references on last page of Appendix B and insert in Appendix G.

IV H

FIG. 2-1 SCHEDULE OF CLOSURE ACTIVITIES



Appendix I-3

Addendum to Surface Impoundment Closure Plan
January 5, 1988

The addendum to the Surface Impoundment Closure Plan was submitted to DEP and US EPA Region I on January 5, 1988.

A copy of this addendum could not be located in time for inclusion in this RCRA Permit Application.

Appendix I-4

Addendum to Surface Impoundment Closure Plan
February 23, 1988

Addendum to Surface Impoundment Closure Plan

AVCO-Lycoming TEXTRON

February 23, 1988

Amendment to Surface Impoundment Closure Plan dated September 1987.

The following changes shall be made to the plan:

1. Section 4-D, Page 4-7, Sampling and Analyses of Soils. Perimeter sampling and analyses of soils will be conducted at 35 foot intervals in order to achieve a 90 percent probability of detecting hazardous waste. For the two sides of the equalization lagoon that require sheeting, soil samples will be taken from test pits dug along the sheeting line. Sheeting will be installed only after confirmation sampling indicates that the sheeting is outside the range of hazardous material. Additional soil sampling shall be conducted according to the original plan.

2. Section 4-D, Page 4-8. The removal standards for metals, cyanide and chromium will be drinking water standards.

3. Create Appendix H and enclose the attached Hazardous Waste Substance List.

Textron Lycoming

SUBSTANCE LIST

Your sample ID See below
EML sample ID 71204-AVC
Date submitted 12-04-87
Date(s) analyzed 12-04 to 12-23-87

* * * ALL VALUES REPORTED IN ug/gm (wet weight) * * *

Method 8010/8020 via GC-PID/HECD. NOTE: not detected (nd) = <0.05 ppm

Compound:	871204-1	871204-2	871204-3
Benzene	<0.05	<0.05	<0.05
Benzyl chloride	<0.05	<0.05	<0.05
Bis (2-chloroethoxy)methane	<0.05	<0.05	<0.05
Bis (2-chloroisopropyl)ether	<0.05	<0.05	<0.05
Bromobenzene	<0.05	<0.05	<0.05
Bromodichloromethane	<0.05	<0.05	<0.05
Bromoform	<0.05	<0.05	<0.05
Bromomethane	<0.05	<0.05	<0.05
Carbon tetrachloride	<0.05	<0.05	<0.05
Chloracetaldehyde	<0.05	<0.05	<0.05
Chloral	<0.05	<0.05	<0.05
Chlorobenzene	<0.05	<0.05	<0.05
Chloroethane	<0.05	<0.05	<0.05
Chloroform	<0.05	<0.05	<0.05
1-Chlorohexane	<0.05	<0.05	<0.05
2-Chloroethyl vinyl ether	<0.05	<0.05	<0.05
Chloromethane	<0.05	<0.05	<0.05
Chloromethyl methyl ether	<0.05	<0.05	<0.05
Chlorotoluene	<0.05	<0.05	<0.05
Dibromochloromethane	<0.05	<0.05	<0.05
Dibromomethane	<0.05	<0.05	<0.05
1,2-Dichlorobenzene	<0.05	<0.05	<0.05
1,3-Dichlorobenzene	<0.05	<0.05	<0.05
1,4-Dichlorobenzene	<0.05	<0.05	<0.05
Dichlorodifluoromethane	<0.05	<0.05	<0.05
1,1-Dichloroethane	<0.05	<0.05	<0.05
1,2-Dichloroethane	<0.05	<0.05	<0.05
1,1-Dichloroethylene	<0.05	<0.05	<0.05
trans-1,2-Dichloroethylene	<0.05	<0.05	<0.05
Dichloromethane	<0.05	<0.05	<0.05
1,2-Dichloropropane	<0.05	<0.05	<0.05
1,3-Dichloropropylene	<0.05	<0.05	<0.05
Ethylbenzene	<0.05	<0.05	<0.05
1,1,1,2-Tetrachloroethane	<0.05	<0.05	<0.05
1,1,2,2-Tetrachloroethane	<0.05	<0.05	<0.05
Tetrachloroethylene (PCE)	0.07	0.25	0.10
Toluene	<0.05	<0.05	<0.05
1,1,1-Trichloroethane	<0.05	<0.05	<0.05
1,1,2-Trichloroethane	<0.05	<0.05	<0.05
Trichloroethylene (TCE)	<0.05	<0.05	<0.05
Trichlorotrifluoromethane	<0.05	<0.05	<0.05
Trichloropropane	<0.05	<0.05	<0.05
Vinyl chloride	<0.05	<0.05	<0.05
Xylenes	<0.05	<0.05	<0.05
Dichloropropane	<0.05	<0.05	<0.05
Dichloropropylene	<0.05	<0.05	<0.05
Tetranitromethane	<5	<5	<5

JAN 04 1988

CT DEPT HEALTH CERTIFICATION
ENVIRONMENTAL MONITORING LABORATORY, INC.
WALLINGFORD CT

Analyst

EML

Textron Lycoming

REPORT OF RESULTS

Your sample ID See below

Date submitted 12-04-87

EML sample ID 71204-AVC

Date(s) analyzed 12-04 to [illegible]-23

METHOD 625 GC/MS FRACTION-ACID COMPOUNDS (PHENOLS)

* * * ALL VALUES REPORTED IN ug/gm (ppm) * * *

Sample ID:	871204-1	871204-2	871204-3
Compound			
2-Chlorophenol	nd<0.5	nd<0.5	nd<0.5
2,4-Dichlorophenol	nd<0.5	nd<0.5	nd<0.5
2,4-Dimethylphenol	nd<0.5	nd<0.5	nd<0.5
4,6-Dinitro-o-cresol	nd<1	nd<1	nd<1
2,4-Dinitrophenol	nd<1	nd<1	nd<1
2-Nitrophenol	nd<0.5	nd<0.5	nd<0.5
4-Nitrophenol	nd<0.5	nd<0.5	nd<0.5
p-Chloro-m-cresol	nd<0.5	nd<0.5	nd<0.5
Pentachlorophenol	nd<0.5	nd<0.5	nd<0.5
Phenol	nd<0.5	nd<0.5	nd<0.5
2,4,6-Trichlorophenol	nd<0.5	nd<0.5	nd<0.5

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REPORT OF RESULTS

Your sample ID	See below	Date submitted	12-04-87
EML sample ID	71204-AVC	Date(s) analyzed	12-04 to 12-23-87

METHOD 625: GC/MS FRACTION-BASE/NEUTRAL COMPOUNDS

* * * ALL RESULTS REPORTED IN ug/gm (ppm) * * *

Compound	871204-1	Compound	871204 1
Acenaphthene	nd<0.1	Diethylphthalate	nd<0.5
Acenaphthylene	nd<0.1	Dimethylphthalate	nd<0.5
Anthracene	nd<0.1	di-n-Butylphthalate	nd<0.5
Benzidine	nd<5	2,4-Dinitrotoluene	nd<0.5
Benzo(a)anthracene	nd<0.1	2,6-Dinitrotoluene	nd<0.5
Benzo(a)pyrene	nd<0.1	di-n-Octylphthalate	nd<0.5
Benzo(b)fluoranthene	nd<0.1	1,2-Diphenylhydrazine	nd<0.5
Benzo(ghi)perylene	nd<0.2	Fluoranthene	nd<0.1
Benzo(k)fluoranthene	nd<0.1	Fluorene	nd<0.1
bis(2-Chloroethoxy)methane	nd<0.5	Hexachlorobenzene	nd<0.5
bis(2-chloroethyl)ether	nd<0.5	Hexachlorobutadiene	nd<0.5
bis(2-ethylhexyl)phthalate	nd<0.5	Hexachlorocyclopentadiene	nd<0.5
4-Bromophenylphenylether	nd<0.5	Hexachloroethane	nd<0.5
Butylbenzylphthalate	nd<0.5	Indeno(1,2,3-cd)pyrene	nd<0.2
2-Chloronaphthalene	nd<0.5	Isophorone	nd<0.5
4-Chlorophenylphenylether	nd<0.5	Naphthalene	nd<0.1
Chrysene	nd<0.1	Nitrobenzene	nd<0.5
Dibenzo(ah)anthracene	nd<0.2	n-Nitrosodimethylamine	nd<5
1,2-Dichlorobenzene	nd<0.5	n-Nitrosodi-n-propylamine	nd<5
1,3-Dichlorobenzene	nd<0.5	n-Nitrosodiphenylamine	nd<5
1,4-Dichlorobenzene	nd<0.5	Phenanthrene	nd<0.1
3,3'-Dichlorobenzidine	nd<5	Pyrene	nd<0.1
bis(2-chloroisopropyl)ether	nd<0.5	1,2,4-Trichlorobenzene	nd<0.5

NOTE: nd = not detected

Analyst ____________

ENVIRONMENTAL MONITORING LABORATORY, INC. WALLINGFORD, CT

EML

REPORT OF RESULTS

Your sample ID See below
Date submitted 12-04-87

EML sample ID [illegible]
Date(s) analyzed 12-04 to 12-[illegible]

METHOD 625: GC/MS FRACTION-BASE/NEUTRAL COMPOUNDS

* * * ALL RESULTS REPORTED IN ug/gm (ppm) * * *

Compound	871204-2	Compound	871204-2
Acenaphthene	nd<0.1	Diethylphthalate	nd<0.5
Acenaphthylene	nd<0.1	Dimethylphthalate	nd<0.5
Anthracene	nd<0.1	di-n-Butylphthalate	nd<0.5
Benzidine	nd<5	2,4-Dinitrotoluene	nd<0.5
Benzo(a)anthracene	nd<0.1	2,6-Dinitrotoluene	nd<0.5
Benzo(a)pyrene	nd<0.1	di-n-Octylphthalate	nd<0.5
Benzo(b)fluoranthene	nd<0.1	1,2-Diphenylhydrazine	nd<0.5
Benzo(ghi)perylene	nd<0.2	Fluoranthene	nd<0.1
Benzo(k)fluoranthene	nd<0.1	Fluorene	nd<0.1
bis(2-Chloroethoxy)methane	nd<0.5	Hexachlorobenzene	nd<0.5
bis(2-chloroethyl)ether	nd<0.5	Hexachlorobutadiene	nd<0.5
bis(2-ethylhexyl)phthalate	nd<0.5	Hexachlorocyclopentadiene	nd<0.5
4-Bromophenylphenylether	nd<0.5	Hexachloroethane	nd<0.5
Butylbenzylphthalate	nd<0.5	Indeno(1,2,3-cd)pyrene	nd<0.2
2-Chloronaphthalene	nd<0.5	Isophorone	nd<0.5
4-Chlorophenylphenylether	nd<0.5	Naphthalene	nd<0.1
Chrysene	nd<0.1	Nitrobenzene	nd<0.5
Dibenzo(ah)anthracene	nd<0.2	n-Nitrosodimethylamine	nd<5
1,2-Dichlorobenzene	nd<0.5	n-Nitrosodi-n-propylamine	nd<5
1,3-Dichlorobenzene	nd<0.5	n-Nitrosodiphenylamine	nd<5
1,4-Dichlorobenzene	nd<0.5	Phenanthrene	nd<0.1
3,3'-Dichlorobenzidine	nd<5	Pyrene	nd<0.1
bis(2-chloroisopropyl)ether	nd<0.5	1,2,4-Trichlorobenzene	nd<0.5

NOTE: nd = not detected

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REPORT OF RESULTS

Your sample ID See below

Date submitted 12-04-87

EML sample ID 71204-AVC

Date(s) analyzed 12-04 to 12-23-87

METHOD 625: GC/MS FRACTION-BASE/NEUTRAL COMPOUNDS

* * * ALL RESULTS REPORTED IN ug/gm (ppm) * * *

Compound	871204-3	Compound	871204-3
Acenaphthene	nd<0.1	Diethylphthalate	nd<0.5
Acenaphthylene	nd<0.1	Dimethylphthalate	nd<0.5
Anthracene	nd<0.1	di-n-Butylphthalate	nd<0.5
Benzidine	nd<5	2,4-Dinitrotoluene	nd<0.5
Benzo(a)anthracene	nd<0.1	2,6-Dinitrotoluene	nd<0.5
Benzo(a)pyrene	nd<0.1	di-n-Octylphthalate	nd<0.5
Benzo(b)fluoranthene	nd<0.1	1,2-Diphenylhydrazine	nd<0.5
Benzo(ghi)perylene	nd<0.2	Fluoranthene	nd<0.1
Benzo(k)fluoranthene	nd<0.1	Fluorene	nd<0.1
bis(2-Chloroethoxy)methane	nd<0.5	Hexachlorobenzene	nd<0.5
bis(2-chloroethyl)ether	nd<0.5	Hexachlorobutadiene	nd<0.5
bis(2-ethylhexyl)phthalate	nd<0.5	Hexachlorocyclopentadiene	nd<0.5
4-Bromophenylphenylether	nd<0.5	Hexachloroethane	nd<0.5
Butylbenzylphthalate	nd<0.5	Indeno(1,2,3-cd)pyrene	nd<0.2
2-Chloronaphthalene	nd<0.5	Isophorone	nd<0.5
4-Chlorophenylphenylether	nd<0.5	Naphthalene	nd<0.1
Chrysene	nd<0.1	Nitrobenzene	nd<0.5
Dibenzo(ah)anthracene	nd<0.2	n-Nitrosodimethylamine	nd<5
1,2-Dichlorobenzene	nd<0.5	n-Nitrosodi-n-propylamine	nd<5
1,3-Dichlorobenzene	nd<0.5	n-Nitrosodiphenylamine	nd<5
1,4-Dichlorobenzene	nd<0.5	Phenanthrene	nd<0.1
3,3'-Dichlorobenzidine	nd<5	Pyrene	nd<0.1
bis(2-chloroisopropyl)ether	nd<0.5	1,2,4-Trichlorobenzene	nd<0.5

NOTE: nd = not detected

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Appendix H

ASTM C33 ASTM D1557 Standard Specifications

recautions give... 9.2.2.2 to guard against g between time of removal from curing to g.

nsportation of Specimens to Laboratory

1 Specimens shall not be transported from eld to the laboratory before completion of nitial curing. Specimens to be transported to an age of 48 h shall not be demolded to completion of transportation. Prior to porting, specimens shall be cured and protected as required in Section 9. During transportation, the specimens must be protected with suitable cushioning material to prevent damage from jarring and from damage by freezing temperatures, or moisture loss. Moisture loss may be prevented by wrapping the specimens in plastic or surrounding them with wet sand or wet saw dust. When specimens are received by the laboratory, they shall be removed from molds if not done before shipment and placed in the required standard curing at 73.4 ± 3°F (23 ± 1.7°C).

TABLE 1 Number of Layers Required for Specimens

imen Type and Size, Depth, in. (mm)	Mode of Compaction	Number of Layers	Approximate Depth of Layer, in. (mm)
ers			
305)	rodding	3 equal	4 (100)
r 12 (305)	rodding	as required	4 (100)
305) to 18 (460)	vibration	2 equal	half depth of specimens
r 18 (460)	vibration	3 or more	8 (200) as near as practicable
52) to 8 (200)	rodding	2 equal	half depth of specimen
r 8 (200)	rodding	3 or more	4 (100)
52) to 8 (200)	vibration	1	depth of specimen
r 8 (200)	vibration	2 or more	8 (200) as near as practicable

TABLE 2 Number of Roddings to be Used in Molding Cylinder Specimens

Diameter of Cylinder, in (mm)	Number of Strokes/Layer
6 (152)	25
8 (200)	50
10 (250)	75

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is standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional rds and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the nsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, Pa. 19103

Designation: C 33 – 86

Standard Specification for
CONCRETE AGGREGATES[1]

This standard is issued under the fixed designation C 33; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This specification has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards

1. Scope

1.1 This specification defines the requirements for grading and quality of fine and coarse aggregate (other than lightweight or heavyweight aggregate) for use in concrete.[2]

1.2 The information in this specification may be used by a specifier (designer, architect, engineer, etc.) to define the quality and grading of the aggregate to be used in the concrete in the structure. The specification may be also used by a contractor, concrete supplier, or other purchaser as a purchase document describing the material to be furnished by the aggregate producer.

NOTE 1—This specification is regarded as adequate to ensure satisfactory materials for most concrete. It is recognized that, for certain work or in certain regions, it may be either more or less restrictive than needed. The specifier should ascertain that aggregates specified are or can be made available in the area of the work, with regard to grading, physical, or chemical properties, or combination thereof.

1.3 *Units of Measurement:*

1.3.1 With regard to sieve sizes and the size of aggregate as determined by the use of testing sieves, the values in inch-pound units are shown for the convenience of the user; however, the standard sieve designation shown in parentheses is the standard value as stated in Specification E 11.

1.3.2 With regard to other units of measure, the values stated in inch-pound units are to be regarded as standard.

2. Applicable Documents

2.1 *ASTM Standards:*

C 29 Test Method for Unit Weight and Voids Aggregate[3]

C 40 Test Method for Organic Impurities in Fine Aggregates for Concrete[3]

C 87 Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar[3]

C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate[3]

C 117 Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing[3]

C 123 Test Method for Lightweight Pieces in Aggregate[3]

C 125 Definitions of Terms Relating to Concrete and Concrete Aggregates[3]

C 131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine[3]

C 136 Method for Sieve Analysis of Fine and Coarse Aggregates[3]

C 142 Test Method for Clay Lumps and Friable Particles in Aggregates[3]

C 227 Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)[3]

C 289 Test Method for Potential Reactivity of Aggregates (Chemical Method)[3]

C 294 Descriptive Nomenclature of Constitu-

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[1] This specification is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.03.05 on Methods of Testing and Specifications for Physical Characteristics of Concrete Aggregates.

Current edition approved March 27, 1986. Published May 1986. Originally published as C 33 – 21 T. Last previous edition C 33 – 85. Changes from the previous revision have included references to heavyweight aggregates in 1.1, 2.1, and footnote 2.

[2] For lightweight aggregates, see Specifications C 331, C 332, and C 330; for heavyweight aggregates — Specification C 637 and Descriptive Nomenclature C 638.

ents of [illegible]neral Aggregates[3]

C 295 Practice for Petrographic Examination of Aggregates for Concrete[3]

C 330 Specification for Lightweight Aggregates for Structural Concrete[3]

C 331 Specification for Lightweight Aggregates for Concrete Masonry Units[3]

C 332 Specification for Lightweight Aggregates for Insulating Concrete[3]

C 342 Test Method for Potential Volume Change of Cement-Aggregate Combinations[3]

C 535 Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine[3]

C 586 Test Method for Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)[3]

C 637 Specifications for Aggregates for Radiation-Shielding Concrete[3]

C 638 Descriptive Nomenclature of Constituents of Aggregates for Radiation Shielding Concrete[3]

C 666 Test Method for Resistance of Concrete to Rapid Freezing and Thawing[3]

D 75 Practice for Sampling Aggregates[3]

D 3665 Practice for Random Sampling of Construction Materials[4]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[3]

2.2 *Related Document:*

3. Ordering Information

3.1 The purchaser shall include the following information in the purchase order when applicable:

3.1.1 Reference to this specification, C 33, and date of issue,

3.1.2 Whether the order is for fine aggregate or for coarse aggregate,

3.1.3 Quantity, in tons or metric tons (Note 2),

3.1.4 When the order is for fine aggregate (Note 3):

3.1.4.1 Whether the optional grading in 5.2 applies,

3.1.4.2 Whether the restriction on reactive materials in 6.3 applies,

3.1.4.3 In the case of the sulfate soundness test (7.1) which salt is to be used. If none is stated, either salt may be used,

finer than No. 200 sieve (Table 1). If not [illegible]d, the 3.0 % limit shall apply,

3.1.4.5 The appropriate limit for coal and lignite (Table 1). If not stated, the 1.0 % limit shall apply.

3.1.5 When the order is for coarse aggregate (Note 3):

3.1.5.1 The grading (size number) (9.1 and Table 2),

3.1.5.2 The class designation (10.1 and Table 3),

3.1.5.3 Whether the restriction on reactive materials in 10.2 applies,

3.1.5.4 In the case of the sulfate soundness test (Table 3), which salt is to be used. If none is stated, either salt may be used.

3.1.6 Any exceptions or additions to this specification (see Notes 1 and 3).

Note 2—The weight should be determined as loaded in the hauling unit, including any natural moisture present. No water should be added at the time of loading.

Note 3—The specifier (architect, engineer, etc) should include in the contract documents his requirements as to the items listed in 3.1.4, 3.1.5, and 3.1.6. Otherwise, any grading or quality described in this specification which is furnished may be deemed to be acceptable, even though it may later prove to be unsatisfactory in service.

FINE AGGREGATE

4. General Characteristics

4.1 Fine aggregate shall consist of natura sand, manufactured sand, or a combinatio thereof.

5. Grading

5.1 *Sieve Analysis*—Fine aggregate, excep as provided in 5.2, 5.3, and 5.4, shall be grade within the following limits:

Sieve (Specification E 11)	Percent Passing
⅜-in (9.5 mm)	100
No. 4 (4.75-mm)	95 to 100
No. 8 (2.36-mm)	80 to 100
No. 16 (1.18-mm)	50 to 85
No. 30 (600-μm)	25 to 60
No. 50 (300-μm)	10 to 30
No. 100 (150-μm)	2 to 10

5.2 The minimum percent shown above fo material passing the No. 50 (300-μm) and No 100 (150-μm) sieves may be reduced to 5 and 0 respectively, if the aggregate is to be used in air entrained concrete containing more than 400 l of cement per cubic yard (237 kg/m³) or i nonair-entrained concrete containing more tha [illegible] n approved mineral admixture is used to supply the deficiency in percent passing these sieves. Air-entrained concrete is here considered to be concrete containing air-entraining cement or an air-entraining agent and having an air content of more than 3 %.

5.3 The fine aggregate shall have not more than 45 % passing any sieve and retained on the next consecutive sieve of those shown in 5.1, and its fineness modulus shall be not less than 2.3 nor more than 3.1.

5.4 Fine aggregate failing to meet the sieve analysis and fineness modulus requirements of 5.1, 5.2, or 5.3, may be accepted provided that concrete made with similar fine aggregate from the same source has an acceptable performance record in similar concrete construction; or, in the absence of a demonstrable service record, provided that it is demonstrated that concrete of the class specified, made with the fine aggregate under consideration, will have relevant properties at least equal to those of concrete made with the same ingredients, with the exception that a reference fine aggregate be used which is selected from a source having an acceptable performance record in similar concrete construction.

Note 4—Fine aggregate that conforms to the grading requirements of a specification, prepared by another organization such as a state transportation agency, which is in general use in the area, should be considered as having a satisfactory service record with regard to those concrete properties affected by grading.

Note 5—Relevant properties are those properties of the concrete which are important to the particular application being considered. STP 169B[5] provides a discussion of important concrete properties.

5.5 For continuing shipments of fine aggregate from a given source, the fineness modulus shall not vary more than 0.20 from the base fineness modulus. The base fineness modulus shall be that value that is typical of the source. If necessary, the base fineness modulus may be changed when approved by the purchaser.

Note 6—The base fineness modulus should be determined from previous tests, or if no previous tests exist, from the average of the fineness modulus values for the first ten samples (or all preceding samples if less than ten) on the order. The proportioning of a concrete mixture may be dependent on the base fineness modulus of the fine aggregate to be used. Therefore, when it appears that the base fineness modulus is considerably different from the value used in the concrete mixture, a suitable adjustment in the mixture may be necessary

6.1 The amount of delete[illegible] substances i fine aggregate shall not exce[illegible] the limits prescribed in Table 1.

6.2 *Organic Impurities:*

6.2.1 Fine aggregate shall be free of injurio amounts of organic impurities. Except as here provided, aggregates subjected to the test fo organic impurities and producing a colo darker than the standard shall be rejected.

6.2.2 A fine aggregate failing in the test ma be used, provided that the discoloration is du principally to the presence of small quantiti of coal, lignite, or similar discrete particles.

6.2.3 A fine aggregate failing in the test ma be used, provided that, when tested for th effect of organic impurities on strength of mo tar, the relative strength at 7 days calculated accordance with Test Method C 87, is not le than 95 %.

6.3 Fine aggregate for use in concrete that w be subject to wetting, extended exposure to h mid atmosphere, or contact with moist grou shall not contain any materials that are delete ously reactive with the alkalies in the cement an amount sufficient to cause excessive expa sion of mortar or concrete, except that if su materials are present in injurious amounts, t fine aggregate may be used with a cement co taining less than 0.60 % alkalies calculated sodium oxide equivalent ($Na_2O + 0.658K_2O$) with the addition of a material that has be shown to [illegible] harmful expansion due to t alkali-agg[illegible] reaction. (See Appendix X1)

7. Soundness

7.1 Except as provided in 7.2 and 7.3, fi aggregate subjected to five cycles of the soundn test shall have a weighted average loss not grea than 10 % when sodium sulfate is used or 15 when magnesium sulfate is used.

7.2 Fine aggregate failing to meet the requi ments of 7.1 may be accepted, provided th concrete of comparable properties, made fr similar aggregate from the same source, has giv satisfactory service when exposed to weatheri similar to that to be encountered.

7.3 Fine aggregate not having a demonstra service record and failing to meet the requi ments of 7.1 may be accepted, provided it g

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Annual Book of ASTM Standards, Vol 04.03.

[5] *Significance of Tests and Properties of Concrete and Concrete Making Materials*, STP 169B, ASTM, 1978.

[illegible] ing and thawing tests (see Test Method C 666).

COARSE AGGREGATE

8. General Characteristics

8.1 Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, air-cooled blast furnace slag, or crushed hydraulic-cement concrete, or a combination thereof, conforming to the requirements of this specification.

NOTE 7—Although crushed hydraulic-cement concrete has been used as an aggregate with reported satisfactory results, its use may require some additional precautions. Mixing water requirements may be increased because of the harshness of the aggregate. Partially deteriorated concrete, used as aggregate, may reduce freeze-thaw resistance, affect air void properties or degrade during handling, mixing, or placing. Crushed concrete may have constituents that would be susceptible to alkali-aggregate reactivity or sulfate attack in the new concrete or may bring sulfates, chlorides, or organic material to the new concrete in its pore structure.

9. Grading

9.1 Coarse aggregates shall conform to the requirements prescribed in Table 2 for the size number specified.

NOTE 8—The ranges shown in Table 2 are by necessity very wide in order to accommodate nationwide conditions. For quality control of any specific operation, a producer should develop an average gradation for the particular source and production facilities, and control the gradation within reasonable tolerances from this average. Where coarse aggregate sizes numbers 357 or 467 are used, the aggregate should be furnished in at least two separate sizes

10. Deleterious Substances

10.1 Except for the provisions of 10.3, the limits given in Table 3 shall apply for the class of coarse aggregate designated in the purchase order or other document (Notes 9 and 10). If the class is not specified, the requirements for Class 3S, 3M, or 1N shall apply in the severe, moderate, and negligible weathering regions, respectively (see Table 3 and Fig. 1).

NOTE 9—The specifier of the aggregate should designate the class of coarse aggregate to be used in the work, based on weathering severity, abrasion, and other factors of exposure. (See Table 3 and Fig. 1.) The limits for coarse aggregate corresponding to each class designation are expected to ensure satisfactory performance in concrete for the respective type and location of construction. Selecting a class with unduly restrictive limits may result in unnecessary cost if materials meeting those requirements are not locally available. Selecting a class with lenient limits may result in unsatisfactory performance and premature deterioration of the concrete. While concrete in dif[illegible] made with different classes of coarse aggregate, the specifier may wish to require the coarse aggregate for all concrete to conform to the same more restrictive class to reduce the chance of furnishing concrete with the wrong class of aggregate, especially on smaller projects.

NOTE 10—For coarse aggregate in concrete exposed to weathering, the map with the weathering regions shown in Fig. 1 is intended to serve only as a guide to probable weathering severity. Those undertaking construction, especially near the boundaries of weathering regions, should consult local weather bureau records for amount of winter precipitation and number of freeze-thaw cycles to be expected, for determining the weathering severity for establishing test requirements of the coarse aggregate. For construction at altitudes exceeding 5000 ft (1520 m) above sea level, the likelihood of more severe weathering than indicated by the map should be considered.

10.2 Coarse aggregate for use in concrete that will be subject to wetting, extended exposure to humid atmosphere, or contact with moist ground shall not contain any materials that are deleteriously reactive with the alkalies in the cement in an amount sufficient to cause excessive expansion of mortar or concrete except that if such materials are present in injurious amounts, the coarse aggregate may be used with a cement containing less than 0.60 % alkalies calculated as sodium oxide equivalent ($Na_2O + 0.658K_2O$) or with the addition of a material that has been shown to prevent harmful expansion due to the alkali-aggregate reaction. (See Appendix X1.).

10.3 Coarse aggregate having test results exceeding the limits specified in Table 3 may be accepted provided that concrete made with similar aggregate from the same source has given satisfactory service when exposed in a similar manner to that to be encountered; or, in the absence of a demonstrable service record, provided that the aggregate produces concrete having satisfactory relevant properties (see Note 5).

METHODS OF SAMPLING AND TESTING

11. Methods of Sampling and Testing

11.1 Sample and test the aggregates in accordance with the following methods, except as otherwise provided in this specification. Make the required tests on test samples that comply with requirements of the designated test methods. The same test sample may be used for sieve analysis and for determination of material finer than the No. 200 (75-µm) sieve. Separated sizes from the sieve analysis may be used in preparation of samples for soundness or abrasion tests. For determination of all other tests and for evaluation of potential alkali reactivity where required, use independent test samples.

11.1.1 *Sampling*—Practice D 75 and Practice D 3665.

11.1.2 *Grading and Fineness Modulus*—Method C 136.

11.1.3 *Amount of Material Finer than No. 200 (75-µm) Sieve*—Test Method C 117.

11.1.4 *Organic Impurities*—Test Method C 40.

11.1.5 *Effect of Organic Impurities on Strength*—Test Method C 87.

11.1.6 *Soundness*—Test Method C 88.

11.1.7 *Clay Lumps and Friable Particles*—Test Method C 142.

[illegible] using a liquid of 2.0 specific gravity to remove the particles of coal and lignite. Only material that is brownish-black, or black, shall be considered coal or lignite. Coke shall not be classed as coal or lignite.

11.1.9 *Weight of Slag*—Test Method C 29.

11.1.10 *Abrasion of Coarse Aggregate*—Test Method C 131 or Test Method C 535.

11.1.11 *Reactive Aggregates*—See Appendix X1.

11.1.12 *Freezing and Thawing*—Procedures for making freezing and thawing tests of concrete are described in Test Method C 666.

11.1.13 *Chert*—Test Method C 123 is used to identify particles in a sample of coarse aggregate lighter than 2.40 specific gravity, and Practice C 295 to identify which of the particles in the light fraction are chert.

TABLE 1 Limits for Deleterious Substances in Fine Aggregate for Concrete

Item	Weight Percent of Total Sample, max
Clay lumps and friable particles	3.0
Material finer than No. 200 (75 µm) sieve.	
Concrete subject to abrasion	3.0[A]
All other concrete	5.0[A]
Coal and lignite	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

[A] In the case of manufactured sand, if the material finer than the No. 200 (75 µm) sieve consists of the dust of fracture, essentially free of clay or shale, these limits may be increased to 5 and 7 %, respectively.

TABLE 2 Grading Requirements for Coarse Aggregates

Size Number	Nominal Size (Sieves with Square Openings)	Amounts Finer than Each Laboratory Sieve (Square-Openings), Weight Percent												
		4 in. (100 mm)	3½ in. (90 mm)	3 in. (75 mm)	2½ in. (63 mm)	2 in. (50 mm)	1½ in. (37.5 mm)	1 in. (25.0 mm)	¾ in. (19.0 mm)	½ in. (12.5 mm)	⅜ in. (9.5 mm)	No. 4 (4.75 mm)	No. 8 (2.36 mm)	No. 16 (1.18 mm)
1	3½ to 1½ in. (90 to 37.5 mm)	100	90 to 100	...	25 to 60	...	0 to 15	...	0 to 5	...	...	...	...	...
2	2½ to 1½ in. (63 to 37.5 mm)	...	...	100	90 to 100	35 to 70	0 to 15	...	0 to 5	...	...	...	...	...
3	2 to 1 in. (50 to 25.0 mm)	...	...	...	100	90 to 100	35 to 70	0 to 15	...	0 to 5	...	...	...	...
357	2 in. to No. 4 (50 to 4.75 mm)	...	...	...	100	95 to 100	...	35 to 70	...	10 to 30	...	0 to 5	...	...
4	1½ to ¾ in. (37.5 to 19.0 mm)	...	...	...	...	100	90 to 100	20 to 55	0 to 15	...	0 to 5	...	...	...
467	1½ in. to No. 4 (37.5 to 4.75 mm)	...	...	...	...	100	95 to 100	...	35 to 70	...	10 to 30	0 to 5	...	...
5	1 to ½ in. (25.0 to 12.5 mm)	...	...	...	...	...	100	90 to 100	20 to 55	0 to 10	0 to 5	...	...	...
56	1 to ⅜ in. (25.0 to 9.5 mm)	...	...	...	...	...	100	90 to 100	40 to 85	10 to 40	0 to 15	0 to 5	...	...
57	1 in. to No. 4 (25.0 to 4.75 mm)	...	...	...	...	...	100	95 to 100	...	25 to 60	...	0 to 10	0 to 5	...
6	¾ to ⅜ in. (19.0 to 9.5 mm)	...	...	...	...	...	...	100	90 to 100	20 to 55	0 to 15	0 to 5	...	...
67	¾ in. to No. 4 (19.0 to 4.75 mm)	...	...	...	...	...	...	100	90 to 100	...	20 to 55	0 to 10	0 to 5	...
7	½ in. to No. 4 (12.5 to 4.75 mm)	...	...	...	...	...	...	...	100	90 to 100	40 to 70	0 to 15	0 to 5	...
8	⅜ in. to No. 8 (9.5 to 2.36 mm)	...	...	...	...	...	...	...	...	100	85 to 100	10 to 30	0 to 10	0 to

TABLE 3 Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregate for Concrete

NOTE—See Fig. 1 for the location of the weathering regions and footnote E to this table for the computation of the weathering index. The weathering regions are defined as follo in terms of the weathering index:

(S) Severe Weathering Region—Weathering Index greater than 500 day-inches (1270 day-cm).
(M) Moderate Weathering Region—Weathering Index 100 to 500 day-inches (254 to 1270 day-cm).
(N) Negligible Weathering Region—Weathering Index less than 100 day-inches (254 day-cm).

Class Designation	Type or Location of Concrete Construction	Maximum Allowable, %						
		Clay Lumps and Friable Particles	Chert[C] (Less Than 2.40 sp gr SSD)	Sum of Clay Lumps, Friable Particles, and Chert (Less Than 2.40 sp gr SSD)[C]	Material Finer Than No. 200 (75-μm) Sieve	Coal and Lignite	Abrasion[A]	Magnesium Sulfate Soundness (5 cycles)[B]
		Severe Weathering Regions						
1S	Footings, foundations, columns and beams not exposed to the weather, interior floor slabs to be given coverings	10.0	...	...	1.0[D]	1.0	50	...
2S	Interior floors without coverings	5.0	...	...	1.0[D]	0.5	50	...
3S	Foundation walls above grade, retaining walls, abutments, piers, girders, and beams exposed to the weather	5.0	5.0	7.0	1.0[D]	0.5	50	18
4S	Pavements, bridge decks, driveways and curbs, walks, patios, garage floors, exposed floors and porches, or waterfront structures, subject to frequent wetting	3.0	5.0	5.0	1.0[D]	0.5	50	18
5S	Exposed architectural concrete	2.0	3.0	[illegible]	1.0[D]	0.5	50	18
		Moderate Weathering Regions						
1M	Footings, foundations, columns, and beams not exposed to the weather, interior floor slabs to be given coverings	10.0	...	...	1.0[D]	1.0	50	...
2M	Interior floors without coverings	5.0	...	...	1.0[D]	0.5	50	...
3M	Foundation walls above grade, retaining walls, abutments, piers, girders, and beams exposed to the weather	5.0	8.0	10.0	1.0[D]	0.5	50	18
4M	Pavements, bridge decks, driveways and curbs, walks, patios, garage floors, exposed floors and porches, or waterfront structures subject to frequent	5.0	5.0	7.0	1.0[D]	0.5	50	18

TABLE 3 *Continued*

Class Designation	Type or Location of Concrete Construction	Maximum Allowable, %						
		Clay Lumps and Friable Particles	Chert[C] (Less Than 2.40 sp gr SSD)	Sum of Clay Lumps, Friable Particles, and Chert (Less Than 2.40 sp gr SSD)[C]	Material Finer Than No. 200 (75-μm) Sieve	Coal and Lignite	Abrasion[A]	Max. Sulfate Soundnes (5 cycle
5M	Exposed architectural concrete	3.0	3.0	5.0	1.0[D]	0.5	50	18
		Negligible Weathering Regions						
1N	Slabs subject to traffic abrasion, bridge decks, floors, sidewalks, pavements	5.0	...	...	1.0[D]	0.5	50	...
2N	All other classes of concrete	10.0	...	...	1.0[D]	1.0	50	...

[A] Crushed air-cooled blast-furnace slag is excluded from the abrasion requirements. The rodded or jigged unit weight of crushed air-cooled blast-furnace slag shall be not less than 70 lb/ft^3 (1120 kg/m^3). The grading of slag used in the unit weight test shall conform to the grading to be used in the concrete. Abrasion loss of gravel, crushed gravel, or crushed stone shall be determined on the test size or sizes most nearly corresponding to the grading or gradings to be used in the concrete. When more than one grading is to be used, the limit on abrasion loss shall apply to each.

[B] The allowable limits for soundness shall be 12 % if sodium sulfate is used.

[C] These limitations apply only to aggregates in which chert appears as an impurity. They are not applicable to gravels that are predominantly chert. Limitations on soundness of such aggregates must be based on service records in the environment in which they are used.

[D] This percentage may be increased under either of the following conditions: (*1*) if the material finer than the No. 200 (75-μm) sieve is essentially free of clay or shale the percentage may be increased to 1.5; or (*2*) if the source of the fine aggregate to be used in the concrete is known to contain less than the specified maximum amount passing the No. 200 (75-μm) sieve (Table 1) the percentage limit (L) on the amount in the coarse aggregate may be increased to $L = 1 + [(P)/(100 - P)](T - A)$, where P = percentage of sand in the concrete as a percent of total aggregate, T = the Table 1 limit for the amount permitted in the fine aggregate, and A = the actual amount in the fine aggregate. (This provides a weighted calculation designed to limit the maximum mass of material passing the No. 200 (75-μm) sieve in the concrete to that which would be obtained if both the fine and coarse aggregate were supplied at the maximum tabulated percentage for each of these ingredients.)

[E] Weathering Index. The effect of weathering is related to the weathering index, which for any locality is the product of the average annual number of *freezing cycle days* and the average annual *winter rainfall* in inches (or centimetres), defined as follows: *A Freezing Cycle Day* is any day during which the air temperature passes either above or below 32°F (0°C). The average number of freezing cycle days in a year may be taken to equal the difference between the mean number of days during which the minimum temperature was 32°F (0°C) or below and the mean number of days during which the maximum temperature was 32°F (0°C) or below. *Winter Rainfall* is the sum, in inches (or centimetres) of the mean monthly corrected precipitation (rainfall) occurring during the period between and including the normal date of the first occurrence of freezing (32°F, 0°C) in the fall and the normal date of the last occurrence of freezing (32°F, 0°C) in the spring. The winter rainfall for any period is equal to the total precipitation less one tenth of the total fall of snow, sleet, and hail. Rainfall for a portion of a month is prorated.

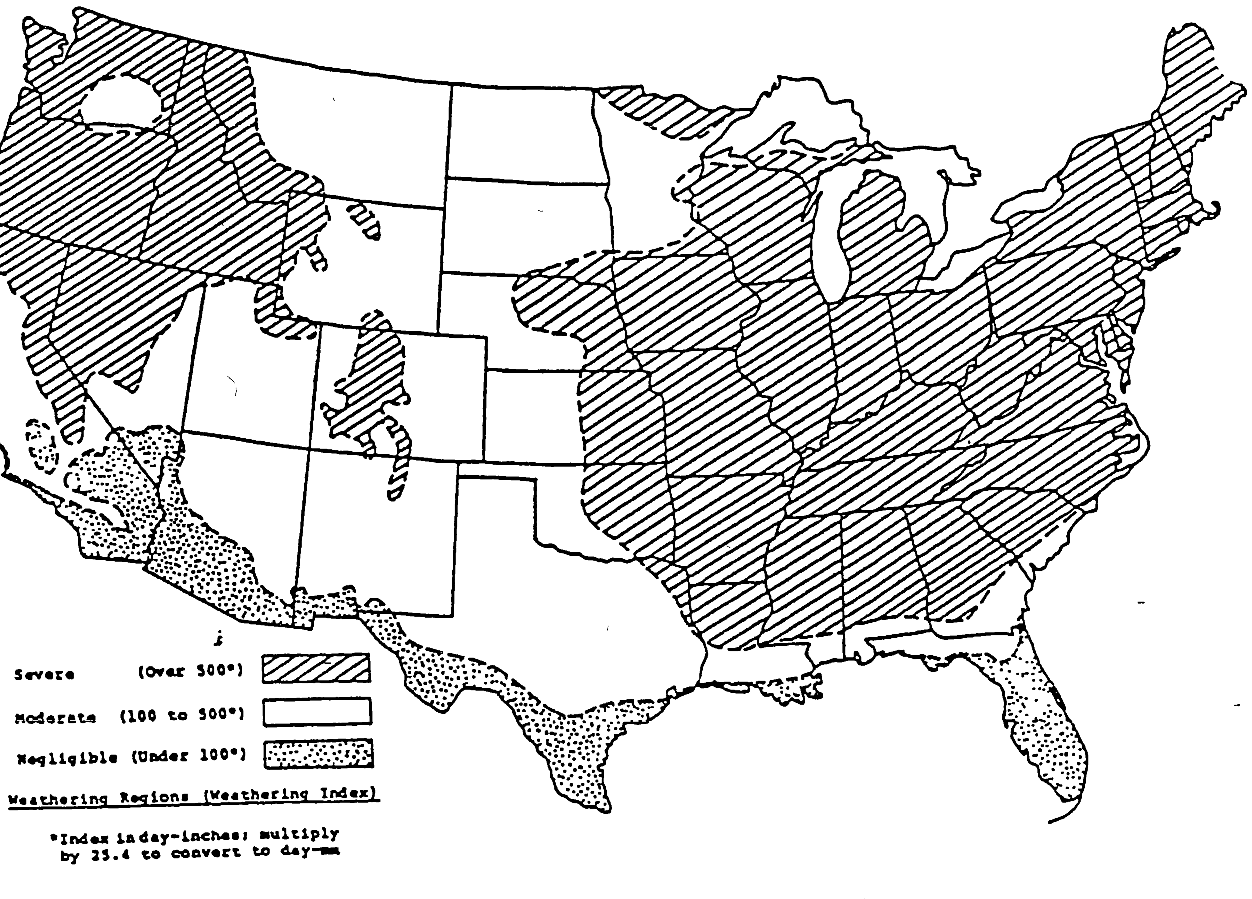

FIG. 1 Location of Weathering Regions

Designation: [illegible]

Standard Test Methods for
MOISTURE-DENSITY RELATIONS OF SOILS AND SOIL-AGGREGATE MIXTURES USING 10-lb (4.54-kg) RAMMER AND 18-in. (457-mm) DROP[1]

tanda. d is issued under the fixed designation D 1557; the number immediately following the designation indicates the f original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last roval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

methods have been approved for use by agencies of the Department of Defense and for listing in the DoD Index of ications and Standards.

cope

l These laboratory compaction methods :r the determination of the relationship be-:n the moisture content and density of soils soil-aggregate mixtures (Note 1) when ipacted in a mold of a given size with a 10-4.54-kg) rammer dropped from a height of in. (457 mm) (Note 2). Four alternative cedures are provided as follows:

.1.1 *Method A*—A 4-in. (101.6-mm) mold; terial passing a No. 4 (4.75-mm) sieve;

.1.2 *Method B*—A 6-in. (152.4-mm) mold; terial passing a No. 4 (4.75-mm) sieve;

.1.3 *Method C*—A 6-in. (152.4-mm) mold; terial passing a ¾-in. (19.0-mm) sieve; and

.1.4 *Method D*—A 6-in. (152.4-mm) mold; terial passing a ¾-in. (19.0-mm) sieve, corted by replacement for material retained on i-in. sieve.

NOTE 1—Soils and soil-aggregate mixtures should regarded as natural occurring fine- or coarse-lned soils or composites or mixtures of natural ls, or mixtures of natural and processed soils or regates such as silt, gravel, or crushed rock.

NOTE 2—These laboratory compaction test meth-s when used on soils and soil-aggregates which are t free-draining will, in most cases, establish a well-fined optimum moisture content and maximum nsity (see Section 7). However, for free-draining ils and soil-aggregate mixtures, these methods will t, in many cases, produce a well-defined moisture-nsity relationship and the maximum density ob-ined will generally be less than that obtained by bratory methods.

1.2 The method to be used should be indi-ated in the specifications for the material being ated. If no method is specified, the provisions of Section 5 shall govern.

2. Applicable Documents

2.1 *ASTM Standards:*

C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate[2]

D 854 Test Method for Specific Gravity of Soils[3]

D 2168 Methods for Calibration of Laboratory Mechanical-Rammer Soil Compactors[3]

D 2216 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures[3]

D 2487 Test Method for Classification of Soils for Engineering Purposes[3]

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[3]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[4]

3. Apparatus

3.1 *Molds*—The molds shall be cylindrical in shape, made of rigid metal and be within the capacity and dimensions indicated in 3.1.1 or 3.1.2. The molds may be the "split" type, consisting either of two half-round sections, or a section of pipe split along one element, a cyl meeting the requirements of this . The molds may also be the "taper" oviding the internal diameter taper is uniform and is not more than 0.200 in./linear ft (16.7 mm/linear m) of mold height. Each mold shall have a base plate assembly and an extension collar assembly, both made of rigid metal and constructed so they can be securely attached to or detached from the mold. The extension collar assembly shall have a height extending above the top of the mold of at least 2 in. (50 mm) which may include an upper section that flares out to form a funnel providing there is at least a ¾-in. (19-mm) straight cylindrical section beneath it.

3.1.1 *Mold*, 4.0 in. (101.6 mm) in diameter, having a capacity of 1/30 ± 0.0004 ft³ (944 ± 11 cm³) and conforming to Fig. 1.

3.1.2 *Mold*, 6.0 in. (152.4 mm) in diameter, having a capacity of 1/13.333 ± 0.0009 ft³ (2124 ± 25 cm³) and conforming to Fig. 2.

3.1.3 The average internal diameter, height, and volume of each mold shall be determined before initial use and at intervals not exceeding 1000 times the mold is filled. The mold volume shall be calculated from the average of at least six internal diameter and three height measurements made to the nearest 0.001 in. (0.02 mm), or from the amount of water required to completely fill the mold, corrected for temperature variance in accordance with Table 1. If the average internal diameter and volume are not within the tolerances shown in Figs. 1 or 2, the mold shall not be used. The determined volume shall be used in computing the required densities.

3.2 *Rammer*—The rammer may be either manually operated (see 3.2.1) or mechanically operated (see 3.2.2). The rammer shall fall freely through a distance of 18.0 ± 1/16 in. (457.2 ± 1.6 mm) from the surface of the specimen. The manufactured weight of the rammer shall be 10.00 ± 0.02 lb (4.54 ± 0.01 kg). The specimen contact face shall be flat.

3.2.1 *Manual Rammer*—The specimen contact face shall be circular with a diameter of 2.000 ± 0.005 in. (50.80 ± 0.13 mm). The rammer shall be equipped with a guidesleeve which shall provide sufficient clearance so that the free fall of the rammer shaft and head will not be restricted. The guidesleeve holes total) located [illegible] (19.0 ± 1.6 mm) from eac [illegible] an [illegible] ced 90 deg apart. The minimum [illegible] the vent holes shall be ⅜ in. (9.5

3.2.2 *Mechanical Rammer*—The rammer shall operate mechanically in such a manner as to provide uniform and complete coverage of the specimen surface. There shall be 0.10 ± 0.03 in. (2.5 ± 0.8 mm) clearance between the rammer and the inside surface of the mold at its smallest diameter. When used with the 4.0-in. (101.6-mm) mold, the specimen contact face shall be circular with a diameter of 2.000 ± 0.005 in. (50.80 ± 0.13 mm). When used with the 6.0-in. (152.4-mm) mold, the specimen contact face shall have the shape of a section of a circle of a radius equal to 2.90 ± 0.02 in. (73.7 ± 0.5 mm). The sector face rammer shall operate in such a manner that the vertex of the sector is positioned at the center of the specimen. The mechanical rammer shall be calibrated and adjusted, as necessary, in accordance with 3.2.3.

3.2.3 *Calibration and Adjustment*—The mechanical rammer shall be calibrated, and adjusted as necessary, before initial use; near the end of each period during which the mold was filled 1000 times; before reuse after anything, including repairs, which may affect the test results significantly; and whenever the test results are questionable. Each calibration and adjustment shall be in accordance with Methods D2168.

3.3 *Sample Extruder* (optional)—A jack, frame, or other device adapted for the purpose of extruding compacted specimens from the mold.

3.4 *Balances*—A balance or scale of at least 20-kg capacity sensitive to ±1 g and a balance of at least 1000-g capacity sensitive to ±0.01 g.

3.5 *Drying Oven*, thermostatically-controlled, preferably of the forced-draft type, capable of maintaining a temperature of 230 ± 9°F (110 ± 5°C) for determining the moisture content of the compacted specimen.

3.6 *Straightedge*—A stiff metal straightedge of any convenient length but not less than 10 in. (254 mm). The scraping edge shall have a straightness tolerance of ±0.005 in. (±0.13 mm) and shall be beveled if it is thicker then ⅛ in. (3 mm).

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[1] These methods are under the jurisdiction of ASTM Committee D-18 on Soil and Rock.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.08.

[4] *Annual Book of ASTM Standards*, Vols 04.01, 04.02, 04.06, 05.05, and 14.02.

nd No. 4 (4.7), conforming to the requirements of Specification E 11.

3.8 *Mixing Tools*—Miscellaneous tools uch as mixing pan, spoon, trowel, spatula, tc., or a suitable mechanical device for thoroughly mixing the sample of soil with increnents of water.

Procedure

4.1 *Specimen Preparation*—Select a representative portion of quantity adequate to provide, after sieving, an amount of material weighing as follows: Methods A—25 lb (11 kg); Methods B, C, and D—50 lb (23 kg). Prepare specinens in accordance with either 4.1.1 through 4.1.3 or 4.1.4.

4.1.1 *Dry Preparation Procedure*—If the sample is too damp to be friable, reduce the moisture ontent by drying until the material is friable; see 4.1.2 Drying may be in air or by the use of a rying apparatus such that the temperature of e sample does not exceed 140°F (60°C). After rying (if required), thoroughly break up the ggregations in such a manner as to avoid reducg the natural size of the particles. Pass the aterial through the specified sieve as follows: lethods A and B—No. 4 (4.75-mm); Methods and D—¾-in. (19.0-mm). Correct for oversize aterial in accordance with Section 5, if Method is specified.

4.1.2 Whenever practicable, soils classified as IL, CL, OL, GC, SC, MH, CH, OH and PT by est Method D 2487 shall be prepared in accordnce with 4.1.4.

4.1.3 Prepare a series of at least four specions by adding increasing amounts of water to ch sample so that the moisture contents vary approximately 1½ %. The moisture contents lected shall bracket the optimum moisture content, thus providing specimens which, when comcted, will increase in mass to the maximum nsity and then decrease in density (see 7.2 and 3). Thoroughly mix each specimen to ensure en distribution of moisture throughout and en place in a separate covered container and ow to stand prior to compaction in accordance th Table 2. For the purpose of selecting a nding time, it is not required to perform the tual classification procedures described in Test ethod D 2487 (except in the case of referee basis for classifying the sample.

4.1.4 *Moist Preparation Method*—The following alternate procedure is recommended for soils classified as ML, CL, OL, GC, SC, MH, CH, OH and PT by Test Method D 2487. Without previously drying the sample, pass it through the ¾-in. (19.0-mm) and No. 4 (4.75-mm) sieves. Correct for oversize material in accordance with Section 5, if Method D is specified. Prepare a series of at least four specimens having moisture contents that vary by approximately 1½ %. The moisture contents selected shall bracket the optimum moisture content, thus providing specimens which, when compacted, will increase in mass to the maximum density and then decrease in density (see 7.2 and 7.3). To obtain the appropriate moisture content of each specimen, the addition of a predetermined amount of water (see 4.1.3) or the removal of a predetermined amount of moisture by drying may be necessary. Drying may be in air or by the use of a drying apparatus such that the temperature of the specimen does not exceed 140°F (60°C). The prepared specimens shall then be thoroughly mixed and stand, as specified in 4.1.3 and Table 2, prior to compaction.

NOTE 3—With practice, it is usually possible to visually judge the point of optimum moisture closely enough so that the prepared specimens will bracket the point of optimum moisture content.

4.2 *Specimen Compaction*—Select the proper compaction mold, in accordance with the method being used, and attach the mold extension collar. Compact each specimen in five layers of approximately equal height. Each layer shall receive 25 blows in the case of the 4-in. (101.6-mm) mold; each layer shall receive 56 blows in the case of the 6-in. (152.4-mm) mold. The total amount of material used shall be such that the fifth compacted layer is slightly above the top of the mold, but not exceeding ¼ in. (6 mm). During compaction the mold shall rest on a uniform rigid foundation, such as provided by a cylinder or cube of concrete weighing not less than 200 lb (91 kg).

4.2.1 In operating the manual rammer, care shall be taken to avoid rebound of the rammer from the top end of the guidesleeve.

within 5 deg of the vertical. The blows shall be applied at a uniform rate not exceeding approximately 1.4 s per blow and in such a manner as to provide complete and uniform coverage of the specimen surface.

4.2.2 *Mold Sizes*—The mold size used shall be as follows: Method A, 4-in. (101.6-mm); Methods B, C, and D 6-in. (152.4-mm).

4.2.3 Following compaction, remove the extension collar; carefully trim the compacted specimen even with the top of the mold by means of the straightedge and determine the mass of the specimen. Divide the mass of the compacted specimen and mold, minus the mass of the mold, by the volume of the mold (see 3.1.3). Record the result as the wet density, γ_m, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen.

4.2.4 Remove the material from the mold. Determine moisture content in accordance with Method D 2216, using either the whole compacted specimen or alternatively a representative specimen of the whole specimen. The whole specimen must be used when the permeability of the compacted specimen is high enough so that the moisture content is not distributed uniformly throughout. If the whole specimen is used, break it up to facilitate drying. Obtain the representative specimen by slicing the compacted specimen axially through the center and removing 100 to 500 g of material from one of the cut faces.

4.2.5 Repeat 4.2 through 4.2.4 for each specimen prepared.

5. Oversize Corrections

5.1 If 30 % or more of the sample is retained on a ¾-in. (19.0-mm) sieve, then none of the methods described under these methods shall be used for the determination of either maximum density or optimum moisture content.

5.2 *Methods A and B*—The material retained on the No. 4 (4.75-mm) sieve is discarded and no oversize correction is made. However, it is recommended that if the amount of material retained is 7 % or greater, Method C be used instead.

5.3 *Method C*—The material retained on the ¾-in. (19.0-mm) sieve is discarded and no oversize correction is made. However, if greater, it is recommende Method D be used instead.

5.4 *Method D:*

5.4.1 This method shall not be used unless the amount of material retained on the ¾-in. (19.0-mm) sieve is 10 % or greater. When the amount of material retained on the ¾-in. sieve is less than 10 %, use Method C.

5.4.2 Pass the material retained on the ¾-in. (19.0-mm) sieve through a 3-in. or 75-mm sieve. Discard the material retained on the 3-in. sieve. The material passing the 3-in. sieve and retained on the ¾-in. sieve shall be replaced with an equal amount of material passing a ¾-in. sieve and retained on a No. 4 (4.75-mm) sieve. The material for replacement shall be taken from an unused portion of the sample.

6. Calculations

6.1 Calculate the moisture content and the dry density of each compacted specimen as follows:

$$w = [(A - B)/(B - C)] \times 100$$

and

$$\gamma_d = [\gamma_m/(w + 100)] \times 100$$

where:

w = moisture content in percent of the compacted specimens,
A = mass of container and moist specimen,
B = mass of container and oven-dried specimen,
C = mass of container,
γ_d = dry density, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen, and
γ_m = wet density, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen.

7. Moisture-Density Relationship

7.1 From the data obtained in 6.1, plot the dry density values as ordinates with corresponding moisture contents as abscissas. Draw a smooth curve connecting the plotted points Also draw a curve termed the "curve of complete saturation" or "zero air voids curve" on this plot. This curve represents the relationship between dry and corresponding moisture contents w the voids are completely filled with water Values of dry density and nd No. 4 (4.7), conforming to the requirements of ication E 11.

3.8 *Mixing* *ls*—Miscellaneous tools uch as mixing pan, spoon, trowel, spatula, tc., or a suitable mechanical device for thorughly mixing the sample of soil with increments of water.

Procedure

4.1 *Specimen Preparation*—Select a repreentative portion of quantity adequate to proide, after sieving, an amount of material weighng as follows: Methods A—25 lb (11 kg); Methds B, C, and D—50 lb (23 kg). Prepare specinens in accordance with either 4.1.1 through .1.3 or 4.1.4.

4.1.1 *Dry Preparation Procedure*—If the samle is too damp to be friable, reduce the moisture ontent by drying until the material is friable; see .1.2. Drying may be in air or by the use of a rying apparatus such that the temperature of e sample does not exceed 140°F (60°C). After rying (if required), thoroughly break up the ggregations in such a manner as to avoid reducg the natural size of the particles. Pass the aterial through the specified sieve as follows: ethods A and B—No. 4 (4.75-mm); Methods and D—¾-in. (19.0-mm). Correct for oversize aterial in accordance with Section 5, if Method is specified.

4.1.2 Whenever practicable, soils classified as L, CL, OL, GC, SC, MH, CH, OH and PT by est Method D 2487 shall be prepared in accordnce with 4.1.4.

4.1.3 Prepare a series of at least four speciens by adding increasing amounts of water to ch sample so that the moisture contents vary approximately 1½ %. The moisture contents lected shall bracket the optimum moisture connt, thus providing specimens which, when comcted, will increase in mass to the maximum nsity and then decrease in density (see 7.2 and 3). Thoroughly mix each specimen to ensure en distribution of moisture throughout and en place in a separate covered container and ow to stand prior to compaction in accordance th Table 2. For the purpose of selecting a nding time, it is not required to perform the tual classification procedures described in Test ethod D 2487 (except in the case of referee testing, if previous data exist which provide a basis for classifying the sample.

4.1.4 *Moist Preparation Method*—The following alternate procedure is recommended for soils classified as ML, CL, OL, GC, SC, MH, CH, OH and PT by Test Method D 2487. Without previously drying the sample, pass it through the ¾-in. (19.0-mm) and No. 4 (4.75-mm) sieves. Correct for oversize material in accordance with Section 5, if Method D is specified. Prepare a series of at least four specimens having moisture contents that vary by approximately 1½ %. The moisture contents selected shall bracket the optimum moisture content, thus providing specimens which, when compacted, will increase in mass to the maximum density and then decrease in density (see 7.2 and 7.3). To obtain the appropriate moisture content of each specimen, the addition of a predetermined amount of water (see 4.1.3) or the removal of a predetermined amount of moisture by drying may be necessary. Drying may be in air or by the use of a drying apparatus such that the temperature of the specimen does not exceed 140°F (60°C). The prepared specimens shall then be thoroughly mixed and stand, as specified in 4.1.3 and Table 2, prior to compaction.

NOTE 3—With practice, it is usually possible to visually judge the point of optimum moisture closely enough so that the prepared specimens will bracket the point of optimum moisture content.

4.2 *Specimen Compaction*—Select the proper compaction mold, in accordance with the method being used, and attach the mold extension collar. Compact each specimen in five layers of approximately equal height. Each layer shall receive 25 blows in the case of the 4-in. (101.6-mm) mold; each layer shall receive 56 blows in the case of the 6-in. (152.4-mm) mold. The total amount of material used shall be such that the fifth compacted layer is slightly above the top of the mold, but not exceeding ¼ in. (6 mm). During compaction the mold shall rest on a uniform rigid foundation, such as provided by a cylinder or cube of concrete weighing not less than 200 lb (91 kg).

4.2.1 In operating the manual rammer, care shall be taken to avoid rebound of the rammer from the top end of the guidesleeve. 5 deg of the vertical. The blows shall be applied at a uniform rate not exceeding approximately 1.4 s per blow and in such a manner as to provide complete and uniform coverage of the specimen surface.

4.2.2 *Mold Sizes*—The mold size used shall be as follows: Method A, 4-in. (101.6-mm); Methods B, C, and D 6-in. (152.4-mm).

4.2.3 Following compaction, remove the extension collar; carefully trim the compacted specimen even with the top of the mold by means of the straightedge and determine the mass of the specimen. Divide the mass of the compacted specimen and mold, minus the mass of the mold, by the volume of the mold (see 3.1.3). Record the result as the wet density, γ_m, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen.

4.2.4 Remove the material from the mold. Determine moisture content in accordance with Method D 2216, using either the whole compacted specimen or alternatively a representative specimen of the whole specimen. The whole specimen must be used when the permeability of the compacted specimen is high enough so that the moisture content is not distributed uniformly throughout. If the whole specimen is used, break it up to facilitate drying. Obtain the representative specimen by slicing the compacted specimen axially through the center and removing 100 to 500 g of material from one of the cut faces.

4.2.5 Repeat 4.2 through 4.2.4 for each specimen prepared.

5. Oversize Corrections

5.1 If 30 % or more of the sample is retained on a ¾-in. (19.0-mm) sieve, then none of the methods described under these methods shall be used for the determination of either maximum density or optimum moisture content.

5.2 *Methods A and B*—The material retained on the No. 4 (4.75-mm) sieve is discarded and no oversize correction is made. However, it is recommended that if the amount of material retained is 7 % or greater, Method C be used instead.

5.3 *Method C*—The material retained on the ¾-in. (19.0-mm) sieve is discarded and no oversize correction is made. However, if [illegible], it is recommended [illegible] Method [illegible] used instead.

5.4 *Method D:*

5.4.1 This method shall not be used unless the amount of material retained on the ¾-in. (19.0-mm) sieve is 10 % or greater. When the amount of material retained on the ¾-in. sieve is less than 10 %, use Method C.

5.4.2 Pass the material retained on the ¾-in. (19.0-mm) sieve through a 3-in. or 75-mm sieve. Discard the material retained on the 3-in. sieve. The material passing the 3-in. sieve and retained on the ¾-in. sieve shall be replaced with an equal amount of material passing a ¾-in. sieve and retained on a No. 4 (4.75-mm) sieve. The material for replacement shall be taken from an unused portion of the sample.

6. Calculations

6.1 Calculate the moisture content and the dry density of each compacted specimen as follows:

$$w = [(A - B)/(B - C)] \times 100$$

and

$$\gamma_d = [\gamma_m/(w + 100)] \times 100$$

where:

w = moisture content in percent of the compacted specimens,

A = mass of container and moist specimen,

B = mass of container and oven-dried specimen,

C = mass of container,

γ_d = dry density, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen, and

γ_m = wet density, in pounds per cubic foot (or kilograms per cubic metre) of the compacted specimen.

7. Moisture-Density Relationship

7.1 From the data obtained in 6.1, plot the dry density values as ordinates with corresponding moisture contents as abscissas. Draw a smooth curve connecting the plotted points. Also draw a curve termed the "curve of complete saturation" or "zero air voids curve" on this plot. This curve represents the relationship between dry density and corresponding moisture contents when the voids are completely filled with water. Values of dry density and corresponding moisture contents for plotting the curve of complete saturation can be computed using the following equation:

$$w_{sat} = [(62.4/\gamma_d) - (1/G_s)] \times 100$$

where,

w_{sat} = moisture content in percent for complete saturation,

γ_d = dry density in pounds per cubic foot (or kilograms per cubic metre),

G_s = specific gravity of the material being tested (see Note 4), and

62.4 = density of water in pounds per cubic foot (or kilograms per cubic metre).

NOTE 4—The specific gravity of the material can either be assumed or based on the weighted average values of: (*a*) the specific gravity of the material passing the No. 4 (4.75-mm) sieve in accordance with Test Method D 854; and (*b*) the apparent specific gravity of the material retained on the No. 4 (4.75-mm) sieve in accordance with Test Method C 127.

7.2 *Optimum Moisture Content,* w_o—The moisture content corresponding to the peak of the curve drawn as directed in 7.1 shall be termed the "optimum moisture content."

7.3 *Maximum Density*, γ_{max}—The dry density in pounds per cubic foot (or kilograms per cubic metre) of the sample at "optimum moisture content" shall be termed "maximum density."

8. Report

8.1 The report shall include the following:

8.1.1 Method used (Method A, B, C, or D).

8.1.2 Optimum moisture content.

8.1.3 Maximum density.

8.1.4 Description of rammer (whether manual or mechanical).

8.1.5 Description of appearance of material used in test, based on Practice D 2488 (Test Method D 2487 may be used as an alternative).

8.1.6 Origin of material used in test.

8.1.7 Preparation procedure used (moist or dry).

9. Precision

9.1 Criteria for judging the acceptability of the maximum density and optimum moisture content test results are given in Table 3. The standard deviation *s* is calculated from the equation:

$$s^2 = \frac{1}{n-1}\sum_{1}^{n}(x - \bar{x})^2$$

where:

n = number of determinations;

x = individual value of each determination; and

$\bar{x}$ = numerical average of the determinations.

9.2 Criteria for assigning standard deviation values for single-operator precision are not available at the present time.

TABLE 1 Volume of Water per Gram based on Temperature[A]

Temperature, °C (°F)	Volume of Water, ml/g
12 (53.6)	1.00048
14 (57.2)	1.00073
16 (60.8)	1.00103
18 (64.4)	1.00138
20 (68.0)	1.00177
22 (71.6)	1.00221
24 (75.2)	1.00268
26 (78.8)	1.00320
28 (82.4)	1.00375
30 (86.0)	1.00435
32 (89.6)	1.00497

[A] Values other than shown may be obtained by referring to the *Handbook of Chemistry and Physics*, Chemical Rubber Publishing Co., Cleveland, OH.

TABLE 2 Dry Preparation Method—Standing Times

Classification D 2487	Minimum Standing Time, h
GW, GP, SW, SP	no requirement
GM, SM	3
ML, CL, OL, GC, SC	18
MH, CH, OH, PT	36

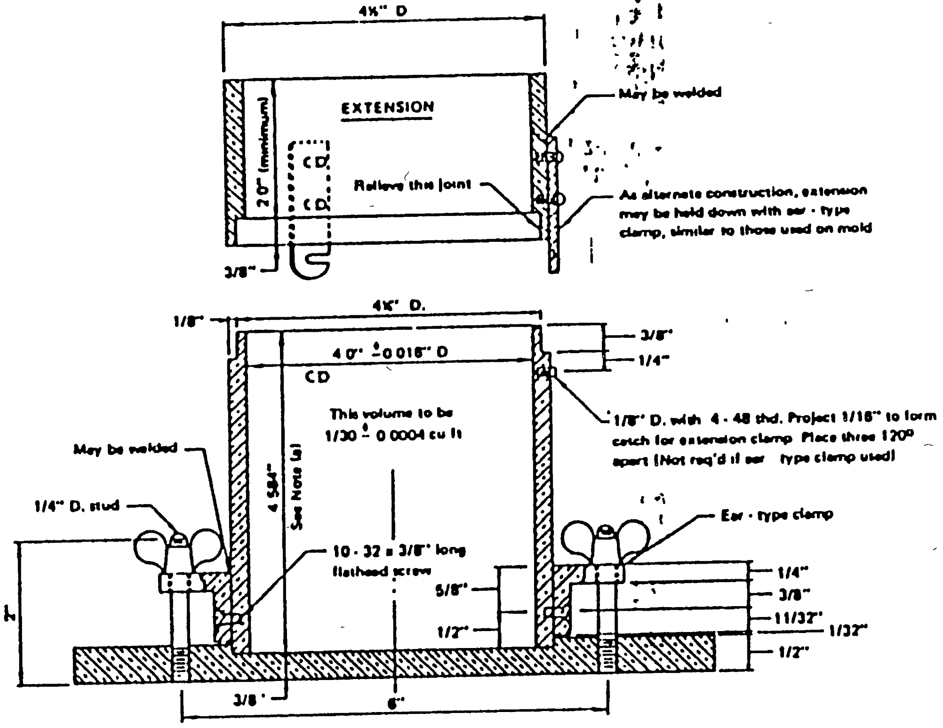
TABLE 3 Precision

	Standard Deviation, *s*	Acceptable Range of Two Results, Expressed as Percent of Mean Value[A]
Single-operator precision:		
Maximum density	...	1.9
Optimum moisture content	...	9.5
Multilaboratory precision:		
Maximum density	±1.66	4.0
Optimum moisture content	±0.86	15.0

[A] This column indicates a limiting range of values which should not be exceeded by the difference between any two results, expressed as a percentage of the average value. In cooperative test programs it has been determined that 95 % of the tests do not exceed the limiting acceptable ranges shown below. All values shown in this table are based on average test results from a variety of different soils and are subject to future revision.

TABLE 4 Metric Equivalents for Figs. 1 and 2

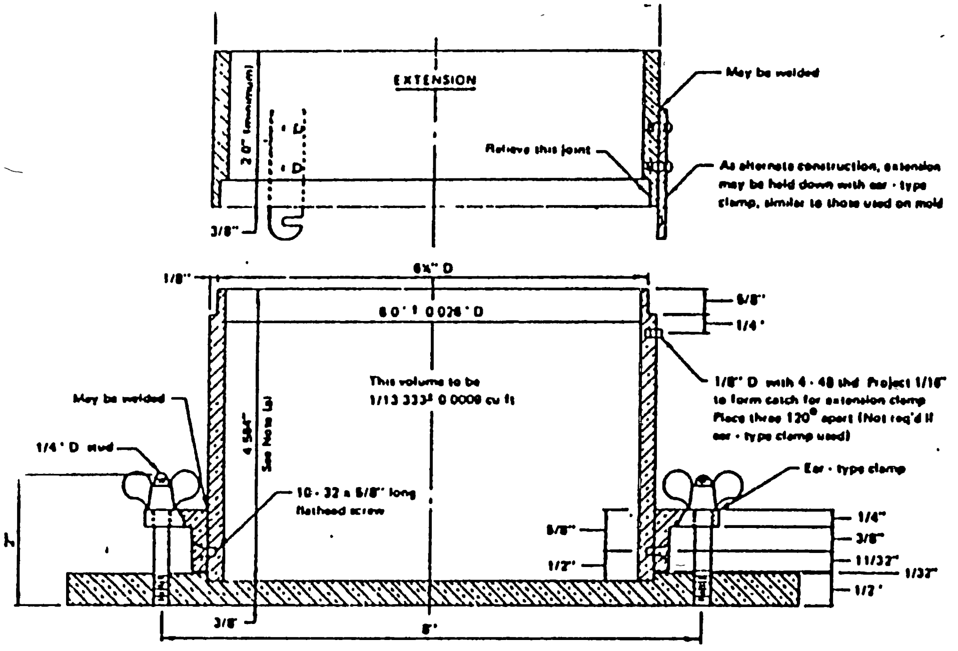
in.	mm
0.016	0.41
0.026	0.66
1/32	0.8
1/16	1.6
1/8	3.2
1/4	6.4
11/32	8.7
3/8	9.5
1/2	12.7
5/8	15.9
2	50.8
2 1/2	63.5
4	101.6
4 1/4	108.0
4 1/2	114.3
4.584	116.43
6	152.4
6 1/2	165.1
8	203.2
ft³	**cm³**
1/30	944
0.0004	11
1/13.33	2124
0.0009	25



NOTE 1—The tolerance on the height is governed by the allowable volume and diameter tolerances.

NOTE 2—The methods shown for attaching the extension collar to the mold and the mold to the base plate are recommended. However, other methods are acceptable, providing the attachments are equally as rigid as those shown.

FIG. 1 Cylindrical Mold, 4.0-in. for Soil Tests (see Table 4 for metric equivalents).



NOTE 1 – The tolerance on the height is governed by the allowable volume and diameter tolerances.

NOTE 2 – The methods shown for attaching the extension collar to the mold and the mold to the base plate are recommended. However, other methods are acceptable, providing the attachments are equally as rigid as those shown.

FIG. 2 Cylindrical Mold, 6.0-in. for Soil Tests (see Table 4 for metric equivalents).

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, Pa. 19103.

Standard Test Method for
MOISTURE CONTENT PENETRATION RESISTANCE RELATIONSHIPS OF FINE-GRAINED SOILS[1]

This standard is issued under the fixed designation D 1558; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method is for establishing the moisture-penetration resistance relationships of fine-grained soils as determined by the soil penetrometer.

1.2 The values stated in inch-pound units are to be regarded as the standard.

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Applicable Documents

2.1 *ASTM Standards:*

D 698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop[2]

D 2216 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures[2]

E 380 Metric Practice[3]

3. Significance and Use

3.1 This test method is used with Methods A and B of Test Methods D 698 to develop relationships between moisture content, density, and penetration resistance. These relationships are used with a previously prepared family of moisture-penetration curves as a rapid field test to determine the approximate amount of moisture in the soil.

NOTE 1—When a penetration-resistance measu ment of material in place is compared at a given m ture content with penetration-density curves prep at a specified compactive effort, an approximate ch of compaction (density) may be obtained.

3.2 Penetration resistance determinations not reliable for very dry molded soil specim or very granular soils.

4. Apparatus

4.1 *Moisture-Density Apparatus*, conform to the requirements prescribed in Test Meth D 698.

4.2 *Soil Penetrometer*—A soil penetrome (Fig. 1) consisting of a special spring dynamo eter with pressure indicating scale on the stem the handle. The pressure scale shall be gradua to 90 lb in 2-lb divisions with a line encircl the stem at each 10-lb interval, or graduate 40 kg in 1-kg divisions with a line encircling stem at each 5-kg interval. A sliding ring on stem shall indicate the maximum pressure tained in the test.

4.3 *Set of Penetrometer Needles*—Each pe trometer needle (Fig. 1) shall consist of a sh with a head of known end area. The set interchangeable needles shall include the s given in Table 1 The needle shank shall h graduations inscribed at intervals of ½ in.

---

[1] This test method is under the jurisdiction of ASTM mittee D-18 on Soil and Rock and is the direct responsibili Subcommittee D18.0 on Special and Construction Co Tests.

Current edition approved May 25, 1984. Published 1984. Originally published as D 1558 – 58. Last previous ed D 1558 – 71 (1977)

[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 14.02. Excerp all volumes

SURFACE IMPOUNDMENT CLOSURE PLAN

FOR

AVCO LYCOMING TEXTRON

STRATFORD ARMY ENGINEERING PLANT

STRATFORD, CONNECTICUT 06497

SEPTEMBER 1987

Appendix I-5

DEP/EPA Approval of Surface Impoundment Closure Plan

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

April 5, 1988

APR 07 1988

APPROVAL

Mr. John Fleming, Chief
Environmental Compliance
Avco Lycoming Textron
550 Main Street
Stratford, Conn. 06497-2452

Re: Approval of Closure/Post Closure Plans for surface impoundments Avco Lycoming Textron CTD001181502

Dear Mr. Fleming:

The closure/post-closure plans dated September 1987 as amended September 30, 1987, January 5, 1988 and February 24, 1988 prepared for Avco Lycoming by Metcalf & Eddy, Inc. have been reviewed by the Connecticut Department of Environmental Protection (DEP) and the U.S. Environmental Protection Agency (EPA), Region 1.

The DEP and EPA have determined that these plans comply with the closure/post closure requirements pursuant to section 22a-449(c)-29 of the regulations of Connecticut State Agencies and with Title 40 Part 265 Subparts G, K and N of the Code of Federal Regulations. Both agencies hereby approve the plans as modified by Attachment A.

Avco Lycoming Textron shall contact the DEP and the EPA for their review of the following closure/post-closure plan events at least 14 days prior to their implementation:

A. Prior to conducting verification soil and berm sampling;

B. Prior to placement of the Cap; and

C. Prior to final certification.

All work shall be subject to the review of the DEP and the EPA. They shall decide all questions as to interpretations of approved plans and specifications.

The Regional Administrator of the EPA and Commissioner of DEP may authorize changes to the approved closure/post-closure plans upon written request pursuant to 40 CFR 265.112(c) and 265.118(d), respectively.

This approval does not constitute approval of the groundwater monitoring program implemented pursuant to section 22a-449(c)-28 of Connecticut's Hazardous Waste Management Regulations or 40CFR 265 Subpart F.

This approval does not relieve the facility of the obligation to obtain any other authorizations as may be required by other provisions of the Connecticut General Statutes, Regulations of Connecticut State Agencies, Code of Federal Regulations, or Federal Statutes.

Sincerely,

Stephen W. Hitchcock

Stephen W. Hitchcock, Director
Hazardous Materials Management Unit
Connecticut Department of Environmental Protection

Patricia L. Meaney for

Merrill S. Hohman Director
Waste Management Division
Region I
U.S. Environmental Protection Agency

attachment

cc: Robert Leger - USEPA
Kenneth Feathers - CTDEP

ATTACHMENT "A"

Modifications to Closure/Post-Closure Plans
AVCO-LYCOMING, Stratford
EPA I.D.# CTD001181502

1.) Page 4-8 paragraph 2 of the closure plan dated September 1987 is modified to read as follows:

Analyses of soil samples will be conducted by an EPA and DEP certified laboratory. All soil samples will be analyzed according to the methods presented in Table 4.1. The corrective action limits for contaminated soil removal will be health and environmental based standards or background for all exposure pathways. The leachate extraction procedure will be used for the groundwater pathway and mass analysis for the direct ingestion pathway. Any contaminated soil left in place will be closed as a landfill per section 265.310 of 40 CFR.

2.) Page 4-9 paragraph 1 of the closure plan dated September 1987 is revised to read as follows:

TABLE 4.1 Analytic Methods for Confirmation Soil Sampling

Analysis	Method
Aromatic Volatile Organics	Method 5030/8020(1)
Halogenated Volatile Organics	Method 5030/8010(1)
Total Leachate Cyanide	Insoluble organic extraction(2) Cyanide distillation Method 9019(1)
Arsenic	Extraction Method 1310(1)
Barium	Extraction Method 1310(1)
Cadmium	Extraction Method 1310(1)
Chromium	Extraction Method 1310(1)

ATTACHMENT "A"
Modifications to Closure/Post-Closure Plans
AVCO-LYCOMING, Stratford
EPA I.D.# CTD001181502

Lead	Extraction Method 1310(1)
Mercury	Extraction Method 1310(1)
Nickel	Extraction Method 1310(1)
Selenium	Extraction Method 1310(1)
Silver	Extraction Method 1310(1)
Hexavalent-Chromium	Extraction Method 1310(3)

1. Test Methods for Evaluating Solid Waste, USEPA, DSW, SW-846, third edition, September 1986.
2. Standard Methods for the Evaluation of Water and Wastewater, 16th, edition, p. 329, Cyanide in Solid Waste, b. Insoluble Cyanide.
3. Using EP toxicity test without acetic acid adjustment.

3.) Page 4-7 paragraph 3 and page 4-8 paragraph 1 are modified as follows:

Four samples, randomly selected, one from the floor of each of the surface impoundments and the equalization basin will be taken and analyzed for constituents listed in table 4.1 to comply with the requirements of section 265.119 of 40CFR. Samples will also be taken from the wall of the excavation. It is assumed that because of downward and lateral contaminant migration in the unsaturated zone, more contamination will be present in lower portions of the excavation. As a result, confirmation soil sampling will take place along an imaginary horizontal line located at one-third of the total excavation depth as measured from the bottom of the excavation. In each excavation, samples will be obtained at 35 foot intervals along that horizontal line. It has been assumed that the distribution of wastes within all the surface impoundments is fairly uniform over the long period of disposal, but to address the possibility for some waste segregation the 35 foot sampling interval was selected. This interval will produce a minimum of 21 confirmation samples from the 3 sludge lagoons and a minimum of 18 confirmation samples from the equalization lagoon. Considering a hazardous waste occupying only approximately 10 percent of the total area, the proposed sampling density would have a 90 percent probability of detecting a randomly located hazardous waste (Benson et. al., 1982).

Although differing rates of contaminant migration will affect the depth of penetration, the uniform distribution of waste in these surface impoundments is considered the controlling factor..

Additional soil sampling will take place at "hot spot" locations identified by either visual inspection or OVA screening. The soil sampling and decontamination procedures are outlined in Appendix B of this document.

4.) Page 4-10 paragraph 1 & 2 of the closure plan dated September 1987 are revised to read as follows:

1) Flush pipes at least once with water; 2) verify that there are not combustible gases in the pipe, and if gases are detected, the pipeline should be force-aerated or made inert with carbon dioxide or dry ice; 3) cut the pipe into sections similar to the length of transfer trucks, and 4) store on a 6 mil thick polyethylene ground cover which has been bermed or diked to control 25 yr.- 24 hr. storm run-off and run-on. The pipes will be covered with polyethylene at all times except as necessary to store or remove piping. Most of the piping lies under dirt and thus the surface will not require any special rehabilitation. The 10 inch effluent force main, however, lies under a parking lot which will require patching of the pavement after removal.

The pump station is approximately 70 square feet, 15 feet deep, and constructed of concrete block. The pump station, pump and other appurtenances will be removed and stored on a polyethylene ground cover. To address the possibility for contamination in the pipe trench, confirmation soil samples will be taken from the bottom of the trench at 50-foot intervals along the entire length of the trench. The soil sampling and decontamination procedures are outlined in Appendix B of this document.

5.) Page 4-12 paragraph 1 of the closure plan dated September 1987 is revised to read as follows:

If roll-off boxes are selected for temporary storage of the filter cake, they should have a total capacity of 600 cu. yd. This will allow for ample storage space should logistical problems develop while removing and dewatering the contaminated material. Roll off boxes are available in a variety of sizes and capacities. Typical roll off box dimensions adequate for filter cake storage would be 90 inches in height, 22 feet in length, 90 inches in width, with a capacity of 45.6 cu. yd. All roll-off boxes will contain a synthetic liner to prevent liquid leakage. Tops for the roll off boxes are also necessary. Therefore the contractor should make arrangements to have an adequate number of roll off boxes on site for the temporary storage.

ATTACHMENT "A"
Modifications to Closure/Post-Closure Plans
AVCO-LYCOMING, Stratford
EPA I.D.# CTD001181502

6.) Page 7-2, paragraph 2, is modified to read as follows:

The existing groundwater monitoring system at Avco is made up of 13 monitoring wells, see Figure 5.1. It is likely that during the soils excavation, monitoring wells 1,2,3,5 and the well point may be damaged or destroyed. "As part of construction of the final cap, wells 1,3, and 5 will be replaced outside the limit of the landfill cap with three two - well clusters consisting of a well screened at the water table and a well screened at the same elevation as the previous well. The objective will be to make little or no changes in the well locations for the deeper wells so that the time series of groundwater remains comparable with past data.

Appendix I-6

VFL Technology Corporation Certification of Closure

Schatz
& Schatz,
Ribicoff
& Kotkin
Attorneys at Law

90 State House Square
Suite 900
Hartford, CT 06103-3902
(203) 522-3234
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Bridgeport, CT 06604-4278
(203) 368-4500

Cable: Barrister
Telex (Hartford and Stamford)
99364 (CEOHFD)

Riva Posner
(203) 722-1448

September 11, 1990

Ms. Julie Belaga
Regional Administrator
Region 1
U.S. Environmental Protection Agency
J.F. Kennedy Federal Building
Boston, MA 02203-2211

Re: Avco Corporation, Textron Lycoming Division - Stratford Army Engine Plant, Stratford, Connecticut - Project No. FY82/01B, Surface Impoundment Closure EPA Id. No. CTD001181502

Dear Ms. Belaga:

Enclosed please find a corrected and executed Engineer's Certification of Closure as regards the above referenced matter. This corrected form was requested by Ms. Rona Julian of the E.P.A., who was doing a preliminary review of the file. This corrected certification should be filed with the closure documentation forwarded to you at an earlier date.

If you have any questions regarding this matter, please do not hesitate in contacting me.

Very truly yours,

SCHATZ & SCHATZ,
RIBICOFF & KOTKIN

Riva Posner

Enclosure
cc: Alan Gibson, U.S. Army
Larry O'Connell, Esq., Textron
John S. Fleming, Ph.D., Textron
[redacted]

ENGINEER'S CERTIFICATION OF CLOSURE

I, Alexander J. Fazzini, being a duly licensed Professional Engineer registered in the State of Massachusetts, and I, John S. Fleming, Chief Environmental Engineer of Avco Corporation, Textron Lycoming Division do hereby certify that the hazardous waste disposal unit of Avco Corporation, Textron Lycoming Division located in Stratford, Connecticut, to the best of our knowledge and belief, has been closed in accordance with the specifications in the approved closure plan of March, 1988.

Signature: Alexander J. Fazzini Date: 9/5/90
Alexander J. Fazzini

Business Address:
VFL Technology Corporation
42 Lloyd Avenue
Malvern, PA 19355

Business Telephone: (215) 296-2233

Engineer License No. 33428 civil

State of Issue: Massachusetts - Expiration date 6/30/92

Subscribed and sworn before me this 5 day of [illegible] ~~August~~, 1990.

~~Commissioner of the Superior Court~~
Notary Public
My Commission expires [illegible]

****

Signature: John S. Fleming Date: 8/29/90
John S. Fleming

Business Address:
Avco Corporation
Textron Lycoming Division
550 Main Street
Stratford, CT 06497

Business Telephone: (203) 385-2000

Subscribed and sworn before me this 29 day of August, 1990.

~~Commissioner of the Superior Court~~
Notary Public
My Commission expires March 30, 1995

rp128

Appendix I-7

Minor Departures from Approved Closure Plan

VFL TECHNOLOGY CORPORATION
42 LLOYD AVENUE • MALVERN, PENNSYLVANIA 19355 • (215) 296-2233

November 15, 1988

Textron Lycoming
550 Main Street
Stratford, CT 06497-2452

Attn: Ms. Donna Ashford
Plant Engineering

Subj: TL P.O. No. H236208
VFL Project No. C-2260
Stabilization Work

Dear Donna:

Textron Lycoming's Corporate Purchasing Department has directed VFL Technology to submit to Textron Lycoming Plant Engineering design mix information. This design mix information is for the in-situ stabilization of Lagoons 2, 3, and 4 subsurface conditions. Purchasing has directed that VFL obtain your review and approval for contract records. Enclosed are two copies of this information. Please return one signed copy to either our home or field office. Your cooperation and support is appreciated.

Very truly yours,

James P. Hopkins
James P. Hopkins, P.E.
Vice President Project Management

JPH/al

Enclosure

cc: E. Duggan, TL
J. Landis, VFL
L. Ruggiano, VFL

TEXTRON LYCOMING - STRATFORD, CONNECTICUT

SUBGRADE STABILIZATION

Based upon the following test samples:

P-1	Average Composite Conditions	51% Solids
P-2	Worst Case Composite	25% Solids

	STRENGTH (TSF)	
	P-1	P-2
15% Cement (2 Days)	4.5	.75
15% Cement (3 Days)	-	1.5
15% Cement (7 Days)	-	4.5

Based upon this testing, 15% cement minimum is to be required. Cement ratio may be increased for P-2 type material if necessary for improved cure/accessibility. Actual design decisions by field personnel.

Submitted James P Hopkins

JAMES P. HOPKINS
VFL TECHNOLOGY CORPORATION

Accepted ______________________________

TEXTRON LYCOMING

VFL TECHNOLOGY CORPORATION

42 LLOYD AVENUE • MALVERN, PENNSYLVANIA 19355 • (215) 296-2233

October 11, 1988

Ms. Donna Ashford
Plant Engineering
Textron Lycoming
550 Main Street
Stratford, CT 06497-2452

Subject: Textron Lycoming
Purchase Order No. H236208
VFL Project No. C2260

Dear Donna:

Attached are the washed sieve analyses of fill material for the referenced project. Please excuse the delay in forwarding.

Very truly yours,

James Hopkins

James P. Hopkins, P.E.
Vice President Project Management

JPH/tg

cc: Mr. J. R. Landis/VFL

Attachments (2)

SECURING OUR ENVIRONMENT THROUGH COMPREHENSIVE WASTE MANAGEMENT SERVICES

TEXTRON LYCOMING - STRATFORD, CONNECTICUT

SUBGRADE STABILIZATION

Based upon the following test samples:

P-1	Average Composite Conditions	51% Solids
P-2	Worst Case Composite	26% Solids

	STRENGTH (TSF)	
	P-1	P-2
15% Cement (2 Days)	4.5	.75
15% Cement (3 Days)	-	1.5
15% Cement (7 Days)	-	4.5

Based upon this testing, 15% cement minimum is to be required. Cement ratio may be increased for P-2 type material if necessary for improved cure/accessibility. Actual design decisions by field personnel.

Submitted James P. Hopkins
JAMES P. HOPKINS
VFL TECHNOLOGY CORPORATION

Accepted ______________________
TEXTRON LYCOMING

MATERIALS TESTING, INC.

100 RATON DRIVE • MILFORD, CONNECTICUT 06460 • (203) 878-2765
CHAPMAN ROAD • MARLBOROUGH, CONNECTICUT 06424 • (203) 295-0330

DATE 8-16-88

REPORT NO. S-1000

CLIENT VFL Technology Corp.
Station Square 3
Suite 206
Paoli, Pa. 19302

PROJECT Surface Impoundment Closure
Project #fY 82/01B
Stratford Army Engine Plant

SUBJECT WASHED SIEVE ANALYSIS

MATERIAL: BANK RUN GRAVEL
SOURCE: BUTTERWORTH CONSTRUCTION-ACCESS & SPERRY ROAD- STRATFORD,
SAMPLED BY MATERIALS TESTING, INC., ON 8-10-88

SIEVE SIZE	PERCENT PASSING	SPECIFICATION
3"	100	100
2"	100	
1½"	86.3	
1"	86.3	
3/4"	81.9	
1/2"	77.0	
3/8"	75.3	
1/4"	73.4	
#10	66.5	
#20	56.0	
#40	37.1	
#100	17.6	
#200	7.0	0-10

THE ABOVE TEST RESULT MEETS THE REQUIRED GRADING.

MATERIALS TESTING, INC.

Frank A. Soucy

FRANK A. SOUCY

2cc client
1cc Butterworth Construction

ED AUG 29 1988

MATERIALS TESTING, INC.

100 RATON DRIVE • MILFORD, CONNECTICUT 06460 • (203) 878-2765
CHAPMAN ROAD • MARLBOROUGH, CONNECTICUT 06424 • (203) 295-0330

CLIENT VFL Technology Corp.
Station Square 3
Suite 206
Paoli, Pa 19301

DATE 8-19-88

REPORT NO. S-1001

PROJECT Surface Impoundment Closure
Project #FY 82/01B
Stratford Army Engine Plant

SUBJECT WASHED SIEVE ANALYSIS

MATERIAL: FINE AGGREGATE (SAND)
SOURCE: O & G INDUSTRIES - SHELTON SAND
SAMPLED BY MATERIALS TESTING, INC., ON 8-18-88 FROM
BOSWICK AVENUE - BRIDGEPORT, CT

SIEVE SIZE	PERCENT PASSING	ASTMC-33
3/8"	100	100
#4	97.0	95-100
#8	92.1	80-100
#16	80.3	50-85
#30	52.9	25-60
#50	21.0	10-30
#100	5.8	2-10

THE ABOVE TEST RESULT MEETS THE REQUIRED GRADING.

MATERIALS TESTING, INC.

Frank A. Soucy

FRANK A. SOUCY

2cc client
1cc Butterworth Construction

Appendix I-8

Deed Notice

TOWN OF STRATFORD

OFFICE OF THE TOWN CLERK

STATE OF CONNECTICUT)
SS. Stratford
COUNTY OF FAIRFIELD)

I, June Grace, Assistant Town Clerk of said Stratford, duly appointed and qualified according to law, and having custody of the Seal of said Town of Stratford, hereby certify that the annexed instrument is a true copy from the records of said Town, and that the original Instrument, from which said copy is taken, is recorded in Volume 744 Page 170-174 of the Stratford Land Records at 11:28 A.M on 7/25/90

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the Seal of said Town of Stratford, this 26th day of July A. D. 19 90.

Attest: June Grace Asst
Assistant Town Clerk

"SURVEY SURFACE IMPOUNDMENT CLOSURE PROJECT NO. FY82/01B STRATFORD ARMY ENGINE PLANT AT AVCO PROPERTY STRATFORD, CONN."

All those certain pieces or parcels of land located in the Town of Stratford, County of Fairfield and State of Connecticut and shown on a map entitled, "Survey Surface Impoundment Closure Project No. FY82/01B Stratford Army Engine Plant at Avco Property Stratford, Conn.", dated July 23, 1990, prepared by A H Engineering, P.C., to be filed in the Town of Stratford Land Records, being more particularly bounded and described as follows:

CLOSURE AREA 1
Containing 56,947± Sq. Ft.

Beginning at a point, said point being the Northwesterly corner of the Closure Area 1, said point also being the Southwesterly property corner of land now or formerly of United States of America, and is shown on a map entitled "Map of Survey of Property in Stratford, Conn. for United Aircraft Corp." dated June 14, 1949, by Fuller & Company, said point being the following bearings and distances from the Southerly street line of Sniffen Lane, South 51° 18′ 14″ East for a distance of 294.42 feet, South 38° 39′ 16″ East for a distance of 65.13 feet and South 01° 02′ 15″ East for a distance of 197.76 feet, all being along the Westerly property line as shown on said map of United Aircraft Corp.;

Thence, in an Easterly direction North 88° 57′ 45″ East for a distance of 219.63 feet along the Southerly property line as shown on said map of United Aircraft Corp.;

Thence, in a Southerly direction South 18° 35′ 45″ West for a distance of 27.70 feet along the Easterly property line as shown on said map of United Aircraft Corp. and also on a map entitled "Map of Survey of Property in Stratford, Conn. The Land and Home Development Co.", dated September 27, 1952 prepared by Frank B. Jaynes and Associates.;

Survey Surface Impoundment Closure
Project No. FY82/018 Stratford Army
Engine Plane at Avco Property
Stratford, Conn.

Thence, in a Southerly direction again South 18° 50′ 08″ West for a distance of 13.91 feet, South 50° 21′ 19″ East for a distance of 42.37 feet, South 46° 17′ 25″ East for a distance of 43.12 feet, South 09° 28′ 38″ West for a distance of 107.96 feet and South 34° 03′ 02″ West for a distance of 25.31 feet;

Thence, in a Westerly direction North 80° 24′ 23″ West for a distance of 314.77 feet; thence, Northerly North 05° 25′ 14″ East for a distance of 27.57 feet and North 26° 37′ 01″ East for a distance of 144.25 feet, North 24° 45′ 30″ East for a distance of 11.96 feet all being along a fence and across land of the United States of America to the point and place of beginning.

CLOSURE AREA 2
Containing 37,405± Square Feet

Being more particularly bounded and described as follows:

Beginning at a point, said point being the Southwesterly corner of the Closure Area 2, said point also being on the Southerly property line of land now or formerly of United States of America, also being on the Northerly property line of the Sikorsky Memorial Airport, now or formerly the City of Bridgeport, and shown on a map entitled "Map of Survey of Property in Stratford, Conn. The Land Home Development Co." dated September 27, 1952, prepared by Frank B. Jaynes & Associates. Said parcel is Easterly of the Westerly street line of Main Street by a bearing of North 88° 57′ 45″ East for a distance of 341.69 feet;

Thence, in a Northerly direction North 02° 36' 05" West for a distance of 165.23 feet along a fence being across land of United States of America;

Thence, in an Easterly direction North 78° 44' 45" East for a distance of 210.54 feet across land of United States of America;

Thence, in a Southerly direction South 00° 09' 37" East for a distance of 202.54 feet along a fence across land of United States of America;

Thence, in a Westerly direction South 88° 57' 45" West for a distance of 199.59 feet being along the Southerly property line as shown on said map of The Land Home Development Co., also being the Northerly property line of Sikorsky Memorial Airport to the point and place of beginning.

AHENG5
7/25/90

Rec'd. JUL 25 1990 at 11:28 AM Attest:
June Grace Assistant Town Clerk

Appendix I-9

Survey Plat

Appendix I-10

Certification of Deed Notice

7

& Schatz,
Ribicoff
& Kotkin
Attorneys at Law

90 State House Square
Suite 900
Hartford, CT 06103-3902
(203) 522-3234
Telecopier
(203) 246-1225

1 Landmark Square
Suite 1600
Stamford, CT 06901-2676
(203) 964-0027
Telecopier
(203) 357-9251

100 Fairfield Avenue
Bridgeport, CT 06604-4278
(203) 368-4500

Cable. Barrister
Telex (Hartford and Stamford)
99364(CEOHFD)

Riva Posner
(203) 722-1448

July 25, 1990

FEDERAL EXPRESS

Ms. Julie Belaga
Regional Administrator
Region 1
U.S. Environmental Protection Agency
J. F. Kennedy Federal Building
Boston, MA 02203-2211

Re: Textron Lycoming - Stratford Army Engine Plant, Stratford, Connecticut - Project No. FY82/01B, Surface Impoundment Closure EPA I.D. No. CTD001181502, VFL Technology Corporation Project No. C-2260

Dear Ms. Belaga:

The United States of America acting through the United States Army Aviation Systems Command is the legal Owner, and Textron Lycoming, a Division of AVCO Corporation is the Operator (as such terms are defined at 40 C.F.R. S260.10(1989)) of land known as the Stratford Army Engine Plant located in the Town of Stratford, County of Fairfield and State of Connecticut. This property (hereinafter the "Facility," as such term is defined at 40 C.F.R. S260.10) is subject to federal and state laws pertaining to, inter alia, Hazardous Waste Management, as such term is defined at 40 C.F.R. S260.10; the Resource Conservation and Recovery Act, 42 U.S.C. 6901 <u>et</u> <u>seq</u>. (1989), as amended; The United States Environmental Protection Agency (EPA) regulations pertaining to hazardous waste treatment, storage, and disposal facilities, and specifically 40 C.F.R. SS265.1-.405 (1989), as amended; Title 22a of the Connecticut General Statutes and the Regulations of Connecticut State Agencies as administered by the Connecticut Department of Environmental Protection (DEP).

In accordance therewith, please find the following:

1. Certified copy of Affidavit of Land Use and certification of recording;
2. Certificate of closure for landfill units;

3. Survey;

4. Perimeter test for hazardous waste quantity determination;

5. Documentation required by the DEP and EPA pursuant to the Closure Plan referenced above:

   a. As Built drawings;
   b. Soil verification test results;
   c. Appendix - 9 test results;
   d. Synthetic liner membrane warranty;
   e. Summary of daily logs of construction of landfill cover system; and
   f. List of minor departures from approved closure plan.

Please call me if you have any questions with respect to the foregoing.

Very truly yours,

SCHATZ & SCHATZ,
RIBICOFF & KOTKIN

Riva Posner

Riva Posner

Enclosures
cc: Larry O'Connell, Esq. - Textron
Dr. John S. Fleming - Textron
Mr. Alan Gibson - U.S. Army Aviation Systems Command
Douglas A. Cohen, Esq.

AFFIDAVIT OF LAND USE
MADE
PURSUANT TO 40 C.F.R. S265.119(b)(1) (1989)

STATE OF CONNECTICUT)
) ss. Stratford
COUNTY OF FAIRFIELD)

I, Robert Dennis, Director of Manufacturing Services, Avco Corporation, Textron Lycoming Division, do hereby depose, say and swear to the truth of, the following statements:

1. I am over eighteen (18) years of age and believe in the obligations of an oath.

2. The United States of America is the legal Owner (as such term is defined at 40 C.F.R. S260.10 (1989)) of certain real property located at the intersection of Main Street and Sniffen Lane in the Town of Stratford, County of Fairfield and State of Connecticut ~~as~~ more particularly described in Schedule A attached hereto and made a part hereof.

3. This property (hereinafter the "Facility," as such term is defined at 40 C.F.R. S260.10) is subject to Federal and State of Connecticut laws pertaining to Hazardous Waste Management (as such term is defined at 40 C.F.R. S260.10); the Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq. (1989), as amended; the United States Environmental Protection Agency (EPA) regulations pertaining to the hazardous waste treatment, storage, and disposal facilities, and specifically 40 C.F.R. SS265.1-.405 (1989), as amended; Titles 22a of the Connecticut General Statutes and the Regulations of Connecticut State Agencies.

4. The Operator (as such term is defined at 40 C.F.R. S260.10) of the Facility is Textron Lycoming, a Division of Avco Corporation.

This affidavit is made pursuant to 40 C.F.R. S265.119(b)(1) and is intended to provide the requisite notice that:

a. The Facility has been used to manage hazardous waste; and

b. The future use of the Facility is restricted under 40 C.F.R. S265.110-120 as amended at 54 Fed. Reg. 33,396 397 (1989); and

c. A survey plat, as described at 40 C.F.R. §265.116, and a record of the type, location, and quantity of hazardous wastes disposed of at the Facility, as described at 40 C.F.R. §§265.116 and 265.119(a), has been filed with the Town of Stratford Zoning Commission, the EPA Regional Administrator for Region 1 and the Connecticut Department of Environmental Protection Senior Sanitary Engineer.

Further your deponent sayeth not.

Robert Dennis

Subscribed and sworn to before me
this 25th day of July, 1990.

Riva Posner

Riva Posner
Commissioner of the Superior Court

Appendix I-11

Record of the Type, Location and Quantity of Waste Disposed in the Closed Surface Impoundments

Client :VFL Technology Corp.
Lab No.:128-278-19
PO No. :C2260
Date :12-27-88
Page 1

EPA METHOD 601/8010	MDL	30A	31	32	33
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	39.0	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	34.0	BDL	BDL	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	125.0	76.0	BDL	65.0
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	266.0	1,421.0
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	66.0
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

Client :VFL Technology Corp.
Lab No.:128-278-19
PO No. :C2260
Date :12-27-88
Page 2

EPA METHOD 601/8010	MDL	34	③⑤	36	37
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	27.6	BDL
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	BDL	BDL	BDL	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	43.0	BDL	26.0	47.0
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	164.0	BDL	BDL	37.0
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

Client :VFL Technology Corp.
Lab No.:128-278-19
PO No.:C2260
Date :12-27-88
Page 3

EPA METHOD 601/8010	MDL	38	39	40	41
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	25.0
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	71.0
T12-Dichloroethylene	25	213.0	BDL	BDL	1,027.0
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	29.0	BDL	BDL	76.0
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	175.0	BDL	BDL	719.0
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	234.0	BDL	BDL	355.0
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	BDL	50.0
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

Client :VFL Technology Corp.
Lab No.:128-278-19
PO No. :C2260
Date :12-27-88
Page 4

EPA METHOD 601/8010	MDL	42	43	44	45
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	BDL	BDL	BDL	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	30.0	172.0	BDL	BDL
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	BDL	BDL
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

Client :VFL Technology Corp.
Lab No.:128-278-19
PO No. :C2260
Date :12-27-88
Page 5

EPA METHOD 601/8010	MDL	46	47	48	
Chloromethane	50	BDL	BDL	BDL	
Bromomethane	50	BDL	BDL	BDL	
Vinylchloride	50	BDL	BDL	BDL	
Chloroethane	50	BDL	BDL	BDL	
Methylenechloride	25	BDL	BDL	44.0	
Trichlorofluoromethane	25	BDL	BDL	BDL	
11-Dichloroethylene	25	BDL	BDL	BDL	
11-Dichloroethane	25	BDL	BDL	BDL	
T12-Dichloroethylene	25	BDL	BDL	50.0	
Chloroform	25	BDL	BDL	BDL	
12-Dichloroethane	25	BDL	BDL	117.0	
111-Trichloroethane	25	BDL	BDL	BDL	
Carbontetrachloride	25	BDL	BDL	BDL	
Bromodichloromethane	25	BDL	BDL	BDL	
12-Dichloropropane	25	BDL	BDL	BDL	
T13-Dichloropropylene	25	BDL	BDL	BDL	
Trichloroethylene	25	BDL	BDL	137.0	
Dibromochloromethane	25	BDL	BDL	BDL	
112-Trichloroethane	25	BDL	BDL	BDL	
Cis13-Dichloropropylene	25	BDL	BDL	BDL	
2-Chlorethylvinylether	25	BDL	BDL	BDL	
Bromoform	25	BDL	BDL	BDL	
1122-Tetrachloroethane	25	BDL	BDL	BDL	
Tetrachloroethylene	25	BDL	87.0	111.0	
Chlorobenzene	25	BDL	BDL	BDL	
Benzyl Chloride	50	BDL	BDL	BDL	
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	
Bromobenzene	25	BDL	BDL	BDL	
Chloracetaldehyde	50	BDL	BDL	BDL	
1-Chlorohexane	25	BDL	BDL	BDL	
Chloromethyl methyl ether	50	BDL	BDL	BDL	
Chlorotoluene	25	BDL	BDL	BDL	
Dibromomethane	25	BDL	BDL	BDL	
12-Dichlorobenzene	25	BDL	BDL	BDL	
13-Dichlorobenzene	25	BDL	BDL	BDL	
14-Dichlorobenzene	25	BDL	BDL	BDL	
Trichloropropane	25	BDL	BDL	BDL	

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

Client :VFL Technology Corp.
Lab No.:128-278-19
PO No. :C2260
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EPA METHOD 602/8020

	MDL	30A	31	32	33
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	74.0	64.0	BDL	63.0
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	153.0	86.0	BDL	135.0
O- Xylene	50	132.0	61.0	58.0	301.0
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL UNITS IN PPB UNLESS NOTED.

Client :VFL Technology Corp.
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EPA METHOD 602/8020

	MDL	34	35	36	37
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	BDL	BDL	BDL
O- Xylene	50	119.0	BDL	BDL	81.0
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level. BDL = Below Detection Level

ALL UNITS IN PPB UNLESS NOTED..

Client :VFL Technology Corp.
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EPA METHOD 602/8020

	MDL	38	39	40	41
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	BDL	BDL	BDL
O- Xylene	50	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL UNITS IN PPB UNLESS NOTED.

VFL TECHNOLOGY CORPORATION

42 LLOYD AVENUE • MALVERN, PENNSYLVANIA 19355 • (215) 296-2233 • FAX (215) 296-9545

October 27, 1988

Ms. Donna Ashford
Plant Engineering
Textron Lycoming
550 Main Street
Stratford, CT 06497-2452

Subject: Initial Test Results - Lagoon 2 and 3 Areas
Textron Lycoming Purchase Order No. H236208
VFL Project No. C2260

Dear Donna:

VFL Technology Corporation (VFL) has received test results from Connecticut Testing Laboratory for partial samplings taken in the vicinity of Lagoons 2 and 3. The enclosed sketch shows the test points. Our review of these results show that there are hydrocarbon contaminants that are of potential concern. It is believed that these contaminants are from another source outside of the lagoons.

Your immediate attention to this issue is requested. VFL requests that the issue be addressed at our November 1, 1988 meeting.

Sincerely yours,

James P. Hopkins, P.E.
Vice President Project Management

JPH/tg

Enclosure

cc: Mr. J. Fleming-T/L
Mr. J. R. Landis-VFL
Mr. J. J. Tropea-VFL
Mr. L. M. Ruggiano-VFL

October 21, 1988

VFL
c/o Butterworth Constr.
45 Mayfair Pl.
Stratford, CT 06497

RE Lab. #108-154-13
PO/Job #VFLC2260
Invoice #6239

Gentelmen:

The following is a report of analysis on samples received: October 11, 1988.

RESULTS OF ANALYSIS	18	19	20	21
Arsenic-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/l	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Total-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Lead-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/l	ND<0.002	ND<0.002	ND<0.002	ND<0.002
Selenium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01

	22	23	24	25
Arsenic-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/l	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Total-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Lead-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/l	ND<0.002	ND<0.002	ND<0.002	ND<0.002
Selenium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01

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STEPHEN J. FRANCO
Laboratory Director
PHONE • 203/634•3731
140 GRACEY AVENUE • MERIDEN, CT • 06450

Client :VFL
Lab No.:108-154-13
PO No. :VFLC2260
Date :10-21-88
Page 2

	26	27	28	29
Arsenic-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/l	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/l	ND<0.01	0.01	ND<0.01	ND<0.01
Chromium, Total-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Lead-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/l	ND<0.002	ND<0.002	ND<0.002	ND<0.002
Selenium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01

	30			
Arsenic-mg/l	ND<0.05			
Barium-mg/l	ND<0.5			
Cadmium-mg/l	ND<0.01			
Chromium, Total-mg/l	ND<0.05			
Lead-mg/l	ND<0.05			
Mercury-mg/l	ND<0.002			
Selenium-mg/l	ND<0.01			
Silver-mg/l	ND<0.01			

Please contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director

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STEPHEN J. FRANCO
Laboratory Director
PHONE - 203/634-3731
140 GRACEY AVENUE - MERIDEN, CT - 06450

October 18, 1988

VFL
C/O Butterworth Construction
45 Mayfair Pl.
Stratford, Ct. 06075

RE: LAB. No.108-101-13
P.O. No.VFL C22-60
Inv. No.5188

Gentlemen:

The attached report are results of analysis on the above referenced Purchase Order.

The samples were received on October 11, 1988.

The method of analysis was by Gas Chromatography using FID, PID, and/or HECD techniques.

All results are reported in parts per billion unless noted on the report.

Please contact us if you have any questions.

Very truly yours,

Stephen J. Franco

Stephen J. Franco
Laboratory Director

SJF:hc

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STEPHEN J. FRANCO
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Client :VFL Technology Corp.
Lab No.:128-273-19
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Page 2

RESULTS OF ANALYSIS

	42	43	44	45
Arsenic-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/L	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Total-mg/L	ND<0.05	0.08	ND<0.05	ND<0.05
Lead-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/L	ND<0.002	ND<0.002	ND<0.002	ND<0.002
Selenium-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Nickel-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Chromium-Hex-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Cyanide-Amenable-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05

	46	47	48	
Arsenic-mg/L	ND<0.05	ND<0.05	ND<0.05	
Barium-mg/L	ND<0.5	ND<0.5	ND<0.5	
Cadmium-mg/L	ND<0.01	ND<0.01	ND<0.01	
Chromium, Total-mg/L	ND<0.05	ND<0.05	ND<0.05	
Lead-mg/L	ND<0.05	ND<0.05	ND<0.05	
Mercury-mg/L	ND<0.002	ND<0.002	ND<0.002	
Selenium-mg/L	ND<0.01	ND<0.01	ND<0.01	
Silver-mg/L	ND<0.01	ND<0.01	ND<0.01	
Nickel-mg/L	ND<0.05	ND<0.05	ND<0.05	
Chromium-Hex-mg/L	ND<0.05	ND<0.05	ND<0.05	
Cyanide-Amenable-mg/L	ND<0.05	ND<0.05	ND<0.05	

Client :VFL Technology Corp.
Lab No.:128-273-19
PO No. :C2260
Date :12-23-88
Page 1

RESULTS OF ANALYSIS

	30A	31	32	33
Arsenic-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/L	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Total-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Lead-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/L	ND<0.002	ND<0.002	ND<0.002	ND<0.002
Selenium-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Nickel-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Chromium-Hex-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Cyanide-Amenable-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05

	34	35	36	37
Arsenic-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/L	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Total-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Lead-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/L	ND<0.002	ND<0.002	ND<0.002	ND<0.002
Selenium-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Nickel-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Chromium-Hex-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Cyanide-Amenable-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05

	38	39	40	41
Arsenic-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/L	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Total-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Lead-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/L	ND<0.002	ND<0.002	ND<0.002	ND<0.002
Selenium-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/L	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Nickel-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Chromium-Hex-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Cyanide-Amenable-mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05

Client :VFL Technology Corp.
Lab No.:128-278-19
PO No. :C2260
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EPA METHOD 602/8020

	MDL	42	43	44	45
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	BDL	BDL	BDL
O- Xylene	50	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level BDL = Below Detection Level

ALL UNITS IN PPB UNLESS NOTED.

Client :VFL Technology Corp.
Lab No.:128-278-19
PO No. :C2260
Date :12-27-88
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EPA METHOD 602/8020

	MDL	46	47	48	
Benzene	50	BDL	BDL	BDL	
Toluene	50	BDL	BDL	BDL	
Ethyl Benzene	50	BDL	BDL	BDL	
P & M Xylene	50	BDL	BDL	BDL	
O- Xylene	50	BDL	BDL	BDL	
1,4-Dichlorobenzene	50	BDL	BDL	BDL	
1,3-Dichlorobenzene	50	BDL	BDL	BDL	
1,2-Dichlorobenzene	50	BDL	BDL	BDL	
Methyl Ethyl Ketone	100	BDL	BDL	BDL	
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL **UNITS** IN PPB UNLESS NOTED.

Client :VFL
Lab No.:108-101-13
PO No. :VFL C22-60
Date :Oct. 17, 1988
Page 1

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL	18	19	20	21
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	91.0	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	BDL	BDL	88.0	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	29.0	BDL	BDL	BDL
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	BDL	BDL
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

lient :VFL
No.:108-101-13
No. :VFL C22-60
Date :Oct. 17, 1988
Page . 2

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL	22	23	24	25
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	92.0	BDL	BDL	BDL
Trichloroethylene	25	BDL	BDL	BDL	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	29.0	54.0	29.0	BDL
Tetrachloroethylene	25	BDL	BDL	BDL	BDL
Chlorobenzene	50	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	25	BDL	BDL	BDL	BDL
Bromobenzene	50	BDL	BDL	BDL	BDL
Chloracetaldehyde	25	BDL	BDL	BDL	BDL
1-Chlorohexane	50	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	25	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	BDL	BDL
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane					

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

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STEPHEN J. FRANCO
Laboratory Director
PHONE--203/634-3731
140 GRACEY AVENUE—MERIDEN, CT--06450

Client :VFL
Lab No.:108-101-13
PO No. :VFL C2260
Date :Oct. 17, 1988
age 3

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL	26	27	28	29
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	BDL	80.0	25.0	50.0
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	BDL	164.0	59.0	96.0
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	122.0	297.0	BDL	BDL
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

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laboratories inc.

STEPHEN J. FRANCO
Laboratory Director
PHONE - 203/634-3731
140 GRACEY AVENUE - MERIDEN, CT - 06450

Client :VFL
Lab No.:108-101-13
PO No. :VFL C220-60
Date :Oct. 17, 1988
Page . 1

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL	30			
Chloromethane	50	BDL			
Bromomethane	50	BDL			
Vinylchloride	50	BDL			
Chloroethane	50	BDL			
Methylenechloride	25	BDL			
Trichlorofluoromethane	25	BDL			
11-Dichloroethylene	25	BDL			
11-Dichloroethane	25	BDL			
T12-Dichloroethylene	25	BDL			
Chloroform	25	BDL			
12-Dichloroethane	25	BDL			
111-Trichloroethane	25	BDL			
Carbontetrachloride	25	BDL			
Bromodichloromethane	25	BDL			
12-Dichloropropane	25	BDL			
T13-Dichloropropylene	25	BDL			
Trichloroethylene	25	26.0			
Dibromochloromethane	25	BDL			
112-Trichloroethane	25	BDL			
Cis13-Dichloropropylene	25	BDL			
2-Chlorethylvinylether	25	BDL			
Bromoform	25	BDL			
1122-Tetrachloroethane	25	BDL			
Tetrachloroethylene	25	44.0			
Chlorobenzene	25	BDL			
Benzyl Chloride	50	BDL			
Bis(2-chlorethoxy)methane	50	BDL			
Bis(2-chloroisopropyl)ethe	50	BDL			
Bromobenzene	25	BDL			
Chloracetaldehyde	50	BDL			
1-Chlorohexane	25	BDL			
Chloromethyl methyl ether	50	BDL			
Chlorotoluene	25	BDL			
Dibromomethane	25	BDL			
12-Dichlorobenzene	25	BDL			
13-Dichlorobenzene	25	BDL			
14-Dichlorobenzene	25	BDL			
Trichloropropane	25	BDL			

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

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STEPHEN J. FRANCO
Laboratory Director
PHONE – 203/634•3731
140 GRACEY AVENUE – MERIDEN, CT • 06450

Client :VFL
Lab No.:108-101-13
PO No. :VFL C2260
Date :Oct. 17, 1988
Page 5

(Sample Matrix= Solid)

EPA METHOD 602/8020

	MDL	18	19	20	21
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	BDL	BDL	BDL
O- Xylene	50	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL UNITS IN PPB UNLESS NOTED.

Client :VFL
Lab No.:108-101-13
PO No. :VFL C2260
Date :Oct. 17, 1988
Page .6

(Sample Matrix= Solid)

EPA METHOD 602/8020

	MDL	22	23	24	25
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	60.0	BDL	BDL
O- Xylene	50	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL UNITS IN PPB UNLESS NOTED.

Client :VFL
Lab No.:108-101-13
PO No. :VFL C2260
Date :Oct. 17, 1988
Page .7

(Sample Matrix= Solid)

EPA METHOD 602/8020

	MDL	26+	27+	28	29
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	114.0	BDL	BDL
Ethyl Benzene	50	BDL	68.0	BDL	BDL
P & M Xylene	50	BDL	237.0	63.0	69.0
O- Xylene	50	BDL	696.0	BDL	207.0
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

+ Unknown Hydrocarbon mix present

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL UNITS IN PPB UNLESS NOTED.

permitted value by state - 10 ppm

Client :VFL
Lab No.:108-101-13
Job. No:VFL C2260
Date :Oct. 17, 1988
Page 8

(Sample Matrix= Solid)

EPA METHOD 602/8020

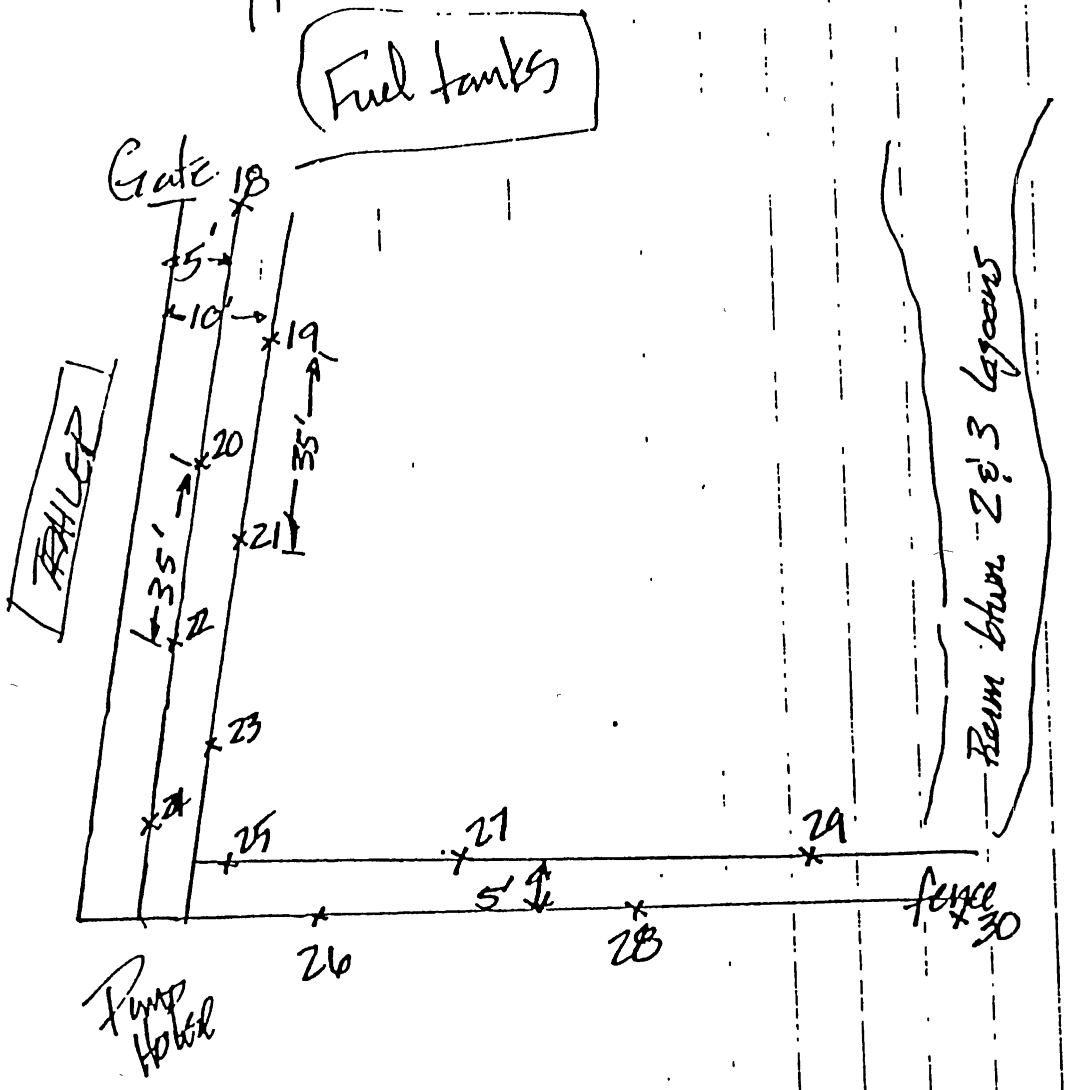
	MDL	30			
Benzene	50	BDL			
Toluene	50	BDL			
Ethyl Benzene	50	BDL			
P & M Xylene	50	BDL			
O- Xylene	50	BDL			
1,4-Dichlorobenzene	50	BDL			
1,3-Dichlorobenzene	50	BDL			
1,2-Dichlorobenzene	50	BDL			
Methyl Ethyl Ketone	100	BDL			
Methyl Iso Butyl Ketone	100	BDL			

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL UNITS IN PPB UNLESS NOTED.

Approx. Sample Locations



TEXTRON Lycoming

Stratford Division
Textron Lycoming /
Subsidiary of Textron Inc.

550 Main Street
Stratford, CT 06497
203/385-2000

13 September 1988

Mr. G. Dews
Ct. D.E.P.
Hazardous Matls. Mgmt.
165 Capitol Avenue
Hartford, CT 06106

Dear Mr. G. Dews:

Enclosed you will find a copy of soil analyses on samples taken in the equalization lagoon in our Surface Impoundment Closure.

The schedule plans call for the Cap to be ordered in the next week to ten days. In this regard I am also submitting a copy of the addendum which the Army consultant, Metcalf & Eddy had sent to us, but did not forward to you for review. The closure contractor for the surface impoundments would like to complete work on the equalization lagoon before the sludge impoundments completion.

If you have any questions, please do not hesitate to contact me.

Very truly yours

TEXTRON LYCOMING

John Fleming

John Fleming, Supv.
Environmental Compliance

Enclosure

September 12, 1988

VFL
550 Main St.
Stratford CT 06497

RE: LAB. No.88-279-17
P.O. No.VFL-C2260
Inv. No.4776

Gentelmen:

The attached report are results of analysis on the above referenced Purchase Order.

The samples were received on August 25, 1988.

The method of analysis was by Gas Chromatography using FID, PID, and/or HECD techniques.

All results are reported in parts per billion unless noted on the report.

Please contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director

SJF:hc

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STEPHEN J. FRANCO
Laboratory Director
PHONE 203/634-[illegible]
140 GRACEY AVENUE MERIDEN, CT [illegible]

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 1

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL	1	2	3	4
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	BDL	BDL	BDL	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	64.0	BDL	BDL	BDL
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	BDL	BDL
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

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STEPHEN J. FR
Laboratory D
PHONE 203/63
140 GRACEY AVENUE MERIDEN, C

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 2

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL	5	6	7	8
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	BDL	BDL	BDL	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	BDL	BDL	BDL	BDL
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	BDL	BDL
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/**BDL=** Below Detection Level/**UNITS=** PPB

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STEPHEN J. FRA
Laboratory Dir
PHONE 203/634-
140 GRACEY AVENUE MERIDEN, CT

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page ~~2~~ 3

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL	9	10	11	12
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	BDL	BDL	BDL	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	BDL	BDL	BDL	BDL
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	BDL	BDL
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/**BDL=** Below Detection Level/**UNITS=** PPB

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STEPHEN J. FRA[illegible]
Laboratory [illegible]
PHONE 203/[illegible]
140 GRACEY AVENUE MERIDEN, CT [illegible]

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 4

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL	13	14	15	16
Chloromethane	50	BDL	BDL	BDL	BDL
Bromomethane	50	BDL	BDL	BDL	BDL
Vinylchloride	50	BDL	BDL	BDL	BDL
Chloroethane	50	BDL	BDL	BDL	BDL
Methylenechloride	25	BDL	BDL	BDL	BDL
Trichlorofluoromethane	25	BDL	BDL	BDL	BDL
11-Dichloroethylene	25	BDL	BDL	BDL	BDL
11-Dichloroethane	25	BDL	BDL	BDL	BDL
T12-Dichloroethylene	25	BDL	BDL	BDL	BDL
Chloroform	25	BDL	BDL	BDL	BDL
12-Dichloroethane	25	BDL	BDL	BDL	BDL
111-Trichloroethane	25	BDL	BDL	BDL	BDL
Carbontetrachloride	25	BDL	BDL	BDL	BDL
Bromodichloromethane	25	BDL	BDL	BDL	BDL
12-Dichloropropane	25	BDL	BDL	BDL	BDL
T13-Dichloropropylene	25	BDL	BDL	BDL	BDL
Trichloroethylene	25	BDL	BDL	BDL	BDL
Dibromochloromethane	25	BDL	BDL	BDL	BDL
112-Trichloroethane	25	BDL	BDL	BDL	BDL
Cis13-Dichloropropylene	25	BDL	BDL	BDL	BDL
2-Chlorethylvinylether	25	BDL	BDL	BDL	BDL
Bromoform	25	BDL	BDL	BDL	BDL
1122-Tetrachloroethane	25	BDL	BDL	BDL	BDL
Tetrachloroethylene	25	BDL	BDL	BDL	BDL
Chlorobenzene	25	BDL	BDL	BDL	BDL
Benzyl Chloride	50	BDL	BDL	BDL	BDL
Bis(2-chlorethoxy)methane	50	BDL	BDL	BDL	BDL
Bis(2-chloroisopropyl)ethe	50	BDL	BDL	BDL	BDL
Bromobenzene	25	BDL	BDL	BDL	BDL
Chloracetaldehyde	50	BDL	BDL	BDL	BDL
1-Chlorohexane	25	BDL	BDL	BDL	BDL
Chloromethyl methyl ether	50	BDL	BDL	BDL	BDL
Chlorotoluene	25	BDL	BDL	BDL	BDL
Dibromomethane	25	BDL	BDL	BDL	BDL
12-Dichlorobenzene	25	BDL	BDL	BDL	BDL
13-Dichlorobenzene	25	BDL	BDL	BDL	BDL
14-Dichlorobenzene	25	BDL	BDL	BDL	BDL
Trichloropropane	25	BDL	BDL	BDL	BDL

MDL= Minimum Detectable Level/**BDL**= Below Detection Level/**UNITS**= PPB

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 5

(Sample Matrix= Solid)

EPA METHOD 601/8010	MDL		17		
Chloromethane	50		BDL		
Bromomethane	50		BDL		
Vinylchloride	50		BDL		
Chloroethane	50		BDL		
Methylenechloride	25		BDL		
Trichlorofluoromethane	25		BDL		
11-Dichloroethylene	25		BDL		
11-Dichloroethane	25		BDL		
T12-Dichloroethylene	25		BDL		
Chloroform	25		BDL		
12-Dichloroethane	25		BDL		
111-Trichloroethane	25		BDL		
Carbontetrachloride	25		BDL		
Bromodichloromethane	25		BDL		
12-Dichloropropane	25		BDL		
T13-Dichloropropylene	25		BDL		
Trichloroethylene	25		BDL		
Dibromochloromethane	25		BDL		
112-Trichloroethane	25		BDL		
Cis13-Dichloropropylene	25		BDL		
2-Chlorethylvinylether	25		BDL		
Bromoform	25		BDL		
1122-Tetrachloroethane	25		59.0		
Tetrachloroethylene	25		BDL		
Chlorobenzene	25		BDL		
Benzyl Chloride	50		BDL		
Bis(2-chlorethoxy)methane	50		BDL		
Bis(2-chloroisopropyl)ethe	50		BDL		
Bromobenzene	25		BDL		
Chloracetaldehyde	50		BDL		
1-Chlorohexane	25		BDL		
Chloromethyl methyl ether	50		BDL		
Chlorotoluene	25		BDL		
Dibromomethane	25		BDL		
12-Dichlorobenzene	25		BDL		
13-Dichlorobenzene	25		BDL		
14-Dichlorobenzene	25		BDL		
Trichloropropane	25		BDL		

MDL= Minimum Detectable Level/**BDL**= Below Detection Level/**UNITS**= PPB

connecticut testing laboratories inc.

STEPHEN J. FR[illegible]
Laboratory D[illegible]
PHONE 203/63[illegible]
140 GRACEY AVENUE MERIDEN, CT [illegible]

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 6

(Sample Matrix= Solid)

EPA METHOD 602/8020

	MDL	**1**	**2**	**3**	**4**
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	BDL	BDL	BDL
O- Xylene	50	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL **UNITS** IN **PPB** UNLESS NOTED.

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 7

(Sample Matrix= Solid)

EPA METHOD 602/8020

	MDL	5	6	7	8
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	BDL	BDL	BDL
O- Xylene	50	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL **UNITS** IN **PPB** UNLESS NOTED.

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STEPHEN J. FRANCO
Laboratory Director
PHONE 203/634-3731
140 GRACEY AVENUE MERIDEN, CT 06450

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 8

(Sample Matrix= Solid)

EPA METHOD 602/8020

	MDL	9	10	11	12
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	BDL	BDL	BDL
O- Xylene	50	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL **UNITS** IN **PPB** UNLESS NOTED.

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 9

(Sample Matrix= Solid)

EPA METHOD 602/8020

	MDL	13	14	15	16
Benzene	50	BDL	BDL	BDL	BDL
Toluene	50	BDL	BDL	BDL	BDL
Ethyl Benzene	50	BDL	BDL	BDL	BDL
P & M Xylene	50	BDL	BDL	BDL	BDL
O- Xylene	50	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	50	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	50	BDL	BDL	BDL	BDL
Methyl Ethyl Ketone	100	BDL	BDL	BDL	BDL
Methyl Iso Butyl Ketone	100	BDL	BDL	BDL	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL **UNITS** IN **PPB** UNLESS NOTED.

Client :VFL
Lab No.:88-279-17
PO No. :VFL-C2260
Date :9-12-88
Page 10

(Sample Matrix= Solid)

EPA METHOD 602/8020

	MDL		17		
Benzene	50		BDL		
Toluene	50		BDL		
Ethyl Benzene	50		BDL		
P & M Xylene	50		BDL		
O- Xylene	50		BDL		
1,4-Dichlorobenzene	50		BDL		
1,3-Dichlorobenzene	50		BDL		
1,2-Dichlorobenzene	50		BDL		
Methyl Ethyl Ketone	100		BDL		
Methyl Iso Butyl Ketone	100		BDL		

MDL = Minimum Detectable Level

BDL = Below Detection Level

ALL **UNITS** IN **PPB** UNLESS NOTED.

September 9, 1988

VFL
550 Main Street
Stratford, Ct. 06497

RE Lab. #88-274-17
PO/Job #VFL-C2260
Invoice #4763

Gentlemen:

The following is a report of analysis on samples received: August 25, 1988.

RESULTS OF ANALYSIS

	1	2	3	4
Arsenic-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/l	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/l	ND<0.01	ND<0.01	ND<0.01	0.03
Chromium, Total-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Lead-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/l	ND<0.02	ND<0.02	ND<0.02	ND<0.02
Selenium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Hex.-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Nickel-mg/l	0.19	0.06	ND<0.05	0.06
Cyanide, Total-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05

	5	6	7	8
Arsenic-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/l	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/l	0.02	0.01	0.01	0.02
Chromium,total-mg/l	ND<0.05	ND<0.05	0.11	0.06
Lead-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/l	ND<0.02	ND<0.02	ND<0.02	ND<0.02
Selenium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Hex.-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Nickel-mg/l	0.30	0.13	0.17	0.15
Cyanide, Total-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05

connecticut testing laboratories inc.

STEPHEN J. FRA
Laborator
PHONE 203/634
140 GRACEY AVENUE MERIDEN, CT

Client :VFL
Lab No.:88-274-17
PO No. :VFL-C2260
Date :Sept. 9, 1988
Page 2

RESULTS OF ANALYSIS

	9	10	11	12
Arsenic-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/l	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/l	0.01	0.02	ND<0.01	ND<0.01
Chromium,total-mg/l	0.06	0.12	0.51	0.16
Lead-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/l	ND<0.02	ND<0.02	ND<0.02	ND<0.02
Selenium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium,Hex.-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Nickel-mg/l	0.03	0.21	ND<0.05	ND<0.05
Cyanide,Total-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05

	13	14	15	16
Arsenic-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Barium-mg/l	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Cadmium-mg/l	0.06	0.05	0.07	0.02
Chromium, Total-mg/l	0.09	0.10	0.05	0.05
Lead-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Mercury-mg/l	ND<0.02	ND<0.02	ND<0.02	ND<0.02
Selenium-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Silver-mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium, Hex.-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Nickel-mg/l	0.20	0.13	0.18	0.27
Cyanide, Total-mg/l	ND<0.05	ND<0.05	ND<0.05	ND<0.05

Client :VFL
Lab No.:88-274-17
PO No. :VFL-C2260
Date :Sept. 9, 1988
Page 3

RESULTS OF ANALYSIS	17				
Arsenic-mg/l	ND<0.05				
Barium-mg/l	ND<0.5				
Cadmium-mg/l	ND<0.01				
Chromium, Total-mg/l	0.07				
Lead-mg/l	ND<0.05				
Mercury-mg/l	ND<0.02				
Selenium-mg/l	ND<0.01				
Silver-mg/l	ND<0.01				
Chromium, Hex-mg/l	ND<0.05				
Nickel-mg/l	0.02				
Cyanide, Total-mg/l	ND<0.05				

Please contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director

42 LLOYD AVENUE • MALVERN, PENNSYLVANIA
(215) 296-2233

UBJECT: VFL Project No. C2260
Lagoon Closure Drawings.

DATE 10/05/88

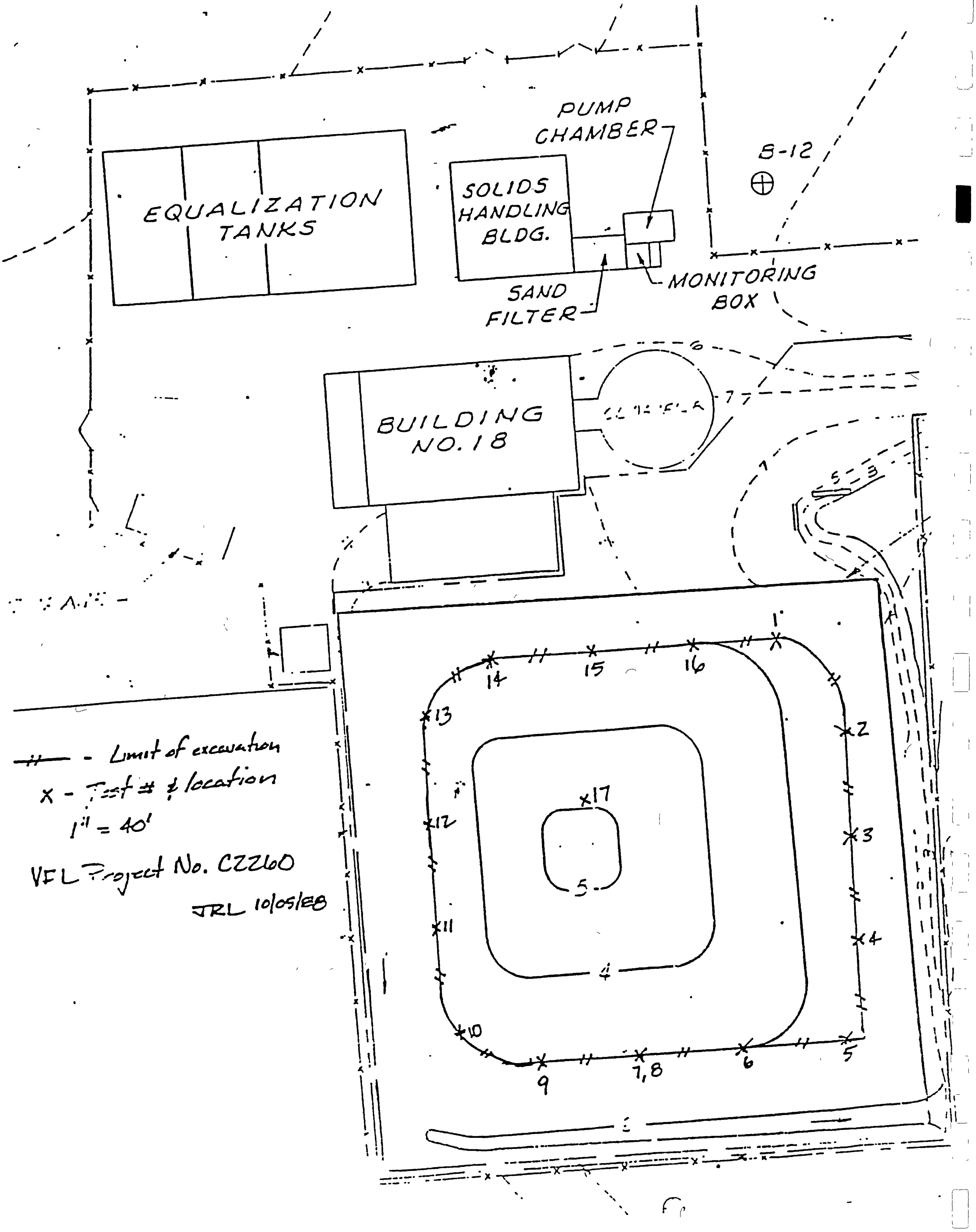
Per your request, attached are two figures showing sample locations in the equalization Lagoon area and a typical x-section of the area sampled. If you have any questions or comments please contact me.

J.R. Landis

cc. J.P. Hopkins/VFL

DATE BY

BY



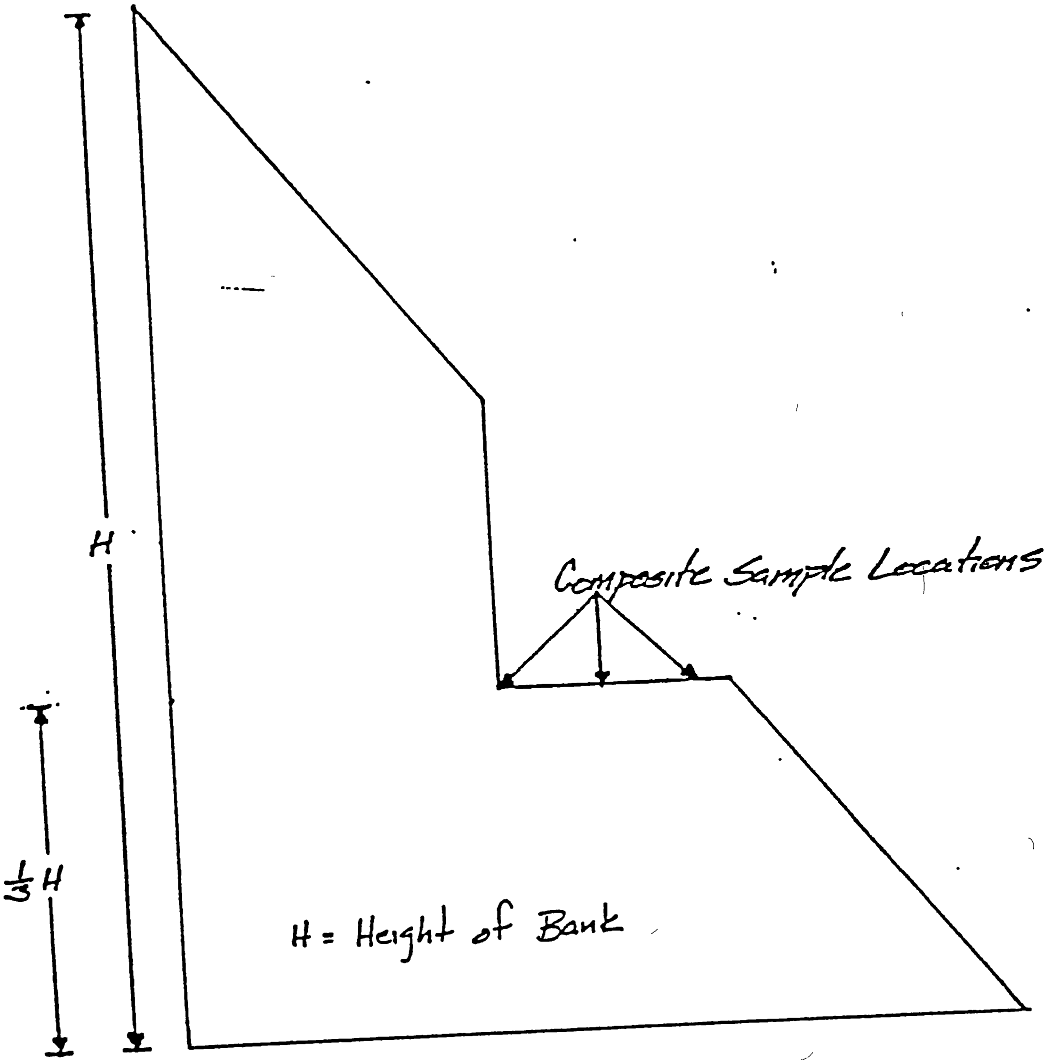
—||— - Limit of excavation

x - Test # & location

1" = 40'

VFL Project No. C2260

JRL 10/05/88



Typical X-section of sample areas

Appendix I-12

Letter from U.S. Army Documenting Acceptance of 40 CFR 265 Subpart H Financial Requirements

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY AVIATION SYSTEMS COMMAND
4300 GOODFELLOW BOULEVARD, ST. LOUIS, MO 63120-1798

[illegible]

JAN - 6 [illegible]

Office of Deputy Director, Administrative
and Installation Support Activity

SUBJECT: Stratford Army Engine Plant Groundwater Monitoring and
Financial Assurance Certification

Mr. Richard Boynton
Chief of CT/RI Waste Program Section
U.S. Environmental Protection Agency
Region I, HSC-CANS
John F. Kennedy Federal Building
Boston, Massachusetts 02203

Dear Mr. Boynton:

I, Colonel Charles L. Brown, Jr., Deputy Commander for Installation and Resource Management, acting as Agent for the U.S. Government who owns the Stratford Army Engine Plant, CTD 001181502, located at Stratford, Connecticut, certify that the equalization lagoon and sludge storage lagoons at this facility are in compliance with all applicable groundwater monitoring requirements in 40 CFR, Part 265, Subpart F.

This facility does not need to comply with 40 CFR, Subpart H as noted in 40 CFR, Part 265.140(c) as it is government-owned.

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the persons who manage the system, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

Charles L. Brown, Jr.
Colonel, General Staff
Deputy Commander for Installation
and Resource Management

Copies Furnished:

Mr. Barry Cirox (DEP)
Mr. John Fleming (AVCO)
Mr. Ron Matteuzzi (AMSAV-PEC)
Mr. Robert Garfield (AMSAV-JR)

Section J

Information Requirements and Description of Solid Waste Management Units [40 CFR 270.14(d)(1)]

Table of Contents

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List of Figures

Section J

Information Requirements and Description of Solid Waste Management Units [40 CFR 270.14(d)(1)]

This Section describes the solid waste management units (SWMUs) at the Textron Lycoming facility. For the purposes of this section, the most recent EPA definition for SWMUs presented in the July 27, 1990 Federal Register (55 FR 145) page 30808 was used:

> *"Any discernable unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released."*

The accompanying discussion and examples found in 55 FR 145 were also used to clarify the above definition as necessary.

J Summary of Solid Waste Management Units

In accordance with the definition presented in 55 FR 145, the following SWMUs were identified at the Textron Lycoming facility:

- #1 — the waste oil accumulation tanks in the Oil House Tank Farm
- #2 — the hazardous waste accumulation tanks in the Oil House Tank Farm
- #3 — the waste collection sumps, waste containment sumps, containment area, pumps, underground piping, and other associated waste conveying systems related to the waste tanks in the Oil House Tank Farm
- #4 — the floor drains and sumps in Building 16 and all associated piping
- #5 — the stormwater and wastewater collection and conveying system for the Oil Abatement Plant
- #6 — the Oil Abatement Plant treatment system
- #7 — the Oil/Alum Tank
- #8 — the sumps, pumps, piping and any other components of the wastewater collection and conveying system for the Chemical Wastewater Treatment System (including those associated with both the cyanide destruct and metals treatment facilities)
- #9 — the Chemical Wastewater Treatment System (including the cyanide destruct and metals treatment facilities)
- #10 — the current container accumulation area adjacent to the Oil House Tank Farm

- #11 — the former container accumulation east of Building 13 notified in the original RCRA Part A Permit Application
- #12 — the former Container Storage Areas A and B for which a Closure Plan has been prepared and submitted
- #13 — the Sludge Roll-Off Container area used to accumulate treated sludge
- #14 — the oily wastewater sump associated with the metal chips bins
- #15 — the soil pile located at the southern end of the property where soils that contained low levels of petroleum hydrocarbons are stored
- #16 — the four closed surface impoundments
- #17 — the causeway on the Housatonic River
- #18 — the Building 65 area
- #19 — waste paint tank
- #20 — Building #19 dry well

The location of each SWMU is indicated in Figure J-1 numerically by their corresponding subsection number (i.e., #1 for J-1, #2 for J-2, etc.), as indicated above.

The following information is provided in Sections J-1 through J-18 for each of the above SWMUs:

- location on a facility site plan
- type of unit
- description of unit operation

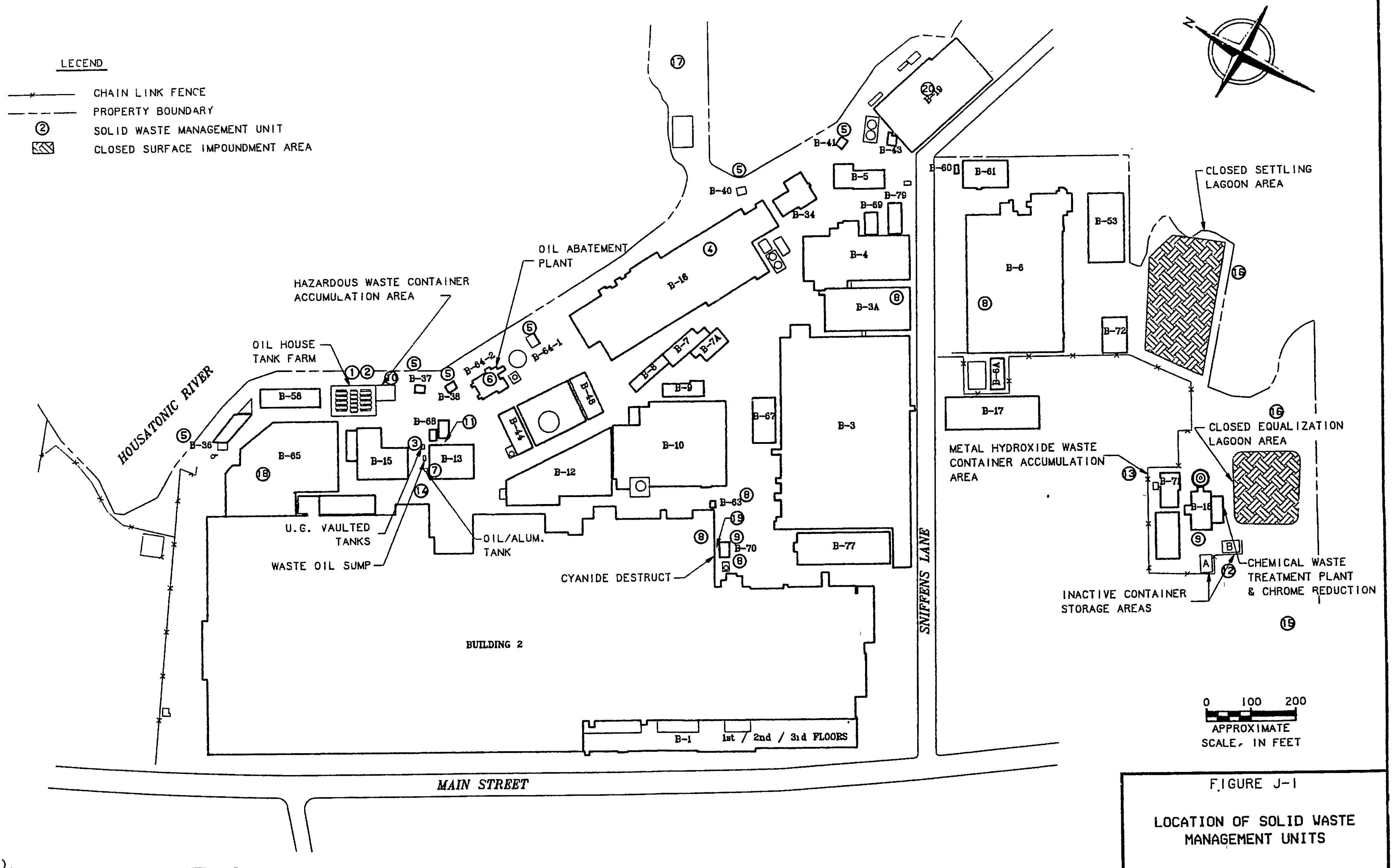

FIGURE J-1

LOCATION OF SOLID WASTE MANAGEMENT UNITS

TEXTRON LYCOMING
STRATFORD, CONNECTICUT

0	11/14/9	ISSUED FOR PERMIT APPLICATION	JED	
NO	DATE	REVISIONS	CHK BY	DATE

WehranEnviroTech

DCM-10221S.04.1 ATION WASTE MANAGE UNITS DWG LL119105

- dimensions/structural description
- period of unit operation
- wastes managed in unit
- any data or evidence of a release

The SWMUs described in Sections J-1 through J-18 have been used to manage either hazardous or non-hazardous solid wastes. However, in accordance with 40 CFR 270.14(d)(2), there are no records or documentation from available information which would indicate any releases of hazardous wastes or hazardous constituents have occurred from these SWMUs with the exception of the closed surface impoundments (see Section J-16) and the Building 65 area (see Section J-18).

Although not specifically listed in this section, Textron Lycoming also manages hazardous and non-hazardous solid wastes at satellite accumulation areas throughout the plant. These satellite accumulation areas are used to accumulate solid wastes in 55 gallon drums at or near the point of generation, and under the supervision of the operator of the process generating the waste. When filled these containers are transferred to the facilities main drum accumulation area described in Section J-10. No significant releases to the environment of hazardous wastes or hazardous constituents have occurred in any of these satellite accumulation areas.

In preparing this Section of the RCRA Part B Permit Application, Textron Lycoming has included all areas of the facility in which solid waste are currently managed. In addition, Textron Lycoming has also attempted to include, to the extent possible from available information, other SWMUs that were operated at the site in the past. Textron Lycoming has included these SWMUs which predate it's operation of the facility in order to make this permit application as complete as possible. Information reviewed by Textron Lycoming to complete this Section of the permit application included the "Draft Environmental Baseline Study Report" (dated May 3, 1991) prepared for the facility (known as the Stratford Army Engine Plant, or SAEP) by the United States Army. Please note that the facility is owned by the United States Army.

J-1 Waste Oil Tanks

- **Location:** The waste oil tanks are located in the Oil House Tank Farm between Building 15 and the eastern property boundary, and is indicated as SWMU #1 in Figure J-1.
- **Type of Unit:** This SWMU is comprised of three aboveground waste oil accumulation tanks within the Oil House Tank Farm.
- **Description of Operation:** The waste oil tanks are used to accumulate various oils prior to disposal. Waste oil is pumped into the tanks as it is removed from the production areas, and as necessary, the tanks are emptied into tanker trucks for off-site disposal.
- **Structural Description:** Waste oil is accumulated in three identical 10,000 gallon horizontal above ground storage tanks that are designated as Tank #11, Tank #12,

and Tank #13. The tanks are supported on saddles that elevate the tanks above the concrete slab, which is part of the containment structure for these and other tanks. Three foot high concrete walls completely surrounding this concrete slab on all four sides completes the containment structure and provides 100% positive containment. The tanks and the containment structure are commonly referred to as the Oil House Tank Farm.

- **Period of Operation:** The three waste oil tanks were installed in 1981 and have been in operation since.
- **Wastes Managed in Unit:** The waste oil tanks are used to accumulate Connecticut regulated wastes that are designated as CR02 and CR03. The waste oil is a mixture of lubrication, hydraulic, and cutting oils used in the various manufacturing areas of the facility. Tanks #12 and #13 are used to accumulate non-soluble oils (CR02), whereas, Tank #11 is used to accumulate water soluble oils and coolants (CR03).
- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-2 Hazardous Waste Tanks

- **Location:** The hazardous waste tanks are located in the Oil House Tank Farm between Building 15 and the eastern property boundary, and is indicated as #2 in Figure J-1.

- **Type of Unit:** This SWMU is comprised of five above ground accumulation tanks within the Oil House Tank Farm.

- **Description of Operation:** The hazardous waste tanks are used to accumulate waste solvent, solvent contaminated oil, and waste fuel for less than 90 days, prior to disposal. The various wastes are pumped into the appropriate tank as the materials are removed from the production areas, and as necessary, the tanks are emptied into tanker trucks for off-site disposal of the wastes.

- **Structural Description:** The various hazardous wastes are accumulated in any one of four identical 5,000 gallon horizontal storage tanks that are designated as Tank #5, Tank #6, Tank #7, and Tank #9 . A fifth tank, Tank #4, was also used for Connecticut regulated waste and hazardous waste. This tank is also a horizontal storage tank and has a capacity of 10,000 gallons. The tanks are supported on saddles that elevate the tanks above the concrete slab, which is part of the containment structure for these and other tanks. Three foot high concrete walls completely surrounding this concrete slab on all four sides completes the containment structure and provides 100% positive containment. The tanks and the containment structure is commonly referred to as the Oil House Tank Farm.

- **Period of Operation:** The five hazardous waste tanks were installed in 1981 and have been in operation since, with the exception of Tank #4 which was removed from service in 1988, and Tank #5 which was removed from service in 1991. Although removed from service, Tanks #4 and #5 have remained in place.

- **Wastes Managed in Unit:** The hazardous waste tanks are or were used to accumulate wastes as designated below:
    - ▸ Tank #4 — 1,1,1-trichloroethane/Varsol (F001/D001) and waste oil (CR02)
    - ▸ Tank #5 — 1,1,1-trichloroethane (F001)
    - ▸ Tank #6 — 1,1,1-trichloroethane (F001)
    - ▸ Tank #7 — waste jet fuel (D001)
    - ▸ Tank #9 — solvent/oil mixture (F001)

  The hazardous wastes accumulated in these tanks are or were generated in the various manufacturing and test areas of the facility.

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-3 Hazardous Waste and Waste Oil Transfer Systems

- **Location:** The hazardous waste and waste oil transfer systems start just outside and to the north of Building 13 and terminates in the Oil House Tank Farm, and is indicated as SWMU #3 in Figure J-1.

- **Type of Unit:** This SWMU consists of three transfer systems, each comprised of a receiving tank, a containment vault, a pump, and a transfer pipe.

- **Description of Operation:** There are three similar transfer systems, with each one being dedicated to a particular waste stream. The systems are designed so that a portable container of waste fuel, waste solvent/oil mixture, or waste oil can be emptied into a receiving tank and transferred to the appropriate waste accumulation tank in the Oil House Tank Farm. The portable containers range in size from a 55 gallon drum to a 200 gallon portable tank.

- **Structural Description:** There is a total of three separate transfer systems; one for waste fuel, one for waste solvent/oil mixtures, and one for waste oil. The waste fuel and the solvent/oil transfer systems are identical to each other, and the waste oil system is very similar to these other two systems. The waste fuel and the solvent/oil system each have a 500 gallon vaulted underground receiving tank into which the contents of the portable waste containers are emptied. The carbon steel tank is oriented horizontally in a below ground concrete containment vault. A pump, that is located just inside of Building 13, is used to transfer the waste in the receiving tank through a pipe, that is routed through a covered pipe trench and then overhead, into the appropriate accumulation tank (Tank #7 or Tank #9) in the Oil

House Tank Farm. The waste oil transfer system is the same as the other two systems with the exception of the receiving tank. Instead of a 500 gallon cylindrical tank, two 400 gallon rectangular 3/8″ steel plate tank encased in concrete vaults are the receiving tanks. The two waste oil receiving tanks are connected through an equalization pipe. A pump, that is located just inside of Building 13, is used to transfer the waste oil in the receiving tank through a pipe, that is routed through a covered pipe trench and then overhead, into the appropriate accumulation tank (Tank #12 and Tank #13) in the Oil House Tank Farm. The transfer lines for each of the three systems are 2″ diameter carbon steel pipe, approximately 250 feet long.

- **Period of Operation:** The waste fuel and waste solvent/oil transfer systems were installed in 1986, which replaced similar transfer systems that were at the same location. The waste oil transfer system was installed prior to 1970. The three systems are presently operating.
- **Wastes Managed in Unit:** Two hazardous wastes and a Connecticut regulated waste are managed in this SWMU, and are listed below:
  - ▸ Waste solvent/oil mixtures — F001
  - ▸ Waste jet fuel — D001
  - ▸ Waste oil — CR02
- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-4 Building 16 Drain System

- **Location:** The Building 16 Drain System is located throughout Building 16, which is situated along the eastern property boundary, and is indicated as SWMU #4 in Figure J-1.
- **Type of unit:** This SWMU is a gravity drain, collection, and conveyance system.
- **Description of Operation:** The drain system was used to collect and convey accumulated liquids from the floor of Building 16. This includes the 24 engine test cells and the work areas outside of the test cells. Wash water, fire protection water, and incidental fuel and oil spills were drained to this system by gravity to a collection sump just outside of Building 16. The collected liquids were then pumped to the Oil Abatement Plant for treatment.
- **Structural Description:** The Building 16 Drain System consisted of approximately 52 floor drains located throughout the building. Presently all of the floor drains have been sealed off and are no longer used. The drain pipes are installed under the concrete floor slab of Building 16. Flow through the system was by gravity, with the system operating at atmospheric pressure.
- **Period of Operation:** The drain system was installed when Building 16 was constructed in 1953, and has been in use up until the summer of 1991, at which time all the remaining active drains were sealed. During earlier refurbishing work of some of the test cell in the period 1978 to 1982, 9 of the floor drains were sealed.

- **Description of Operation:** This Stormwater and Wastewater Collection System gathers all water runoff from the paved surfaces and roofs of the facility, non-contact cooling water, boiler blowdown, and oily wastewater. This system previously collected the wash water from the floor drain system in Building 16 before the floor drain system was sealed and taken out of service in 1991 (see Section J-4). The system is a combination of gravity drains and pump stations to transfer the water to the Oil Abatement Plant for treatment. Of the entire collection system, only the portions of it that are connected to the Building 16 drains (see Section J-4) and the catch basin next to the Oil/Alum Tank (see Sections J-7 and J-14) are or were used to convey non-stormwater. These two portions of the collection system, up to the Oil Abatement Plant are the SWMU. The remainder of the system is dedicated to the collection and conveyance of stormwater only.

- **Structural Description:** The Stormwater and Wastewater Collection System consists of numerous roof drains and catch basins that are connected through an extensive network of above ground and underground drainage pipe, that discharge to one of the 6 pump stations (B-36, B-37, B-38, B-40, B-41,and B-64). The pump station are underground concrete sumps each equipped with up to four vertical centrifugal pump each rated from 2500 to 5000 GPM. The portions of the system that comprise this SWMU are the catch basin next to the Oil/Alum Tank, the underground pipe to pump station B-37 from the catch basin, pump station B-37, the pipe to the Oil Abatement Plant Surge Tank from B-37, the underground pipe to pump station B-40 from Building 16, pump station B-40, and the pipe to the Oil Abatement Surge Tank from B-40.

- **Wastes Managed in Unit:** The Building 16 Drain System's primary function is to collect and remove wash down water for the test cells. The wash down water would typically contain small amounts of hydraulic and lubricating oils (CR02), and jet fuel (D001) that are incidental releases from the testing of the turbine engines. This would include small discharges from the making and breaking of hydraulic and fuel line connections. It is also believed that degreasing solvents, such as 1,1,1-trichloroethane (F001) had been used in the test cells for cleaning purposes, and that small amounts of these materials were also present in the wash down water discharged to the drain system.

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred, although the integrity some of the drain pipe has been questioned.

J-5 Stormwater and Wastewater Collection System for the Oil Abatement Plant

- **Location:** The Stormwater and Wastewater Collection System is found throughout the site, and is generally located north of Sniffens Lane and east of Main Street. The location of the pump stations, which are part of the system, and are indicated as SWMU #5 on Figure J-1. The complete system is shown in Figure B-2.

- **Type of Unit:** This SWMU is a wastewater collection and conveyance system.

- **Period of Operation:** Portions of the underground drain and pump system were initially install in 1929 when the facility was first constructed, and has been extensively modified over the years to accommodate the many facility expansions.
- **Wastes Managed in Unit:** The Stormwater and Wastewater Collection System is designed to manage stormwater run-off and washdown water containing insoluble oils (CR02).
- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-6 Oil Abatement Plant

- **Location:** The Oil Abatement Plant is located just north of Building 16, along the eastern property boundary, and is indicated as SWMU #6 in Figure J-1.
- **Type of Unit:** This SWMU is a wastewater treatment system for oily wastewater.
- **Description of Operation:** Oily wastewater from Building 16 (see Section J-4) and the Oil/Alum Tank catch basin (see Sections J-7 and J-14), non-contact cooling water, boiler blowdown, and stormwater run-off from nearly all of the roofs and paved surfaces from Main Street to the eastern property boundary (see Section J-5) is treated in the Oil Abatement Plant. The combined storm and wastewater are collected in a Surge Tank, from where the water is transferred to the treatment

basin. Sodium hydroxide is added to the wastewater to accelerate the coalescing of the dispersed oil phase so as to make the skimming of the oil layer more efficient. In the past alum was use to effect the oil/water separation. The recovered oil layer is transferred to the Oil/Alum Tank, with the treated water from the Oil Abatement Plant being discharged to the Housatonic River under State of Connecticut water discharge permit number DEP/WPC 138-023.

- **Structural Description:** The Oil Abatement Plant consists of the following three major components:
  - ▸ Surge Tank — is a 200,000 gallon carbon steel vertical tank. The tank has a flat bottom that rests on a concrete slab.
  - ▸ NaOH/Alum Addition System — NaOH or alum is stored in a vertical 10,000 gallon FRP tank that is located in a concrete containment structure. The solution from this tank is metered into the treatment system at a fixed ratio relative to the wastewater rate.
  - ▸ Skimming Basin — is a square concrete structure that consists of two separate chambers, each being approximately 15 feet wide by 60 feet long by 15 feet deep. The coalesced oil layer is decanted from the basins and transferred to the Oil/Alum Tank (see Section J-7), while the remaining water layer is continuously discharged to the river at a maximum rate of 1.8 MGPD.
- **Period of Operation:** The Oil Abatement Plant was constructed and put into operation in 1976, and is currently in service.

- **Wastes Managed in Unit:** The Oil Abatement Plant is designed to manage storm and washdown water containing insoluble oils (CR02).

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-7 Oil/Alum Tank

- **Location:** The Oil/Alum Tank is located near the northeast corner of Building 13, and is indicated as SWMU #7 in Figure J-1.

- **Type of Unit:** This SWMU is an oily wastewater accumulation tank.

- **Description of Operation:** The concentrated oily phase skimmed from the Oil Abatement Plant is transferred to the Oil/Alum Tank to allow the mixture to further gravity separate. After a period of time, the heavier water phase is drained from the tank and returned to the Oil Abatement Plant for treatment, via the catch basin next to this tank. The lighter oil phase is accumulated in the Oil/Alum Tank. When several thousand gallons of oil has been accumulated, the tank is emptied by a waste hauler for off-site disposal.

- **Structural Description:** The Oil/Alum Tank is a 10,000 gallon vertical tank, that is made of carbon steel. The tank has a flat bottom and rests on a concrete pad.

- **Period of Operation:** The Oil/Alum Tank was constructed and put into operation in 1976 as part of the Oil Abatement Plant, and is currently in service.

- **Wastes Managed in Unit:** The Oil/Alum Tank is designed to process the concentrated insoluble oil phase (CR02) from the Oil Abatement Plant.

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-8 Chemical Wastewater Collection System

- **Location:** The Chemical Wastewater Collection System originates in each building on the site that generates, collects, or pretreats metal working, cleaning, or plating wastewater. This includes Buildings 2, 70, 6, 3A, and 63. The collection system gathers wastewater from all these sources and conveys it to Building 18 through one of two transfer lines. All these location are indicated as SWMU #8 in Figure J-1. The complete system is shown in Figure B-4.

- **Type of Unit:** This SWMU is a wastewater collection and conveyance system.

- **Description of Operation:** The Chemical Wastewater Collection System gathers all wastewater from the metal working operations at the facility, the pump station in Building 63, and the water from the Cyanide Destruct Unit in Building 70. The collection system is a combination of gravity drains and pump stations used to transfer the various wastewaters to the Chemical Wastewater Treatment System for treatment. The system is designed so that some wastewaters can be segregated from other wastewater prior to certain treatment steps. Cyanide bearing wastewater is collected and pretreated in Building 70, the Cyanide Destruct Unit, (see Section J-9) before being mixed with general wastewater in Building 63 and pumped to Building 18 for treatment. Chrome bearing wastewater can be collected separately in a dedicated pump system, conveyed in a separate transfer pipe to Building 18 for pretreatment, then combined with the other wastewater for treatment. At times, the pretreated cyanide-bearing wastewater is combined with chrome and non-chrome bearing wastewater, and transferred to the treatment system through a single pipeline.

- **Structural Description:** The Chemical Wastewater Collection System is made up of the following major components:
  - Open concrete floor trenches in the plating rooms
  - Floor drains and under slab pipes in the plating rooms
  - The underground collection pipe that collects wastewater from the various buildings
  - Pump station in Building 63 and the chrome-bearing wastewater pump station next to Building 63, that are used to transfer the wastewater through separate forced-mains to the Chemical Wastewater Treatment Plant

  - Underground forced-mains from the two pump station to the treatment facility; one for chrome bearing wastewater, and the other for combined general wastewater and pretreated cyanide-bearing wastewater
  - Underground pipe from the Cyanide Destruct Unit to the pump station in Building 63

- **Period of Operation:** The Chemical Wastewater Collection System was originally installed in 1951 and has been expanded as necessary. The system is currently in operation.

- **Wastes Managed in Unit:** The Chemical Wastewater Collection System is designed to collect and convey metal bearing wastewaters containing chrome, cadmium, cyanide, nickel, iron, zinc, and copper from metal working, cleaning, plating, and pretreatment operations.

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-9 Chemical Wastewater Treatment System

- **Location:** The Chemical Wastewater Treatment System is made up of three subsystems, and are located in two buildings on the site. The Cyanide Destruct Unit is located in Building 70, while the Chrome Reduction Unit and the Metals Removal

Unit are located in the Chemical Wastewater Treatment Plant in Building 18, which is near the southern property boundary. Both locations are indicated as SWMU #9 in Figure J-1.

- **Type of Unit:** This SWMU is made up of three wastewater treatment processes.
- **Description of Operation:** A description of the operation of the three treatment systems are presented below:
  - The Cyanide Destruct Unit — is used to pretreat cyanide-bearing wastewater. This is done by first adding sodium hypochlorite to the wastewater to oxidize the cyanide compounds in a reactor vessel under controlled pH conditions, then going through a second pH adjustment tank. Sodium hydroxide and sulfuric acid are used to control the pH of the water during the treatment process.
  - The Chrome Reduction Unit — treats chrome-bearing wastewater by reducing hexavalent chromium to trivalent chromium using sulfuric acid, sulfur dioxide and/or sodium metabisulfite.
  - The Metals Removal Unit — treats the combined wastewater streams (the two pretreated streams discussed above plus the general wastewater stream) to remove the various dissolved metals. This is done by forming an insoluble metal hydroxide precipitate with the addition of sodium hydroxide or lime. The sludge generated by this precipitation reaction is drawn off the bottom of the clarifier, thickened in a separate tank, and further dewatered with the use of a filter press. The overflow from the clarifier is sent through a sand filter before the treated water is discharged to surface water under an NPDES permit.

- **Structural Description:** A structural description of the three wastewater treatment systems components is presented below:
  - ▸ The Cyanide Destruct Unit — has a pump station that transfers the collected water into the reactor vessel, which is a 5,000 gallon vertical plastic tank. The water for this vessel is then pumped to a second 5,000 gallon vertical plastic tank where the final pH of the water is adjusted. The rest of the system is made up of various pumps, controllers, probes, and switches that allows the system to operate automatically. All the components of this wastewater treatment system are located inside Building 70.
  - ▸ The Chrome Reduction Unit — consists of six baffled tanks, each of which is 4 feet by 25 feet by 13 feet. The tanks are made of concrete and acid resistant brick and have a polymeric lining. The rest of the system is made up of the controls and metering systems for chemical addition and pH adjustment.
  - ▸ The Metals Removal Unit — has an equalization tank that has three separate chambers; one at 240,000 gallons and two at 120,000 gallons, that receives all the wastewater form the Chemical Wastewater Collection System. The equalization tank is constructed of concrete with a double polyethylene liner. After chrome reduction, the wastewater is transferred to a 60,000 gallon concrete clarifier where the chemicals added cause the dissolved metals to precipitate and settle out of the solution. The sludge phase from the clarifier is sent to a 8,000 gallon FRP thickening tank, and then further dewatered in one of two plate-and-frame filter press that each have a capacity of 1 cubic yard.

The overflow water from the clarifier is filtered in a continuous backwash sand filter before being discharged to surface waters.

- **Period of Operation:** The Chemical Wastewater Treatment System was originally built in 1958 and up-graded in 1986 with the addition of the Cyanide Destruct Unit, the equalization tank, and sludge filter press.
- **Wastes Managed in Unit:** The Chemical Wastewater Treatment System is designed to treat metal bearing wastewaters containing chrome, cadmium, cyanide, nickel, iron, zinc, and copper from metal working, cleaning, and plating operations.
- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-10 Container Accumulation Area

- **Location:** The Container Accumulation Area is located along the eastern property boundary, and is west of Building 15 and immediately south of the Oil House Tank Farm, and is indicated as SWMU #10 in Figure J-1.
- **Type of Unit:** This SWMU is a less than 90 day container accumulation area for hazardous and Connecticut regulated wastes.
- **Description of Operation:** The Container Accumulation Area is the designated location on the site where containerized wastes are gathered prior to off-site

disposal. Containerized liquid and solid wastes, typically in 55 gallon drums, are collected from numerous locations at the facility and brought to the Container Accumulation Area. The containers are segregated based on waste compatibility and remain in this area until arrangements are made for off-site disposal. The containers are closed at all times while they are being accumulated.

- **Structural Description:** The Container Accumulation Area is a concrete slab sloped into the containment area. The front (western half) area is used as a staging area to ship and receive containers, while the back (eastern half) area is used for accumulation of containers. The accumulation area is divided into three segregated areas by concrete containment curbs that provide positive containment for all wastes. Each segregated area is 14 feet wide and 20 feet long. The three areas are covered with a structure that has a roof and three walls.

- **Period of Operation:** The Container Accumulation Area was constructed in 1985 and is currently in use.

- **Wastes Managed in Unit:** The Container Accumulation Area is used to collect and prepare for shipping the following containerized wastes:
  - waste jet fuel, paint, aliphatic petroleum solvents (D001)
  - waste acetone (D001, F003)
  - waste sodium hydroxide, potassium hydroxide (D002)
  - waste 1,1,1-trichloroethane (F001)
  - waste oil and other materials contaminated with 1,1,1-trichloroethane (F001)
  - chromium contaminated plating wastes (D007)

  - Connecticut regulated waste oils and coolants (CR01/CR02)
  - other non-hazardous solid wastes

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-11 Original Container Accumulation Area

- **Location:** The Original Container Accumulation Area is located just east of Building 13 and is indicated as SWMU #11 in Figure J-1.

- **Type of Unit:** This unit was originally planned to be the facility's main less than 90 day container accumulation area for hazardous and Connecticut regulated wastes.

- **Description of Operation:** As described in Section A, this location was identified as the storage area for drums of waste in the facility's original Part A submitted in 1980. This area was only used to accumulate hazardous waste for less than 90 days, and this use was discontinued in 1984. This area is now used for the storage of compressed gas cylinders.

- **Structural Description:** This unit consisted of a paved area used for waste drum accumulation.

- **Period of Operation:** The area was used as a less than 90 day waste container accumulation area from prior to 1980, until 1984, and has since been used for non-waste related activities as described above.

- **Wastes Managed in Unit:** Containers (primarily 55 gallon drums) of the following waste materials were accumulated in this area:
  - waste jet fuel, paint, aliphatic petroleum solvents (D001)
  - waste acetone (D001, F003)
  - waste sodium hydroxide, potassium hydroxide (D002)
  - waste 1,1,1-trichloroethane (F001)
  - waste oil and other materials contaminated with 1,1,1-trichloroethane (F001)
  - chromium contaminated plating wastes (D007)
  - Connecticut regulated waste oils and coolants (CR01/CR02)
  - other non-hazardous solid wastes

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-12 Container Accumulation Areas A and B

- **Location:** Container Accumulation Areas A and B are located along the southern property boundary, and are west of Building 18. This location is indicated as SWMU #12 in Figure J-1.

- **Type of Unit:** This SWMU was formerly a less than 90 day container accumulation area for hazardous wastes.

- **Description of Operation:** The Container Storage Areas A and B were the designated location on the site where containerized wastes were accumulated prior to off-site disposal. Containerized liquid and solid wastes, typically in 55 gallon drums, were collected from numerous locations at the facility and brought to the Container Accumulation Area A or B. The containers were segregated based on waste compatibility and remained in the areas until arrangements were made for off-site disposal. The containers were closed at all times while they are being stored.

- **Structural Description:** The Container Storage Areas A and B are sloped concrete slabs. Each storage area is a separate area and are provided with containment dikes that are low concrete block walls. Each segregated area is approximately 12 feet wide and 22 feet long. The two areas are each covered with a roof.

- **Period of Operation:** The Container Accumulation Area was constructed in 1983 and has not been used since 1986. A Closure Plan for these areas has been prepared and submitted to the DEP for approval.

- **Wastes Managed in Unit:** The Container Storage Areas A and B had been used to collect and store, prior to shipping, the following containerized wastes:
  - waste jet fuel, paint, aliphatic petroleum solvents (D001)
  - waste acetone (D001, F003)
  - waste sodium hydroxide, potassium hydroxide (D002)
  - waste 1,1,1-trichloroethane (F001)
  - waste oil and other materials contaminated with 1,1,1-trichloroethane (F001)
  - chromium contaminated plating wastes (D007)
  - Connecticut regulated waste oils and coolants (CR01/CR02)
  - other non-hazardous solid wastes
- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-13 Sludge Roll-off Container Area

- **Location:** The Sludge Roll-Off Container Area is located near the southern property boundary, and is just north of Building 71. This location is indicated as SWMU #13 in Figure J-1.
- **Type of Unit:** This SWMU is a less than 90 day container accumulation area for hazardous wastes.

- **Description of Operation:** Metal hydroxide sludge settled in the clarifier of the Chemical Wastewater Treatment System is dewatered using a filter press. At periodic intervals, the filter cake is removed from the filter press and transferred to the roll-off container. When the roll-off container becomes full, or within 90 days, the roll-off container is removed for off-site disposal of the sludge.

- **Structural Description:** The sludge container is a standard over-the-road 20 cubic yard roll-off steel box with a tarp cover. While accumulating waste, the roll-off is located on a concrete slab that is equipped with a containment berm. The berm is designed so that any spills and/or rainwater collected in the containment area can be pumped to the Chemical Wastewater Treatment Plant.

- **Period of Operation:** The Sludge Roll-Off Container Area has been in use since 1986 to the present time.

- **Wastes Managed in Unit:** This unit is used to accumulate metal hydroxide sludge from the treatment of electroplating wastewaters, which is a F006 hazardous waste.

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-14 Metal Chips Oily Water Sump

- **Location:** The Metal Chips Oily Water Sump is located near the northwest corner of Building 13 and is indicated as SWMU #14 in Figure J-1.
- **Type of Unit:** This SWMU is an underground collection and transfer sump.
- **Description of Operation:** Metal chips generated in the various machining operations on the site are collected and accumulated in two outdoor bins, and are periodically removed by an outside scrap metal dealer for recycling. Oil that is on the chips from the machining operations, and any rainwater, drains from the collection bins to the Oily Water Sump. The accumulated liquid in the sump is pumped to the catch basin next to the Oil/Alum Tank, which is part of the Stormwater and Wastewater Collection System (see Section J-5), and is eventually treated in the Oil Abatement Plant.
- **Structural Description:** The Oily Water Sump is an underground rectangular tank made of steel plate encased in concrete. The sump is approximately 30 feet by 10 feet by 15 feet, and is equipped with a sump pump that is manually controlled to periodically empty the sump.
- **Period of Operation:** The Oily Water Sump was constructed prior to 1970 and is currently in use.
- **Wastes Managed in Unit:** This unit is used to manage insoluble oil which is a Connecticut regulated waste (CR02).

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-15 Soil Pile

- **Location:** The soil pile is located on the southwestern corner of the property, and is indicated as SWMU #15 in Figure J-1.
- **Type of Unit:** This SWMU is a solid waste pile.
- **Description of Operation:** Approximately 11,000 cubic yards of soil from a building excavation was transported to this location for on-site treatment. The treatment process consisted in spreading soil in thin layers in a paved treatment area and turning the layers at periodic intervals to remove the hydrocarbons present in the soil.
- **Structural Description:** The soil pile and the treatment area are situated on paved surface. The area is surrounded with hay bales to control sediment transport, and rainwater runoff is collected and pumped to the Oil Abatement Plant for treatment.
- **Period of Operation:** The soil was removed from the excavation site in 1990 and moved to its present location. The treatment process was ended in 1991.

- **Wastes Managed in Unit:** The waste managed in this unit was soil contaminated by low levels of petroleum hydrocarbons. The treated soil has been approved by the DEP for off-site disposal as cover material at municipal landfills, or on-site as fill.
- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-16 Surface Impoundments

- **Location:** The four surface impoundments formerly associated with the Chemical Wastewater Treatment System were located in two areas at the southern property boundary, to the south and the east of Building 18. This area is indicated as SWMU #16 in Figure J-1.
- **Type of Unit:** These SWMUs were designated as RCRA surface impoundments.
- **Description of Operation:** The surface impoundments had two separate functions as they relate to the operation in Building 18. As wastewater was sent from the production areas to Building 18 for treatment, it was collected in the Equalization Lagoon (Lagoon #1) prior to being introduced into the treatment process. After treatment, which was the chemical precipitation of dissolved heavy metals, the sludge was discharged to one of three Settling Lagoons (Lagoons #2, #3, and #4)

where the precipitated metal hydroxide sludge would settle and be dewatered. As necessary, the sludge would be removed for off-site disposal.

- **Structural Description:** This waste management unit consisted of an Equalization Lagoon and three Sludge Lagoons. The Equalization Lagoon was a 25,600 ft^2 bentonite-lined basin, while the three Settling Lagoons were different sized (9,140 ft^2, 7,920 ft^2, and 12,600 ft^2) unlined basins.

- **Period of Operation:** The Equalization and Sludge Lagoons were constructed in 1958 and were operated until 1986.They were replaced by the addition of an equalization tank and filter press. Closure activities for the lagoons commenced in 1987 and were certified complete May 22 1990, in accordance with a DEP/EPA approved Closure Plan.

- **Wastes Managed in Unit:** The hazardous waste managed in the Equalization Lagoon were as follows:
  - Wastewater treatment sludges form electroplating operations (F006)
  - Spent cyanide plating bath solutions from electroplating operations (F007)
  - Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process (F009)

  The hazardous waste managed in the three Settling Lagoons was sludge generated from the treatment of electroplating wastewater (F006).

- **Evidence of Release:** Groundwater data collected from the detection and assessment monitoring systems installed for the four surface impoundments indicate that the principal inorganic contaminants cadmium, chromium, nickel, and cyanide may have been released from these units. Groundwater monitoring data for the impoundments is presented in Section E-1 and E-2.

J-17 Causeway

- **Location:** The causeway is located along the site's Housatonic River waterfront in the southeast portion of the facility. This area is indicated as SWMU #17 in Figure J-1.
- **Type of Unit:** This SWMU is a filled area reportedly containing some solid waste.
- **Description of Operation:** The causeway was constructed in the 1930s. Additional fill materials were placed on the northern edge of the causeway in the 1950s and 1960s. The causeway was used as an access-way to the Housatonic River for amphibious aircraft manufactured at the site in the 1930s and 1940s. The causeway area was also periodically used for fire training in the 1950s and 1960s. Building #59, which is located on the causeway was constructed in 1968 and was used to store explosives.
- **Structural Description:** The causeway consists of compacted soils and other structural fill materials on which a roadbed was constructed for a runway.
- **Period of Operation:** The causeway was constructed in the 1930s and was used until sometime in the 1970s when use of Building #59 was discontinued.

- **Wastes Managed in Unit:** Reportedly some solid waste materials including asbestos and construction debris were used as fill in this area.

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-18 Building 65 Area

- **Location:** The Building 65 area is located in the northeastern portion of the facility. This area is indicated as SWMU #18 in Figure J-1.

- **Type of Unit:** This SWMU is a filled area reportedly containing some solid waste.

- Description of Operation: Filling of solid wastes along with dredge spoils and other materials.

- **Structural Description:** This area historically received quantities of fill material to elevate it above the level of the Housatonic River and support buildings and other structures to expand the facility to the east. Building 65 is the most recent building to be constructed in this area.

- **Period of Operation:** Filling is believed to have been performed in this area in the 1940s, including the approximately 8 acres of land added to the site by hydraulic dredging of the Housatonic River.

- **Wastes Managed in Unit:** Historical filling of this area has reportedly included construction debris, scrap, and other solid wastes (in addition to dredge spoils, soils, and structural fill).

- **Evidence of Release:** Soil sampling in this area in 1990 during construction activities for Building 65 indicated that some soil contained petroleum hydrocarbons, chromium and lead. Analytical data for soil sampling conducted in the Building 65 area was submitted to Ms. Joan Jouzaitis of US EPA Region I on May 13, 1991 (see Attachment 5-B of this submittal).

J-19 Waste Paint Tank

- **Location:** The exact location of the former waste paint tank is unknown. Reportedly, this tank was located in the area between Building #2 and Building #3. The approximate location of this tank is indicated as SWMU #19 in Figure J-1.

- **Type of Unit:** This SWMU was a waste tank.

- **Description of Operation:** Waste paints generated in the paint shop were reportedly accumulated in this tank prior to disposal.

- **Structural Description:** Unknown.

- **Period of Operation:** Unknown. Believed to be operating in the 1940s and possibly the 1950s prior to being taken out of service.

- **Wastes Managed in Unit:** The specific types of waste paint managed in this unit are unknown.

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

J-20 Building #19 Dry Well

- **Location:** The former dry well was located inside the southwest corner of Building #56. Reportedly, use of this dry well was discontinued prior to construction of the existing Building #19 in the same area in 1987. The approximate location of this dry well is indicated as SWMU #20 in Figure J-1.

- **Type of Unit:** This SWMU was a dry well.

- **Description of Operation:** Wastewaters or possibly other solid wastes were reportedly discharged to the dry well.

- **Structural Description:** The dry well was reportedly constructed of concrete with a gravel bottom.

- **Period of Operation:** Unknown.

- **Wastes Managed in Unit:** The specific types of solid wastes that may have been managed in this unit are unknown.

- **Evidence of Release:** In accordance with 40 CFR 270.14(d)(2), there is no documentation in available records which would indicate that releases of hazardous wastes or hazardous constituents to the environment from this SWMU have occurred.

Section K

Other Federal Laws

[40 CFR 270.14 (b)(20); 270.3]

Textron Lycoming believes the post-closure activities proposed in this application are in compliance with the following federal laws:

- Wild and Scenic Rivers Act
- National Historic Preservation Act of 1966
- Endangered Species Act
- Fish and Wildlife Coordination Act
- Coastal Zone Management Act.

Section L
Certification

L-1 Certification of Application by a Principal of the Company [40 CFR 270.11]

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Date: 12-10-91

Signature:

Name: Ronald L. Newcomb

Title: Vice President, Manufacturing