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

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.

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

Test	Results Filtrate Samples 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.

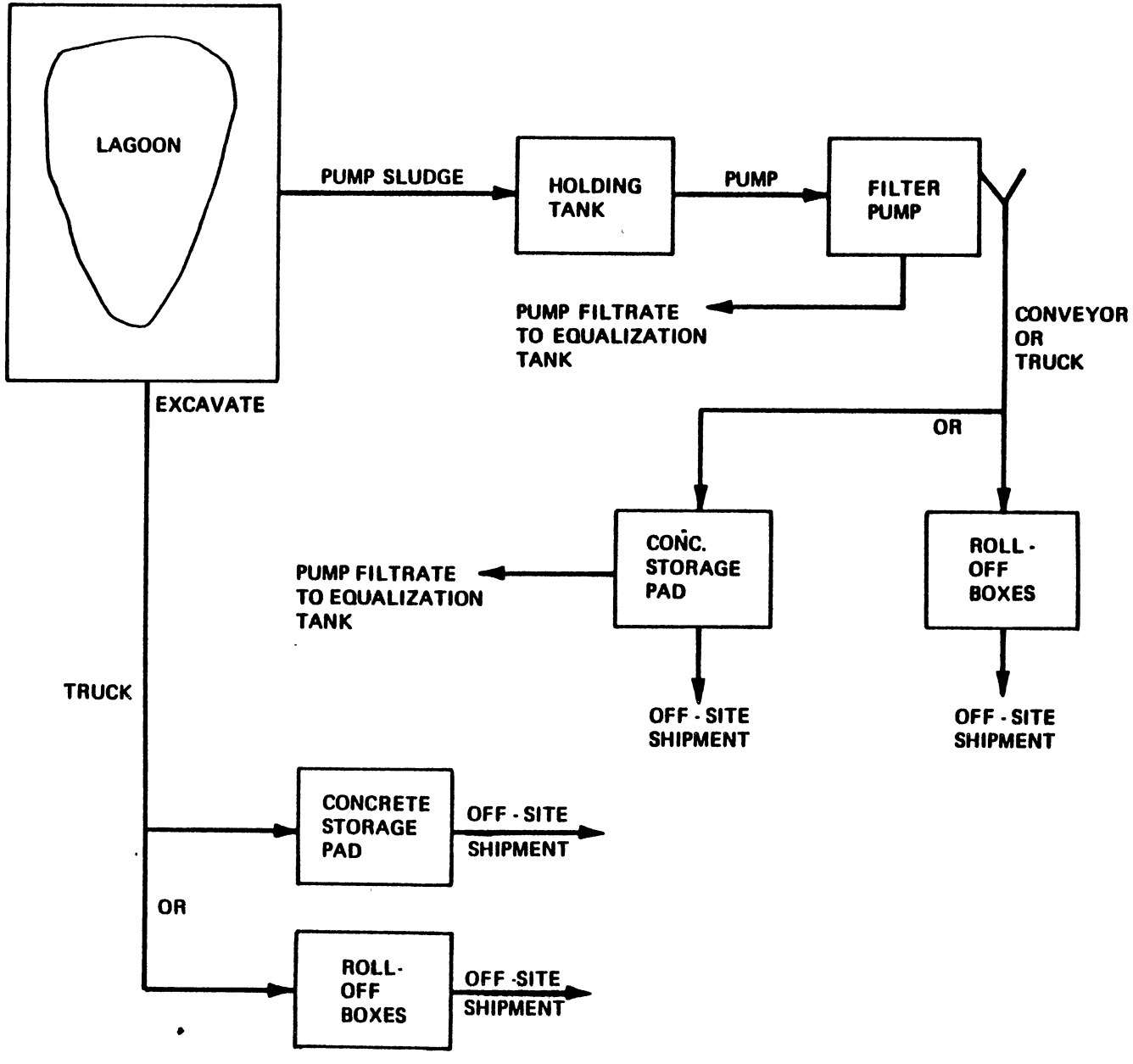

FIGURE 4 - 1. SCHEMATIC OF SLUDGE AND SOIL REMOVAL

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,

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.

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 the 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.

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.

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

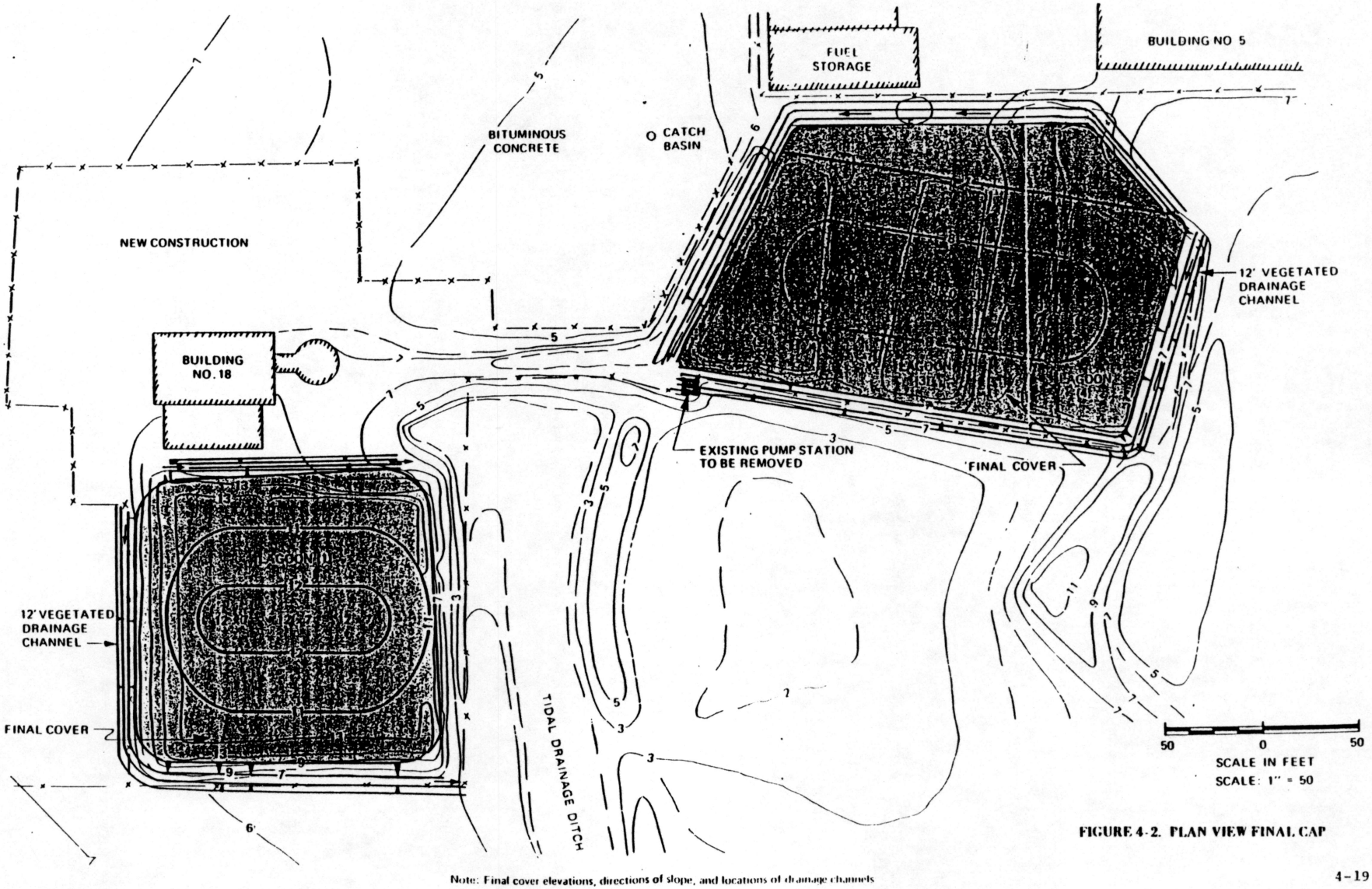
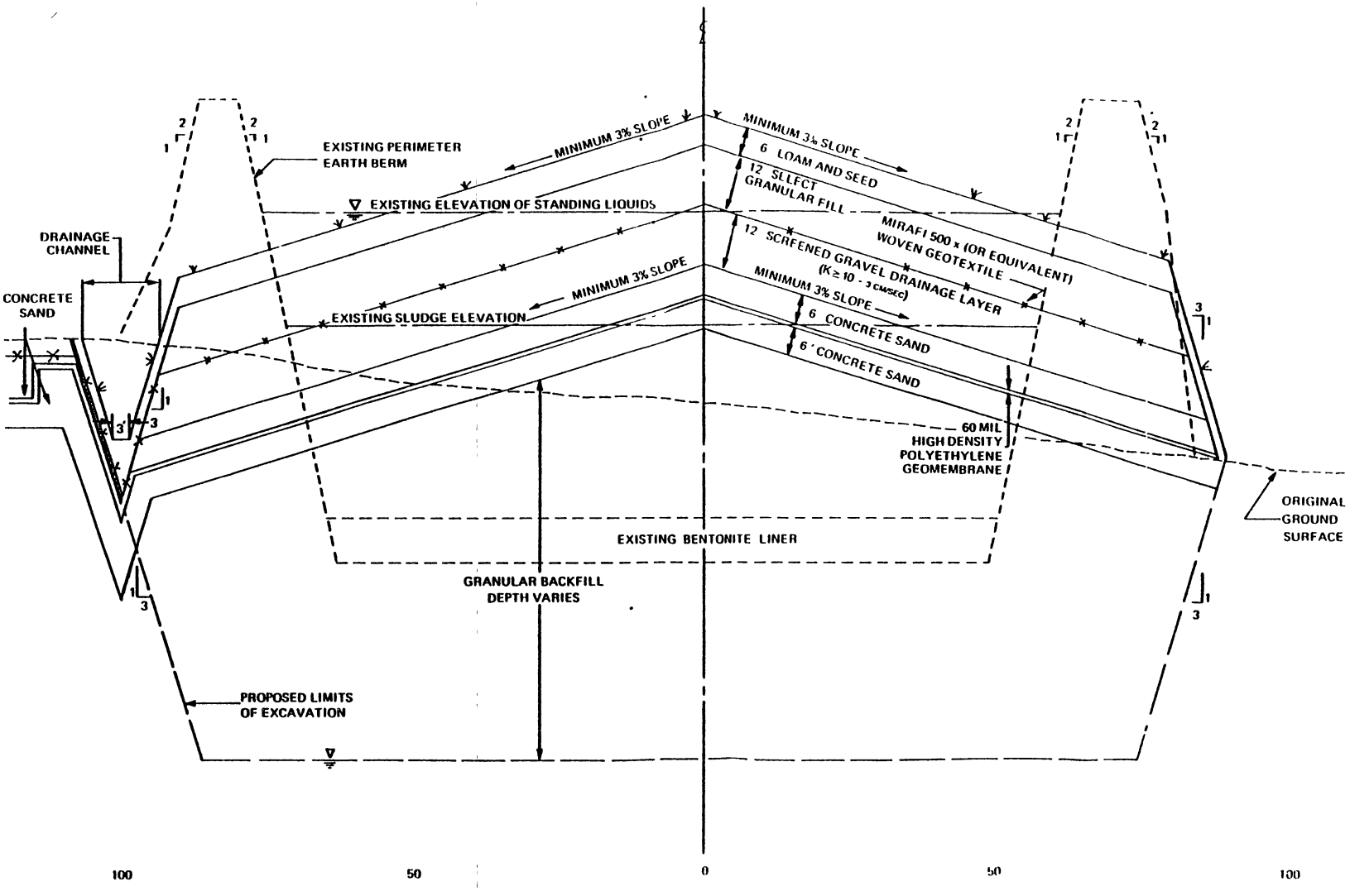


FIGURE 4-2. PLAN VIEW FINAL CAP

Note: Final cover elevations, directions 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.

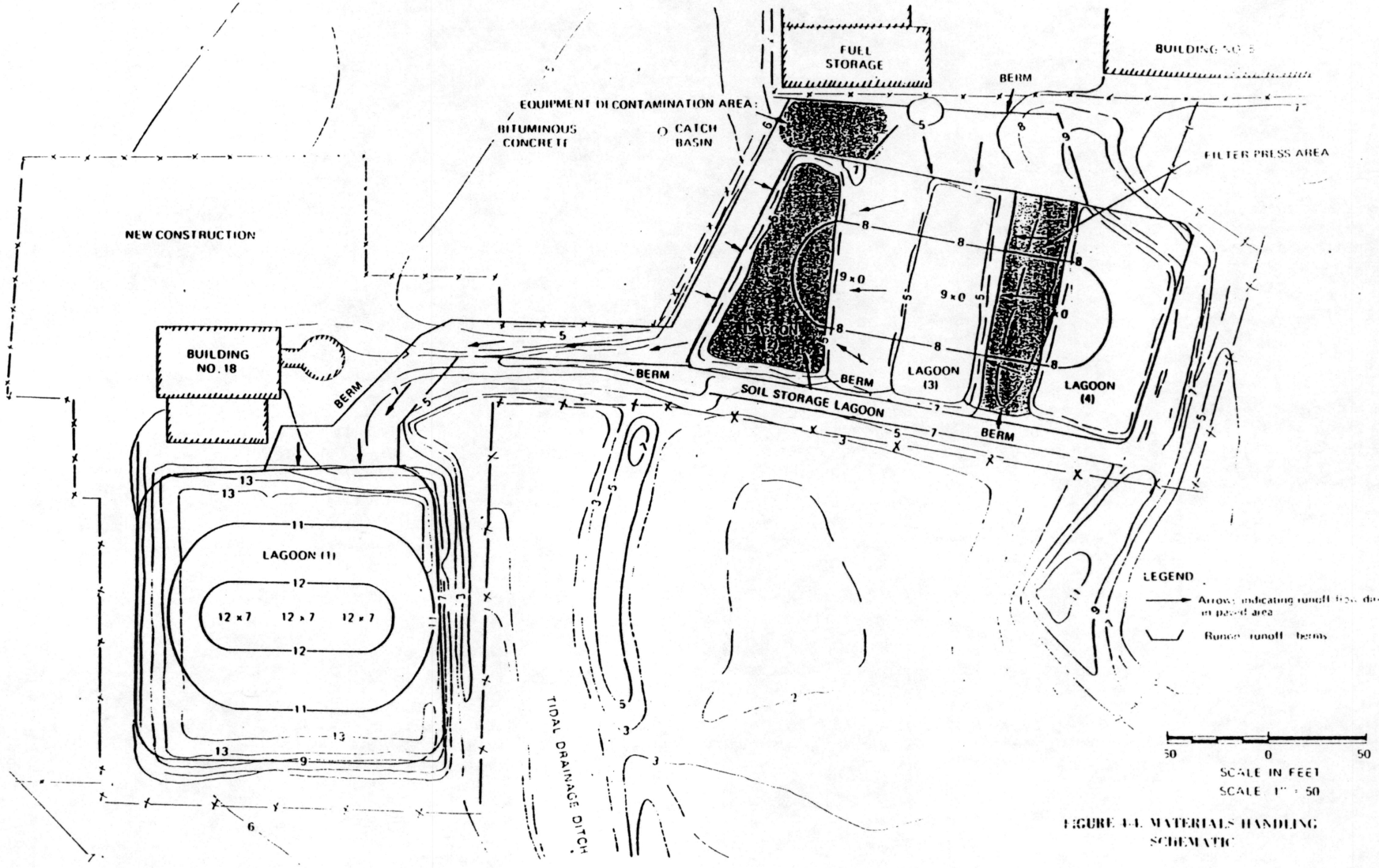


FIGURE 4-1. MATERIALS HANDLING SCHEMATIC

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

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.

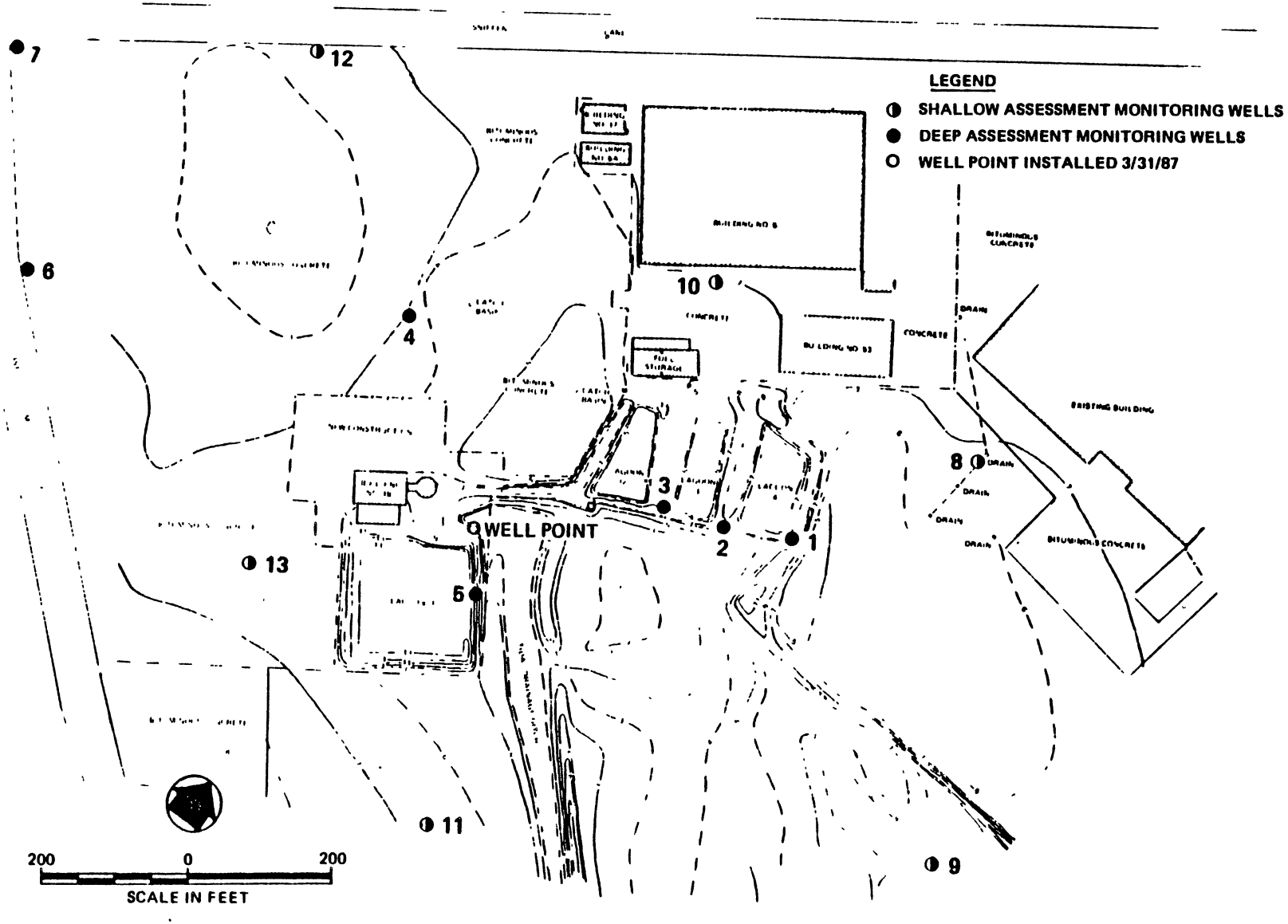


FIGURE 5-1. AVCO SURFACE IMPOUNDMENTS AND MONITORING WELLS

6.0 NOT APPLICABLE

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.

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."

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).

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.

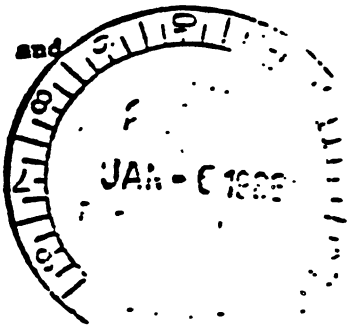
APPENDIX A

Exemption From Financial Requirements

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

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, CID 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 Girox (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:

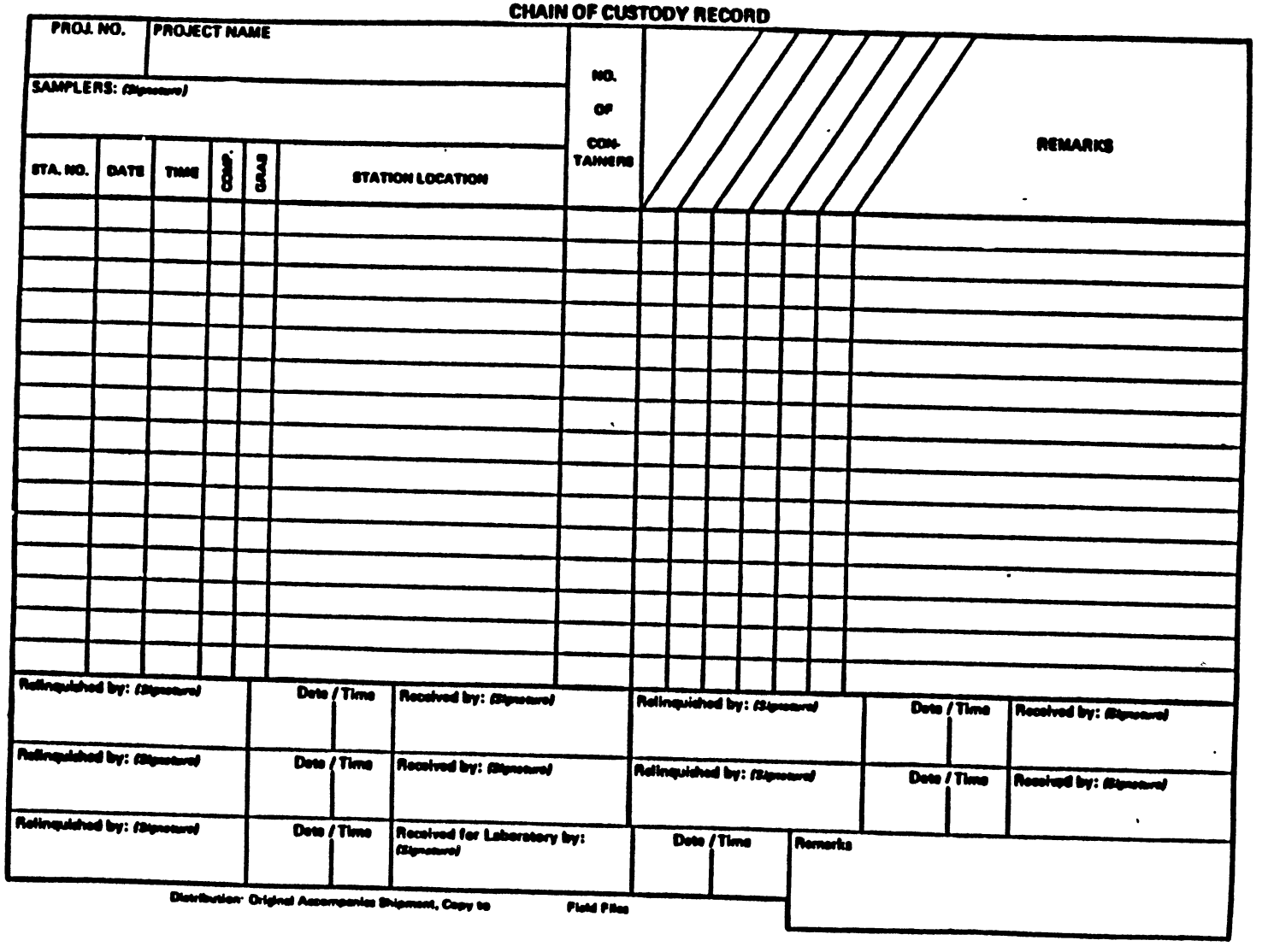
- The chain of custody record shall be initiated for every sample by the person collecting the sample. Every sample shall be assigned a unique identification number that is entered on the chain of custody form. Samples can be grouped for shipment using a single form.
- The record shall be completed in 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 be 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

METCALF & EDDY

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

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

* 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 or	4 millirems
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/ 1
1,4-Dioxane	20 ug/l
Ethanol	26,000 ug/l(short term spill)
Ethylene	100 ug/l
Isopropyl alchol	1000 ug/ 1
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/l)
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-Dichlorol-ethylene	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

*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) acute	FRESHWATER AQUATIC LIFE (ug/l) chronic	SALTWATER AQUATIC LIFE (ug/l) acute	SALTWATER AQUATIC LIFE (ug/l) chronic	HUMAN HEALTH[A] (ug/l)
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 (ug/l) acute	FRESHWATER AQUATIC LIFE (ug/l) chronic	SALTWATER AQUATIC (ug/l) acute	SALTWATER AQUATIC (ug/l) chronic	HUMAN HEALTH[A]
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	chronic	SALTWATER AQUATIC LIFE (ug/l) acute	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/l[C]

PARAMETER	FRESHWATER AQUATIC LIFE (ug/l) acute	chronic	SALTWATER AQUATIC LIFE (ug/l) acute	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 (Chloromethane, bromomethane, dichloromethane, bromodichloromethane tribromethane, dichlorodifluoromethane, trichlorofluoromethane)	11,000	ND	12,000	6400	.19[C]
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	chronic	SALTWATER AQUATIC LIFE (ug/l) acute	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[B] 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]

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), 533) 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

OSHA INTERIM FINAL STANDARD TO PROTECT WORKERS IN HAZARDOUS WASTE OPERATIONS [51 FR 45654, DEC. 19, 1986.]

.ematopoietic 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 ·alth 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 view training meeting the quirements 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 examinations 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 examinations required by paragraph (f)(2) of this section shall include a medical and work history with special emphasis 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 protective equipment used or to be used, and

(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 (1)(1) and (1)(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

Published by THE BUREAU OF NATIONAL AFFAIRS, INC., Washington, D C 20037

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 coptainers 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 stairways.
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 washrooms.
30	First aid stations, infirmaries, and offices.

(n) *Sanitation at temporary workplaces*—(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 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.

TABLE H-102.2.—TOILET FACILITIES—Continued

Number of employees	Minimum number of facilities
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).* Employers 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 weerer 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 ½ 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 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 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.

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 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 8.0.

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:

1. 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, Univ[illegible] Station, Birmingham, Ala. 35294; (205) 934-7032).

[illegible]ch 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

John Fleming

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

STABLEX

- 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.

STABLEX

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.

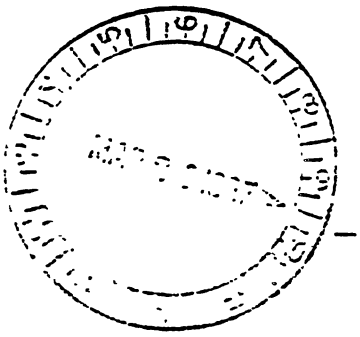
4. Please notify U.S. EPA in accordance with the attached form letter.

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.

Director General
TRANSPORT OF DANGEROUS GOODS
Transport Canada
3rd Floor, Tower B
Place d'Youville
Ottawa, Ontario
K1A ON5

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

NOT APPLICABLE

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

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 ($\times 10^{-4} \frac{cm}{cm \cdot °C}$) Nominal	ASTM D696	1.2	1.2	1.2	1.2	1.2	1.2
Moisture Vapor Transmission ($g/m^2 \cdot day$)	ASTM E96	0.06	0.05	0.04	0.03	0.02	0.01
Thermal Stability Oxidative Induction Time (OIT) (minutes, minimum)	ASTM D3895 130°C, 800 psi O_2	2000	2000	2000	2000	2000	2000

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

MIRAFI® INC

MIRAFI INC P O BOX 240967/CHARLOTTE, N C 28224/(704) 523-7477 or (800) 438-1855/TELEX 216903 MRFI

2MP-3
4-85