

**INDUSTRY GUIDE TO CLOSURE, POST-CLOSURE,
GROUNDWATER MONITORING AND FINANCIAL
REQUIREMENTS UNDER RCRA**

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INDUSTRY GUIDE TO CLOSURE, POST-CLOSURE, FINANCIAL,
AND GROUNDWATER MONITORING REQUIREMENTS UNDER RCRA

CORRECTION AND UPDATE SHEET

1. Page 29 - Section 4.2, 1st sentence
"Initial closure and post-closure cost estimates....."
2. Page 36 - Section 5.1, 1st sentence
"....apply to all facilities operating under interim status in unauthorized states as..."
3. Page 41 - 9th line
"....estimates after the pay-in period is completed."
4. Pages 54-56, Section 5.12
 - Massachusetts will receive public comments through August 1982.
 - New Hampshire will adopt the federal financial assurance regulations on December 31, 1982. Note that interm status facilities will not have to submit documentation, only have it on-site. Only facilities that have had their permit called will have to submit documentation.
 - Connecticut requests that the plans and cost estimates be submitted along with the financial documentation by October 6, 1982.
 - Maine officials hope to have their regulations finalized by the end of 1982 or early 1983.
5. Page 58 - Section 5.14.2
The ICF guidance manual can be obtained from NTIS under number PB 82-237595.

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703)487-4650
6. Pages 66-67, Section 6.6
 - Massachusetts will receive public comments through August, 1982.
 - New Hampshire will adopt the federal liability insurance regulations on December 31, 1982. Sudden coverage will be effective on December 31, 1982. Nonsudden coverage will have the federal effective dates of January 15, 1983, '84, and '85.
 - Connecticut has adopted the federal liability regulations by reference. Sudden coverage will be effective on October 6, 1983. Nonsudden coverage will have the federal effective dates of January 15, 1983, '84 and '85.
 - Maine hopes to have its regulations finalized by the end of 1982 or early 1983.
7. Page 74 - Section 7.3, last paragraph
"....reported to the Regional Administrator or responsible state agency director quarterly....."

8. Page 75 - Section 7.4, 15th line
Same addition as the previous correction.
9. Page 76 - Section 7.4, 14th line
Same addition as the previous correction.
10. Page 78 - Section 7.6.1, 11th line
"Rotary drilling is appropriate in most areas...." (delete not)
11. Page 80 - Section 7.6.2, middle of page

 . Characterization parameters (annually) (delete semi)
 . Indicator Parameters - change total costs to:

 \$825 - \$1,055
 \$3,300 - \$4,220
12. Page 85 - Section 7.8.2, 1st sentence
"All Region I states....."
13. Page 109 - Attachment 1, page 3
The 1982 should be moved from the end of the first sentence to the end of the second sentence.
14. Page 139 - Appendix B
The entire denominator should be placed under a square root sign (radical).

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TABLE OF CONTENTS

<u>CHAPTER</u>	<u>TITLE</u>	<u>PAGE</u>
1	INTRODUCTION	1
2	CLOSURE OF HAZARDOUS WASTE MANAGEMENT FACILITIES	4
3	POST-CLOSURE REQUIREMENTS AT HAZARDOUS WASTE DISPOSAL FACILITIES	18
4	CLOSURE AND POST-CLOSURE COST ESTIMATES	29
5	FINANCIAL ASSURANCE FOR CLOSURE AND POST-CLOSURE	36
6	LIABILITY INSURANCE	60
7	GROUNDWATER MONITORING	70
APPENDIX A	MODEL PLANS	87
APPENDIX B	STUDENT'S T-TEST	135
APPENDIX C	FEDERAL AND STATE CONTACTS	144

CHAPTER 1

INTRODUCTION

This guidance manual was prepared to assist hazardous waste Treatment, Storage and Disposal Facilities (TSDFs) located in the U. S. Environmental Protection Agency's (EPA) Region I understand and comply with the regulations issued under the Federal Resource Conservation and Recovery Act of 1976 (RCRA) and applicable state regulations. This includes facilities located in the states of:

- Vermont;
- Connecticut;
- Massachusetts
- Rhode Island;
- Maine; and
- New Hampshire.

The requirements addressed in this guidance manual are those applicable to facilities that have qualified for interim status from the EPA as described in Section 122.23 of Title 40 of the Code of Federal Regulations (40 CFR 122.23). The regulations applicable to interim status facilities are found, for the most part, in 40 CFR 265.

The requirements described in this guidance manual are related to:

- Closure of TSDFs at the end of their operating life:

- Caring for disposal facilities after they are closed (the post-closure care period);
- Providing financial assurance that funds will be available to conduct closure and provide post-closure care;
- Insuring TSDFs against third party liability claims; and
- Monitoring groundwater both during and after the facility's active life.

All six states in Region I have obtained Phase I authorization from the EPA. Under this authorization, each state is responsible for administering its own closure, post-closure and groundwater monitoring regulatory programs. The states' requirements regarding closure and post-closure are essentially equivalent to the Federal regulations described in Chapters 2 and 3. However, some Region I states have implemented specific groundwater monitoring requirements in addition to issuing regulations equivalent to the Federal groundwater monitoring requirements. Chapter 7, which describes the Federal requirements, also identifies the principal differences between state and Federal groundwater monitoring requirements in Region I states.

Federal regulations governing (1) cost estimates, (2) financial assurance and (3) liability insurance were issued in April of 1982. Region I states had not developed regulations in the latter two areas as of this writing. However, the states'

current plans regarding financial assurance and liability insurance have been included in Chapters 5 and 6 respectively. Federal requirements for estimating closure and post-closure costs are reviewed in Chapter 4.

At the end of each chapter of this report additional sources of information are listed that can be of further assistance to the reader. Many of the cited publications are available from the National Technical Information Service (NTIS) in Springfield, Virginia (703/557-4650). Most are also available for review in the EPA Region I library in Boston, Massachusetts (617/223-5791).

To illustrate the required content and submittal format for closure plans, cost estimates, financial assurance instruments, liability insurance policies and groundwater monitoring plans, examples of these are presented for a hypothetical treatment and storage facility in Appendix A. Although these examples will further assist a facility in developing its own compliance plans, the reader is advised that site-specific considerations may require the use of alternate mechanisms and/or approaches.

Appendix B contains an example of the Student's T-Test used to evaluate groundwater monitoring data.

Appendix C contains a listing of Federal and state regulatory authorities who can be contacted for additional guidance or information.

CHAPTER 2

CLOSURE OF HAZARDOUS WASTE MANAGEMENT FACILITIES

This chapter describes the planning and performance requirements for closure (and partial closure) of hazardous waste management facilities and the minimum required content of the written closure plan. This material is presented in the following order:

- 2.1 Applicability
- 2.2 Closure Plans
- 2.3 Closure Standards and Inventory Removal
- 2.4 Partial Closure
- 2.5 Maximum Waste Inventory
- 2.6 Equipment Decontamination and Disposal
- 2.7 Certification of Closure
- 2.8 Closure Schedule
- 2.9 Extensions for Closure Time
- 2.10 Modifications to the Closure Plan
- 2.11 Sources of Information

Facilities required to have a closure plan must also prepare a closure cost estimate, as described in Chapter 4, and provide assurance that financing of closure activities will be available at the time of closure through one of the mechanisms described in Chapter 5. States and the Federal government are exempt from these additional requirements.

2.1 Applicability

Any facility that stores hazardous wastes for 90 days or longer or treats or disposes of such wastes must plan for the facility's eventual closure. Closure requirements are not

applicable to hazardous waste generators or transporters unless those facilities are also treatment, storage or disposal facilities.

2.2 Closure Plans

A written closure plan must be submitted with the facility's Part B RCRA permit application or 180 days before closure is to begin, whichever comes first. Existing facilities that filed Part A applications and are operating under interim status (as described in 40 CFR Section 122.23) were required to have written closure plans by May 19, 1981. A copy of the most recent closure plan must be kept on-site until closure is certified to be complete and is accepted by EPA or the responsible state agency.

Closure plans will be subject to a 30-day public comment period and may also be subject to a public hearing. The EPA Regional Administrator (RA) or state agency director will approve, modify or disapprove the closure plan within 90 days of its receipt. If the closure plan is not approved, the applicant will have 30 days to submit a modified or new plan and the RA or state agency director another 60 days to approve or modify it.

The closure plan must identify the steps necessary to completely or partially close the facility at any point during its intended operating life, and to completely close the facility at

the end of its intended operating life. The closure plan need not address major accidents or spills. Only events expected to occur during normal operations should be considered in preparing the plan.

The minimum required content of the written closure plan is described in Sections 2.3 through 2.8 of this chapter.

2.3 Closure Standards and Inventory Removal

2.3.1 General Standards

Hazardous waste facilities must be closed in a manner that: (1) minimizes the need for further maintenance and controls, (2) minimizes or eliminates threats to human health and the environment; and (3) avoids post-closure escape of hazardous waste, hazardous waste constituents, leachate, contaminated rainfall, or waste decomposition products to the ground or surface waters or to the atmosphere.

The closure plan should describe in detail how, at closure, all hazardous wastes; hazardous waste residues; and contaminated containers, tanks, liners, soils and other equipment will be disposed of or decontaminated so as to achieve the closure standards.

If any hazardous wastes, residues, or contaminated soils or equipment are to remain at the facility after closure, the facility must be closed as a disposal facility. Such facilities are subject to additional requirements, such as post-closure care, ground water monitoring and nonsudden liability coverage requirements, and are also subject to the closure requirements described below in Sections 2.3.2 and 2.3.3.

2.3.2 Closure of Hazardous Waste Landfills

A final cover that will achieve the closure standards specified in Section 2.3.1 must be placed over the landfill. This will generally consist of an impermeable seal over the landfill, such as a clay cap, covered by a layer of soil and revegetated with plants that will prevent soil erosion without causing root damage to the cap itself. The cover design and performance should be thoroughly described in the closure plan. At a minimum, the description of the cover design should include materials to be used, final surface contours, thickness, porosity, permeability, slope, length of run of slope, and type of vegetation on the cover.

Adequate long-term performance of the landfill liner should be demonstrated in the closure plan based on waste/liner compatibility analyses, leaching tests, and review of construction and operation records. If closure activities or post-closure use of the site would require that the liner and/or cover support heavy loads, such as large earth-moving equipment, the closure plan should demonstrate that those loadings will not result in cover or liner damage.

The closure plan should show how the landfill design and closure will prevent consolidation of materials within the landfill that could lead to rupture of the protective cover.

The closure plan must specify how the steps taken to close the facility will:

- (1) Control pollutant migration from the facility via ground water, surface water, and air;
- (2) Control surface water infiltration and prevent surface water pooling over the landfill;
- (3) Prevent erosion of the landfill cover; and
- (4) Be compatible with the site's intended or expected post-closure use.

The closure plan must also demonstrate that the owner or operator has considered the following factors in developing the closure plan:

- (1) Type and amount of hazardous wastes in the landfill;
- (2) The mobility and expected migration rate of wastes;
- (3) Site location, topography, and surrounding land use, with respect to the potential effects of pollutant migration (e.g., ground water, surface water and drinking water contamination);
- (4) Climate effects, including the amount, frequency, and pH of precipitation; and
- (5) Site geology, hydrology and geohydrology.

If access to the site is to be restricted, the closure plan should describe the activities undertaken at the time of closure to prevent intrusions. For example, fencing off the landfill at closure to prevent cover disturbance by hunters or off-road vehicles should be considered an element of the closure plan.

2.3.2 Closure of Land Treatment Facilities

In addition to the requirements specified in Section 2.3.1, hazardous waste land treatment facilities must meet the requirements described in this section.

Land treatment facilities must be closed in a manner that adequately controls the escape of (1) hazardous contaminants into groundwaters and surface waters and (2) airborne particulate contaminants through wind erosion. Unless all contaminated

soils and materials are to be removed from the facility at closure, the closure plan must state how adequate control will be assured. If contaminants are to remain, the closure plan must consider at least the following:

- (1) Design, function and characteristics of any cover to be used;
- (2) Collection and treatment of site run-off;
- (3) Diversion structures to prevent surface water run-on from entering treated soil areas; and
- (4) Monitoring of soils, soil-pore water, and ground water.

In describing the effectiveness of these and any other controls utilized, the closure plan must at a minimum, demonstrate that the controls will be adequate, considering:

- (1) The amount, characteristics, mobility, and expected migration rates of wastes;
- (2) Site location, topography and surrounding land use with respect to potential pollutant migration effects (e.g., proximity to ground water, surface water and drinking water sources);
- (3) Climatic effects, including amount, frequency and pH of rainfall;
- (4) Geological and soil profiles and surface and subsurface hydrology of the site;
- (5) Soil characteristics, including cation exchange capacity, total organic carbon and pH; and

- (6) Type, concentration and depth of migration of waste constituents in the soil as compared to background levels. Current information from unsaturated zone (zone of aeration) monitoring conducted at the site should be used in the closure plan to evaluate the performance of controls to be used for site closure in the closure plan.

2.4 Partial Closure

The closure plan must describe any partial closure that will take place at the facility prior to final closure. Examples of partial closure activities would be (1) the periodic closure of hazardous waste landfill cells at a facility or (2) discontinuing a process line and removing certain storage and treatment equipment from use. All partial closure activities must be conducted in accordance with the same regulations described in this guide that govern final closure activities.

2.5 Maximum Waste Inventory

The closure plan must describe the maximum inventory of wastes that will be in storage, treatment and disposal at any time during the life of the facility. Amounts of waste should be stated, in appropriate units, for each activity at the site (i.e., treatment, storage and disposal). Maximum waste inventory may differ from a facility's maximum capacity to allow for unusual occurrences, such as inventory buildups during process outages. The estimate of maximum inventory will become a condition of the permit.

2.6 Equipment Decontamination and Disposal

The closure plan should identify the number or amount of storage tanks, pumps, containment structures, piping, liners, soils and other contaminated materials that will require decontamination, or disposal as a hazardous waste, during closure. Decontamination procedures to be used, such as steam cleaning, hydro-blasting and solvent rinsing, should be described. The methods to be used to analyze washing residues to verify satisfactory decontamination and the intended disposal method for those residues should be identified.

A disposal facility disposing of its own contaminated equipment and materials on-site during closure must assure the compatibility of those materials with other wastes at the facility, as appropriate. Disposal of contaminated equipment should not interfere with planned future uses for the land.

2.7 Certification of Closure

Upon completion of facility closure, a certification that all closure activities contained in the approved closure plan have been completed must be submitted to the EPA Regional Administrator or responsible state agency director. This certification must be signed by both the owner/operator and an independent registered professional engineer.

2.8 Closure Schedule

The closure plan must estimate the year in which closure will take place and include a detailed schedule of closure and partial closure activities. The owner/operator must notify the EPA Regional Administrator or state agency director at least 180 days before closure or partial closure activities begin.

The closure schedule must include the total time required to close the facility and a milestone schedule depicting the time required for intervening closure activities. Provisions should be included in the plan for scheduling periodic certification inspections during the closure period.

Closure activities should begin within 30 days after receipt of the last waste shipment at the site. All hazardous wastes must be treated, removed off-site, or disposed of on-site within 90 days of receipt of the final volume of waste and all closure activities must be completed within 180 days from the receipt of the final volume of waste, unless an extension is granted.

2.9 Extensions for Closure Time

In the event that more time is needed for closure than is normally allotted, the closure plan must demonstrate that: (1) the activities will necessarily take longer than 180 days to complete or (2) that the facility will have the capacity to

receive additional wastes, that a person other than the owner or operator will recommence operation of the site, and that closure of the facility would be incompatible with continued operation of the site. The closure plan must also demonstrate that all steps have been and will continue to be taken to prevent threats to human health and the environment from the unclosed but inactive facility.

2.10 Modifications to the Closure Plan

If changes in the operating plans or facility design affect the closure plan or the expected year of plant closure, the owner/operator must request a modification of the closure plan. For example, changes in any of the following should result in a modification of the closure plan: facility size/capacity; types and quantities of wastes onsite at maximum closure inventory; schedule for partial and final closure; and schedules for periodic maintenance and inspection activities.

Changes in technical considerations can also result in closure plan modification; for example, the application of new technology or changes in monitoring requirements, operating contingencies, land-use patterns around the facility, and the response of the EPA Regional Administrator or responsible state agency director to petitions by owners or operators.

2.11 Sources of Information

2.11.1 Federal Regulations

The Federal regulatory requirements for closure described in this chapter can be found in the sections of Title 40 of the Code of Federal Regulations identified in Table 1.

Table 1
Federal Regulatory Citations for
Closure Standards

Topic	Section*
Applicability	265.110(a)
Closure Performance Standard	265.111
Closure Plan	265.112
Amending the Closure Plan	265.112
Time Allowed For Closure	265.113
Disposal of Decontamination of Equipment	265.114
Certification of Closure	265.115
Closure of Tanks	265.197
Closure of Surface Impoundments	265.228
Closure of Land Treatment Facilities	265.280
Closure of Landfills	265.310
Closure of Incinerators	265.351
Closure of Thermal Treatment Facilities	265.381
Closure of Chemical, Physical and Biological Treatment Facilities	265.404

* Code of Federal Regulations, Title 40, Part 190 to 399; Revised as of July 1, 1981; U.S. Government Printing Office; Washington, D.C.

2.11.2 State Regulations

All Region I states have issued final regulations regarding closure that are essentially equivalent to the Federal requirements described in this chapter. However, readers are advised to contact their state hazardous waste permitting authorities to determine if additional state regulations may be applicable to their facilities.

2.11.3 Additional Guidance

Further guidance in developing closure plans can be found in the EPA's guidance manuals:

"Draft Guidance for Subpart G of the Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities" (Draft Report, IR&T Corp., October 6, 1980); and

"Closure of Hazardous Waste Surface Impoundments", EPA Publication No. SW-873, September, 1980 (NTIS Publication No. PB-81-166-894).

The latter document also contains information concerning closure of hazardous waste landfills.

Other publications that may be of use in developing closure plans include:

"Manual for Evaluating Cover Systems for Solid and Hazardous Wastes", EPA Publication No. SW-846, October, 1980, (NTIS Publication No. PB-81-166-340);

"Guidance Manual: Lining of Waste Impoundments and Disposal Facilities", EPA Publication No. SW-870, October, 1980, (NTIS Publication NO. PB-81-166-365)

"Design and Management of Hazardous Waste Land Treatment Facilities", EPA Publication No. SW-874, October, 1980,1 (NTIS Publication No. PB-81-182-107);

"Hydrologic Simulation of Solid Waste Disposal Sites", EPA Publication No. SW-868, October, 1980, (NTIS Publication No. PB-81-166-332); and

"Decontaminating Vessels Containing Hazardous Materials", by P.B. Dransfield and R.T. Greig in Chemical Engineering Progress, January, 1982, pp. 35-38.

CHAPTER 3

POST-CLOSURE REQUIREMENTS AT HAZARDOUS WASTE DISPOSAL FACILITIES

This chapter describes the planning and implementation requirements related to caring for hazardous waste disposal facilities after they are closed.

This guidance material is presented in the following order:

- 3.1 Applicability
- 3.2 Post-Closure Plan
- 3.3 Post-Closure Care Requirements
- 3.4 Schedule
- 3.5 Amending the Post-Closure Plan
- 3.6 Notice to Local Land Authority
- 3.7 Notice in Property Deed

All facilities required to have post-closure plans must also prepare post-closure cost estimates, as described in Chapter 4, and provide assurance that financing of post-closure activities will be available through one of the mechanisms described in Chapter 5. Only states and the Federal government are exempt from these additional requirements.

3.1 Applicability

All hazardous waste management facilities where wastes, waste products or contaminated materials are to remain after closure are considered disposal facilities and must provide post-closure care. Such facilities would include hazardous waste landfills, land treatment facilities, seepage facilities and surface impoundments, so long as hazardous contaminants remain after closure.

3.2 Post-Closure Plans

Owners and operators of disposal facilities were required to have written post-closure plans by May 19, 1981. A copy of the most recent post-closure plan must be kept at the facility until the post-closure care period begins. A copy must also be submitted with the facility's Part B RCRA permit application or 180 days before closure is to begin, whichever comes first.

As with closure plans, post-closure plans are subject to public comments, public hearings, an initial 90-day review cycle by EPA or the responsible state agency and, if necessary, a 30-day period for the applicant to modify the plan followed by a 60-day period in which the Regional Administrator or state agency director will modify or approve the post-closure plan.

The requirement content of written post-closure plans is described in Sections 3.3 and 3.4 of this chapter.

3.3 Post-Closure Care Requirements

3.3.1 General Requirements

Closed hazardous waste disposal facilities or operations must be inspected, monitored and maintained, as necessary, to prevent adverse impacts on human health and on the environment. The post-closure plan must specify how these goals will be achieved.

The post-closure plan must provide the name, address and phone number of a person or office to contact during the post-closure period concerning the facility, or the post-closure program.

All post-closure plans must contain a plan for monitoring groundwater and reporting the results of that monitoring to the EPA Regional Administrator or responsible state agency director. The requirements of the groundwater monitoring plan are described in Chapter 7 of this guidance document.

The post-closure plan must also describe any planned operations or maintenance and inspection activities and the frequencies of those activities.

This would include activities such as:

- Inspections to assure that monitoring equipment is fully functional;

- Periodic mowing to prevent deep-rooting plants from damaging covers or caps;
- Operation and maintenance of groundwater treatment systems used to decontaminate soils; and
- Inspections and maintenance to assure the integrity of covers, caps, or any other containment/control structures to be employed.

If access to the site is to be controlled after closure, the post-closure plan should describe the staffing and/or care required to prevent intrusions onto the site. Examples of post-closure access control could include periodic inspection with maintenance, as needed, of security fences and stationing security guards at entry points.

If the post-closure plan does not provide for restricting site access, the EPA Regional Administrator or state agency director may require that the post-closure plan be revised to include security measures when:

- Wastes may remain exposed after completion of closure; or
- Access by the public or domestic livestock may pose a hazard to human health.

Any planned use of the property on or in which hazardous wastes are to remain must be described in the post-closure plan. Such uses must not disturb the integrity of the final cover, liners or other containment structures unless it is demonstrated that the proposed uses:

- Will not increase potential health or environmental hazards; or
- Are necessary to reduce threats to human health or the environment.

3.3.2 Post-Closure Care of Landfills

In addition to the general requirements described in Section 3.3.1, hazardous waste landfill owners or operators must: (1) operate, maintain and monitor any leachate collection removal and treatment system present so as to prevent excess leachate accumulation in the containment system; (2) maintain and monitor any gas collection and control system; and (3) protect and maintain surveyed benchmarks. These requirements must be addressed in the post-closure plan.

3.3.3 Post-Closure Care of Land Treatment Facilities

Post-closure plans for land treatment facilities must, in addition to the requirements of 3.3.1, provide for maintaining and operating any: (1) run-off collection and treatment system and (2) unsaturated zone monitoring system.

Furthermore, the growth of food chain crops at closed land treatment facilities is subject to extensive controls, documentation and testing to assure the purity of the crops grown.

3.4 Schedule

The post-closure plan should include a schedule of activities planned during the post-closure period. The post-closure period begins upon the certification by an independent registered professional engineer that closure has been completed. The EPA Regional Administrator or responsible state agency director must be notified at least 180 days prior to the date that closure is to begin.

Post-closure care must last for 30 years (unless the post-closure plan is amended as described in Section 3.5). The EPA Regional Administrator or state agency director may require that post-closure care last longer than 30 years if he deems that additional care is necessary to protect human health and the environment.

3.5 Amending The Post-Closure Plan

The post-closure plan may be amended by the owner or operator at any time during the active life of the facility, during the post-closure period or at the end of the post-closure period. The disposal facility owner or operator must submit an amended plan within 60 days of any changes in operating plans or facility design, or events which occur during the active life of the facility, that groundwater contamination during the facility's active life would necessitate that the post-closure plan be

amended. Any changes in the intended future use of the property here hazardous wastes are located also requires an amendment to the post-closure plan.

The owner or operator of the facility may request an amendment to his post-closure plan at any time through a petition to the Regional Administrator or responsible state agency director.

During and at the end of the post-closure period, any member of the public (or the owner/operator) may submit a petition requesting a plan modification. Any petition to alter the required post-closure care (or care period) must provide just cause for doing so and demonstrate that the changes:

- Are necessary to prevent or reduce threats to human health or the environment; or
- Will not increase such threats.

Petitions submitted after closure is complete are subject to a 30-day public comment period and may also be subject to public hearings.

3.6 Notice to Local Land Authority

Within 90 days after closure is complete, a notice must be submitted to both the local land authority and the EPA Regional Administrator (or responsible state agency director) containing a site survey plat and an inventory of disposed waste.

The plat must be prepared and certified by a professional land surveyor. It must contain a prominent note stating the owner's or operator's obligation to restrict disturbance of the site.

The inventory of disposed wastes must identify the type, location and quantity of all wastes disposed of within each cell or area since November 19, 1980. Wastes disposed of before that date should be similarly identified to the best of the owner's or operator's ability.

3.7 Notice in Deed to Property

A notice must be permanently placed in the official property deed (or any other record that would normally be examined in a title search) that will alert any potential purchaser that the land has been used to manage hazardous wastes and that its use is permanently restricted by Federal and state law (40 CFR 265.117(C)).

3.8 Sources of Information

3.8.1 Federal Regulations

The Federal regulatory requirements for post-closure described in this chapter can be found in the sections of Title 40 of the Code of Federal Regulations identified in Table 2.

Table 2
Federal Regulatory Citations for
Post-Closure Standards

Topic	Section*
Applicability	265.110(b)
Security Requirements	265.114
Post-Closure Care and Use of Property	265.117
Post-Closure Plans	265.118
Amending the Closure Plans	265.118
Notice to Local Land Authority	265.119
Notice in Property Deed	265.120
Post-Closure Care of Surface Impoundments	265.228
Post-Closure Care of Land Treatment Facilities	265.280
Post-Closure Care of Landfills	265.310

* Code of Federal Regulations, Title 40, Part 190 to 399; Revised as of July 1, 1981; U.S. Government Printing Office; Washington, D.C.

3.8.2 State Regulations

All Region I states have issued final regulations regarding post-closure care that are essentially equivalent to the Federal requirements described in this chapter. However, readers are advised to contact their respective state hazardous waste permitting authorities to determine if state requirements vary from those described in this chapter.

3.8.3 Additional Guidance

Further guidance in developing post-closure plans can be found in the EPA's guidance manuals:

"Draft Guidance for Supart G of the Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities" (Draft Report, IR&T Corp., October 6, 1980); and

"Closure of Hazardous Waste Surface Impoundments", EPA Publication No. SW-873, September, 1980 (NTIS Publication No. PB-81-166-894).

The latter document also contains information concerning post-closure care at hazardous waste landfills.

Other publications that may be of use in developing closure plans include:

"Manual for Evaluating Cover Systems for Solid and Hazardous Wastes", EPA Publication No. SW-846, October, 1980, (NTIS Publication No. PB-81-166-340);

"Guidance Manual: Lining of Waste Impoundments and Disposal Facilities", EPA Publication No. SW-870, October, 1980, (NTIS Publication NO. PB-81-166-365)

"Design and Management of Hazardous Waste Land Treatment Facilities", EPA Publication No. SW-874, October, 1980,1 (NTIS Publication No. PB-81-182-107);

"Hydrologic Simulation of Solid Waste Disposal Sites", EPA Publication No. SW-868, October, 1980, (NTIS Publication No. PB-81-166-332);

"Landfill and Surface Impoundment Performance Evaluation Manual", EPA Publication No. SW-864, October, 1980 (NTIS Publication No. PB-81-189-359); and

"Hazardous Waste Leachate Management Manual", EPA Publication No. SW-871, October, 1980 (NTIS Publication No. PB-81-189-357).

CHAPTER 4

CLOSURE AND POST-CLOSURE COST ESTIMATES

This chapter describes requirements for preparing, filing and updating closure and post-closure cost estimates. This material is presented in the following order:

- 4.1 Applicability
- 4.2 Cost Estimate Preparation
- 4.3 Closure Cost Estimates
- 4.4 Post-Closure Cost Estimates
- 4.5 Revising the Cost Estimates
- 4.6 Sources of Information

4.1 Applicability

All treatment, storage or disposal facility owners or operators that must prepare closure plans must also prepare closure cost estimates. Similarly, disposal facilities required to have post-closure plans must have accompanying post-closure cost estimates. Only states and the Federal government are exempt and need not prepare cost estimates.

4.2 Cost Estimate Preparation

Initial post-closure cost estimates were to have been prepared by May 19, 1981. Facility changes or corrections to a previously-prepared cost estimate may require that a revised document, termed the "latest cost estimate," be prepared. (If

no such revisions are made the initial cost estimate is considered the latest cost estimate.) The latest cost estimate must be revised annually to adjust for inflation, yeilding the "latest adjusted cost estimate." Copies of the latest cost estimate(s) and the latest adjusted cost estimate(s) must be kept at the facility until closure is certified to be complete and must be included in a facility's RCRA Part B permit application submittal.

4.3 Closure Cost Estimates

A facility's closure cost estimate must provide an accurate estimate of the total costs that would be incurred if the facility were to be closed at the point in its operating life when the extent and manner of its operation would make closure the most expensive. Thus, the conditions on which the cost estimate is based may differ from anticipated conditions at the end of normal facility life with respect to factors such as:

- The amounts of materials requiring disposal;
- The status of processing equipment; and
- The area of the facility in disturbed condition.

Significant differences between the basis of the cost estimate and the normal planned closure activities should be identified in the cost estimate. Except for such adjustments, the closure cost estimate should include all costs expected in conducting closure in adherence with the closure plan.

Closure cost estimates need not include provisions for highly unusual contingencies such as 50-year storm damage or an unexpected major system failure. Only predictable events that may occur over the life of the facility should be considered.

Cost estimates should be based on the operating costs to the owner or operator. This means that in developing the cost estimate, factors such as depreciation costs, capital recovery factors and interest on debts need not be included. For example, if earth-moving equipment owned by the facility operator is to be used, only the costs of owning or operating the equipment need be considered, and not equipment depreciation costs. However, if this equipment must be rented to conduct closure, the full rental costs must be part of the cost estimate.

Cost estimates for each activity must include all associated costs such as fully loaded labor costs, any costs of supervision, fuel and maintenance costs for equipment, administrative costs and provisions for normal contingencies. Depending on the uncertainty of the cost estimate, provision for contingencies could reasonably be expected to fall within the range of 15 to 25 percent.

Cost estimates may not be reduced to account for salvage values or land sales at the time of closure.

4.4 Post-Closure Cost Estimates

Post-closure cost estimates must be based upon the activities, quantities and methods indicated in the post-closure plan. The cost estimate should reflect the costs of purchasing or renting, as appropriate, all necessary labor, materials and equipment to carry out post-closure care. Unlike the closure cost estimate, it may not be assumed that the owner or operator already has adequate equipment for carrying out the post-closure plan.

The cost estimate must cover the period beginning at completion of closure and lasting for 30 years thereafter (unless the post-closure period is amended by the EPA Regional Administrator or responsible state agency director). The cost estimate need not cover the costs of maintaining any partially closed portions of the facility prior to certification of complete facility closure. However, the fact that partial closure has occurred for portions of the facility does not shorten the period of post-closure care for those operations in the cost estimate.

The cost estimate should provide an estimate of the annual post-closure costs arrived at by adding all annual expenditures plus expenditures that will occur less frequently than once per year and dividing the resulting sum by the number of years in the post-closure period (normally 30).

4.5 Revising the Cost Estimate

The cost estimate must be revised annually within 30 days of the anniversary date of the first cost estimate and at any time when changes in closure or post-closure plans increase the costs of conducting those activities. Also, if during the active life of the facility it is found that the costs have been over- or under-estimated, the cost estimate should be revised.

Closure and post-closure care cost estimates are adjusted annually for inflation using a factor derived from the annual Implicit Price Deflator for Gross National Product as published by the Department of Commerce in the Survey of Current Business. To illustrate the calculation, consider the following hypothetical example:

- previous year cost estimate = \$50,000
- previous year deflator = 141.70
- current year deflator = 152.05

After rounding off to the nearest whole number, the inflation factor is computed as $152/142 = 1.07$. The current year cost is then:

- $1.07 \times \$50,000 = \$53,500$

Post-closure cost estimates are adjusted annually in this manner only during the operating life of the facility (and not after closure has commenced).

The latest cost estimate must be kept at the facility together with the latest adjusted (for inflation) cost estimate.

4.6 Sources of Information

4.6.1 Federal Regulations

The Federal requirements regarding cost estimates may be found in the sections of Title 40 of the Code of Federal regulations cited in Table 3.

Table 3
Federal Regulatory Requirements
for Cost Estimates

Topic	Section*
Applicability	265.140
Definitions	265.141
Cost Estimate for Closure	265.142
Cost Estimate for Post-Closure	265.144

* Revised in the Federal Register, Volume 47, April 7, 1982, page 15032.

4.6.2 State Regulations

All Region I states have issued regulations regarding cost estimates that are essentially equivalent to the Federal requirements described in this chapter. However, readers are advised to contact their state hazardous waste permitting authorities to determine if they may be required to comply with additional state requirements.

4.6.3 Additional Information

Further guidance in developing cost estimates can be found in the EPA's draft guidance manual:

"Draft Guidance for Supart H of the Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities" (Draft Report, IR&T Corp., August 29, 1980)

Publications containing cost data that may be of use in estimating closure and post-closure costs include the annual editions of:

"Building Construction Cost Data", Robert Snow Means Company, Inc., Kingston, Massachusetts; and

"Dodge Guide to Public Works and Heavy Construction Costs", McGraw-Hill Information Systems Co., New York, New York.

CHAPTER 5

FINANCIAL ASSURANCE FOR CLOSURE AND POST CLOSURE

This chapter describes the manner in which owners and operators of treatment, storage and disposal facilities are to provide assurance that funding will be available to conduct the closure and post-closure activities required at their facilities. This material is presented in the following order:

- 5.1 Applicability
- 5.2 Financial Assurance Instruments
- 5.3 Trust Funds
- 5.4 Financial Tests
- 5.5 Surety Bonds
- 5.6 Letters of Credit
- 5.7 Insurance Policies
- 5.8 State Assumption of Responsibility
- 5.9 Multiple Financial Assurance Mechanisms and
Multiple Sites
- 5.10 Reduction of Coverage
- 5.11 Termination of Assurance Instruments
- 5.12 State Requirements
- 5.13 Choosing a Mechanism
- 5.14 Sources of Information

5.1 Applicability

The financial assurance requirements discussed in this chapter apply to all facilities operating under interim status as treatment, storage or disposal facilities, excepting states and the Federal government but including municipalities and other local authorities. All facility owners and operators required to provide closure or post-closure cost estimates must also demonstrate financial assurance as described in this chapter.

Facilities in states with an authorized phase I RCRA hazardous waste program (all States in EPA Region I are authorized for phase I) are subject to state requirements, which must be at least substantially equivalent to the Federal requirements as promulgated May 19, 1980. Facilities in a phase I authorized state are not required to supply financial assurance to the EPA Regional Administrator except for those existing facilities that have been notified by EPA through certified mail to submit Part B of their permit application or have voluntarily submitted Part B's.

State regulations may require that facility owners or operators submit financial assurance to the responsible agency director in the state in which the site is located. The status of the requirements of states in Region I is reviewed in Section 5.12 of this chapter. Interim status facilities are advised to keep abreast of regulatory developments in their states prior to selecting a method for providing financial assurance.

5.2 Financial Assurance Instruments

Corresponding to the cost estimates for closure and post-closure of each facility, the owner or operator must meet specific requirements to ensure that the required funds are provided. The regulations enable owners or operators to meet this objective in any of the following three ways:

- The owner or operator can actually provide the funds to cover anticipated closure and post-closure care requirements by establishing a trust fund equal to anticipated requirements; or
- The owner or operator can demonstrate capability to provide adequate funds for closure and post-closure care by meeting certain tests of financial strength; or
- The owner or operator can provide for coverage of anticipated requirements by third parties -- states, insurance companies, financial institutions through letters of credit, or surety companies through surety bonds -- in the event that owners or operators themselves are unable or unwilling to meet the funding or financial test requirements.

The regulations allow a degree of flexibility over time in the choice of financial assurance mechanisms. Subject to the rules concerning the timing of notifications and delivery of instruments, the owner or operator is free to substitute among alternative financial assurance mechanisms which, singly or combined, satisfy the funding requirements for facility closure and post-closure. In the event that a trust fund is substituted for one or more of the other instruments, the trust must be established at an initial funding level equal to what the trust fund would have contained if it had been established at the time of the initial permit.

The regulations contain required standard language for each of the following financial assurance instruments:

- Trust Agreement and Certification of Acknowledgement
- Surety Bond
- Irrevocable Stand-by Letter of Credit
- Certificate of Insurance for Closure or Post-Closure Care
- Letter from Chief Financial Officer
- Corporate Guarantee for Closure or Post-Closure Care

The regulations cited at the end of this chapter should be examined to determine the appropriate wording of these instruments.

Rules regarding the mechanics and operation of each of the financial assurance instruments are described in detail in the following sections.

5.3 Trust Funds

A trust fund is a mechanism whereby the site owner or operator sets aside funds in the form of cash or marketable securities to pay for the proper closure of the site and the required post-closure care. The trustee, a financial institution, controls the fund and invests the money in low risk assets. All income earned by the fund is retained in the fund and reinvested together with fund principal.

Upon closure of the facility, monies in the fund are available to reimburse authorized expenditures for closure or post-closure care, upon submission of itemized bills to the Regional Administrator. Funds remaining after all closure or post-closure requirements have been fulfilled are returned to the owner or operator of the facility.

During interim status, payments into the trust are made annually over 20 years or the remaining life of the facility, whichever is less (the "pay-in" period). After a permit has been issued, the pay-in period is reduced to the life of the initial permit. A Federal permit may be written for a maximum of ten years.

The trustee will furnish annual valuations at least thirty days before the anniversary date of the establishment of the fund to both the Grantor (i.e., facility owner or operator) and the Regional Administrator of the trust fund for closure or post-closure at each facility. Valuations are based on market values no more than 60 days prior to the anniversary date of the establishment of the fund.

During the pay-in period, the minimum annual payment is equal to the unfunded closure and post-closure costs of the facility divided by the number of years remaining in the pay-in period:

$$\text{minimum annual payment} = \frac{CE - CV}{Y}$$

where CE is the latest adjusted cost estimate for closure or post-closure care, CV is the current value of the trust fund, and Y is the number of years remaining in the pay-in period.

The first payment should be made at the time the trust fund is established and subsequent payments no later than 30 days after each yearly anniversary date of the trust fund. The funding level of the trust fund must be increased within 60 days after any increase in the current closure or post-closure cost estimates.

After the pay-in period is completed, the owner or operator must maintain the value of the trust fund at a level equal to or greater than CE. Release of amounts from the fund requires written instructions from the Regional Administrator to the trustee.

The trustee must be a bank or other financial institution which has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or state agency. The trustee may accept written directions from the grantor concerning investment guidelines and objectives, however. The trustee must abide by the "prudent man" doctrine for investments, and may not include securities or other obligations of the grantor in the trust fund portfolio. All expenses

of the trust, including taxes, brokerage commissions, legal services, and trustee compensation -- to the extent not paid directly by the grantor -- are paid by the fund. The trustee must notify the Regional Administrator within 30 to 40 days after the anniversary of the establishment of the Trust if the grantor fails to make a required annual payment.

Prospective grantors should review all tax aspects of trust fund operations with their accountant or tax advisor. Tax status of payments into a trust fund are presently under review by the IRS, but no rulings have been issued to date. Under present statutes, payments into a trust fund are not considered expenses -- and are therefore not deductible -- on Federal income tax returns. Payments by the trust fund for closure or post-closure care expenses are deductible, however, in the year of closure or post-closure care when such expenses are incurred. Income earned by the trust fund is taxable to the grantor, even though not distributed to him in the year earned. Grantor's Federal income tax liability will be credited (reduced), however, to the extent of any Federal income taxes paid by the trust fund on a fiduciary return.

The trust fund is terminated and remaining monies returned to the grantor under one of two conditions:

- The requirements for closure or post-closure care have been satisfied; or
- An alternative financial assurance instrument has been provided to substitute for all or part of the trust fund.

Only the Regional Administrator can release the trustee from his obligations under the trust agreement.

5.4 Financial Test

An owner or operator of a hazardous waste facility is allowed to satisfy the financial responsibility requirements by passing a financial test. The test is based on a firm's most recent audited financial statements and must be recertified on an annual basis within 90 days after the end of the firm's fiscal year.

If a firm passes the financial test, it need not provide any additional assurance that it can meet its closure and post-closure care obligations. A parent company which passes the financial test and which directly owns at least 50 percent of the voting stock of the corporation that is the owner or operator, can provide a guarantee of its subsidiary's obligations.

If a firm fails to provide certification of satisfactory financial condition during any year prior to termination of its closure or post-closure care obligations, an alternative financial assurance mechanism must be supplied within 30 days.

To pass the financial test, the firm must satisfy either one of two sets of criteria, as listed in Table 4. The criteria differ in respect to items (c) and (d). They are based on the firm's most recent independently audited year-end annual financial statements.

The test takes into account the adjusted cost estimates for closure and post-closure care of all facilities owned and operated by the firm (or by the parent company, if the parent company is providing the guarantee) that are not covered by an alternative financial assurance mechanism. Financial ratios are computed based on conventional definitions for the terms specified (for publicly held corporations they correspond generally to the figures reported in annual Form 10-K filings with the Securities and Exchange Commission). To the extent that any portion of closure or post-closure care costs are included in a firm's reported liabilities, such costs can be subtracted from liabilities (and added to net worth and tangible net worth) in computing the firm's ratios for this test.

To certify satisfactory financial condition under the financial test, the owner or operator supplies the following documents to the EPA Regional Administrator in each region where hazardous waste facilities are located (and for which financial assurance is required):

Table 4

Criteria for Financial Test and
Corporate Guarantee for Closure or Post-Closure Care

Criteria (i)	Criteria (ii())
(a) <u>Tangible net worth</u> of at least \$10 million; and	(a) <u>Tangible net worth</u> of at least \$10 million; and
(b) <u>Assets in the United States</u> amounting to at least 90% of total assets or at least six times the sum of the current closure and post-closure cost estimates; and	(b) <u>Assets in the United States</u> amounting to at least 90% of total assets or at least six times the sum of the current closure and post-closure cost estimates; and
(c) <u>Net work capital and tangible net worth</u> each at least six times the sum of the current closure and post-closure cost estimates; and	(c) <u>Tangible net worth</u> at least six times the sum of the current closure and post-closure cost estimates; and
(d) Two of the following three ratios:	(d) <u>Current bond rating</u> for the most recent bond issuance of at least BBB as issued by Standard and Poor's or Baa as issued by Moody's.
(1) A ratio of <u>total liabilities to net worth</u> less than 2.0;	
(2) A ratio of the <u>sum of net income plus depreciation, and amortization to total liabilities</u> greater than 0.1;	
(3) A ratio of <u>current assets to current liabilities</u> greater than 1.5.	

- (a) Letter from chief financial officer;
- (b) Accountant's report for latest fiscal year;
- (c) Accountant's special report; and
- (d) Other information as requested.

The letter from the chief financial officer indicates the facilities owned or operated by the company making the financial guarantee and provides the basic data required by the financial test, including cost estimates for the facilities and computation of ratios. Wording and content of the letter are given explicitly in Section 264.151(f) of the Federal regulations.

The independent Certified Public Accountant's (CPA's) report for the latest fiscal year is a copy of the auditor's examination of the owner's or operator's financial statements for the latest completed fiscal year. It includes the CPA's opinion, stating any qualifications, disclaimers, or adverse opinions, as appropriate. The accountant's special report provides confirmation that the chief financial officer's letter correctly reflects the year-end financial statements and amounts stated therein.

In the example developed in Appendix A, illustrative submissions to qualify under the financial test are presented.

5.5 Surety Bonds

A surety bond is a contract whereby a surety company guarantees to pay the amount of closure or post-closure care costs should the owner or operator fail to meet his obligation. Federal regulations allow two types of surety bonds, financial guarantee bonds and performance bonds. However, performance bonds cannot be used at interim status facilities.

A standby trust fund must be established in conjunction with the surety bond. Payments from a surety company would be made directly into the standby trust. The owner or operator need not make any payments into the standby trust fund.

After obtaining the surety bond from, at a minimum, a federally acceptable surety company (listed in Treasury Circular 570), the owner or operator delivers the bond and standby trust fund documents to the Regional Administrator. The penal sum of the bond is adjusted yearly to correspond to adjustments in the closure or post-closure cost estimates. Adjustments to the penal sum must be made within 60 days after any changes in the cost estimate. The bond remains effective until cancelled with the consent of the Regional Administrator.

The cost to the owner or operator of providing financial assurance by means of a surety bond are the cost of the bond itself plus the incremental opportunity cost of any capital required to be set aside as collateral. The direct cost of the

surety bond is generally between 1.0 and 2.0 percent of the face value of the bond per year and is deductible for tax purposes. EPA expects the use of surety bonds for financial assurance to be limited at first (based on discussions with the Surety Association of America).

5.6 Letters of Credit

A letter of credit is an instrument issued by a financial institution on behalf of the owner or operator of the hazardous waste facility which gives EPA the right to draw from the issuing institution to cover the costs of closure and post-closure care in the event the firm fails to meet its obligation. In a sense, the financial institution substitutes its credit for that of the firm.

The owner or operator establishes a nominally funded standby trust fund in conjunction with a letter of credit in an amount equal to or greater than the current closure or post-closure cost estimates. Both instruments are delivered to the Regional Administrator and are updated annually, as appropriate. Adjustments to the value of the letter of credit must be made within 60 days of any changes in the closure or post-closure cost estimates.

The institution issuing the letter of credit must be a bank or other financial institution which has authority to issue letters or credit and whose letters of credit operations are regulated and examined by a Federal or State Agency. The letter of credit is irrevocable and is issued for a period of at least one year, with automatic extensions for each subsequent year unless 90-day notification is given to the Regional Administrator.

Upon determination under Section 3008 of RCRA that the owner or operator has failed to meet his closure or post-closure care obligations, the Regional Administrator may draw on the letter of credit. Drafts under the letter of credit are deposited into a standby trust fund, from which payments are made for approved closure or post-closure care expenses.

The costs to the owner or operator of providing financial assurance by means of a letter of credit are the cost of the letter of credit itself plus the incremental opportunity cost of any capital required to be set aside as collateral. The annual direct cost of the letter of credit is generally between 0.25 and 2% of the value of the letter of credit, depending on the credit-worthiness of the firm. Such costs are deductible for income tax purposes. Collateral required for letters of credit typically averages 20% of the value of the letters of credit.

5.7 Insurance Policies

A firm may purchase an insurance policy for the amount of the estimated closure and post-closure care costs. The insurance company will pay the cost of closure whenever closure occurs and/or post-closure care during the post-closure care period, up to the full amount of the policy. The policy must also be assignable, meaning that the insurance will continue in force for a successor owner or operator.

The face amount of the policy is at least the amount of current closure or post-closure care costs. Premiums paid during the active life of the site serve to fund the face amount of the policy, in similar fashion to whole life insurance. At the end of site life, the insurer will pay out funds, up to the face amount of the policy, to reimburse authorized expenditures for closure or post-closure care over the post-closure period. The face amount of the insurance must be adjusted accordingly within 60 days of any change in the cost estimates. The policy cannot be cancelled except for failure to pay the premium, and then only 120 days after providing notification of such failure to both the Regional Administrator and the owner or operator.

The owner or operator submits a certificate of insurance signed by the insurer and indicating the face amount of the policy. The insurer must be licensed to transact the business

of insurance, or eligible to provide insurance as an excess or surplus lines insurer, in one or more states. The face amount of the insurance must be adjusted to equal or exceed the covered costs of closure and post-closure, or else other forms of financial assurance provided to make up the difference.

The key issue regarding the insurance mechanism is the deductibility of premium payments for tax purposes. If the premiums are deductible, then the insurance policy would be similar to the trust fund without the adverse tax treatment of fund payments. Until the tax issue is resolved, however, it is doubtful whether any significant interest will develop concerning this option. Currently, no insurance firms are offering to issue this type of policy.

5.8 State Assumption of Responsibility

A state may assume either the owner's or operator's legal responsibility for closure, post-closure care, and liability, or the financial responsibility to cover those requirements in accordance with the Federal standards. If state guarantees for financial responsibility are less than the amounts estimated for closure and post-closure care, then the owner or operator of the facility must supply additional financial assurance mechanisms to cover the shortfall.

5.9 Multiple Financial Assurance Mechanisms and Multiple Sites

The objective of the regulations is to ensure that adequate funding is available to cover the estimated costs of closure and post-closure care. Accordingly, the regulations permit the simultaneous use of more than one financial assurance instrument (FAI) to satisfy the funding requirements for a given facility, and the use of a single FAI to satisfy the funding requirements of several facilities simultaneously. Restrictions on the use of multiple financial assurance mechanisms and of FAI's for multiple facilities are summarized in Tables 5 and 6.

5.10 Reduction of Coverage

Financial assurance instruments may be reduced from time to time to reflect reductions in cost estimates, if any, for the covered facility. Amounts deposited or accumulated in a trust fund may not be recovered, however, unless the aggregated value of the fund exceeds the total amount of the adjusted cost estimate for closure or post-closure care.

5.11 Termination of Assurance Instruments

The owner or operator must obtain formal release (by letter) from the Regional Administrator in order to terminate the requirements for financial assurance for closure and post-closure

Table 5
Restrictions on the Use of Multiple Financial
Assurance Mechanisms for a Single Facility

Allowed mechanisms	Trust funds Surety bonds guaranteeing payment Letters of credit Insurance
Rule of construction	Combined financial assurance must add up to sum of current closure/ post-closure estimates
Stand-by trust funds	Can be consolidated: trust fund can serve as standby trust fund for other mechanisms
Callability	Regional administrator can invoke any or all mechanisms

Table 6
Restrictions on the Use of Financial
Assurance Mechanisms for Multiple Facilities

Allowed mechanisms	All approved mechanisms
Rule of construction	Available funding must equal or exceed the sum required for each facility considered separately
Notifications	Relevant documents must be submitted to Regional Administrator in each EPA region where covered facilities are located
Callability	Regional Administrator restricted to level of funding specified for each facility considered separately

care. This release is only for the financial assurance requirements and does not release the owner or operator from legal responsibility for meeting the closure or post-closure standards.

Release for closure requirements will be obtained within 60 days of certification by the owner or operator and an independent registered professional engineer that closure has been accomplished in accordance with the closure plan. Release for post-closure requirements, after the period of post-closure care, will require the satisfaction of the Regional Administrator that all post-closure care requirements have been completed.

5.12 State Requirements

The status of financial assurance requirements in each of the Region I states is as follows:

Massachusetts

Financial assurance regulations in Massachusetts are in the "Phase II discussion draft" stage. Currently, their regulations do not allow the use of insurance policies or a financial test, however, State authorities will be holding public hearings and plan to have received public comments on incorporating those two alternatives by the end of May, 1982.

New Hampshire

New Hampshire is in the process of adopting the Federal financial assurance regulations by reference. Anticipated adoption will occur in the Summer, 1982.

Connecticut

Connecticut has adopted the Federal financial assurance regulations by reference. The effective date of these regulations is October 6, 1982. Connecticut permits are of 5 years duration (noteworthy especially for trust funds), and municipalities are subject to less stringent requirements.

Vermont

In Vermont, hazardous waste officials are using the Federal financial regulations as a minimum standard for facilities to follow but have not adopted the regulations by reference. Vermont officials may ask a facility to meet certain additional requirements, on a case-by-case basis.

Maine

Financial responsibility regulations for owners/operators of hazardous waste facilities in Maine are in the draft stage and are currently under review by EPA. Maine officials hope to have the regulations finalized by late summer or early fall of 1982.

Maine's regulations are similar to the Federal regulations except as outlined below:

- A 5 year pay-in period is required for trust funds with 25% paid in at the beginning of the period and 15% paid in at the end of every year;
- Trustees are prohibited from making high-risk investments such as in foreign currency. The state suggests preferred investments such as money market funds or T-bills, where liquidity is assured;
- Some of the financial test requirements, including the 1.5:1 ratio for solvency criteria and the \$10 million tangible net worth criteria, are under review; and
- Firms may be required to submit 10K Forms every year.

Rhode Island

Rhode Island has established regulations requiring closure and post-closure cost estimates similar to those of EPA. No regulations have been prepared governing financial assurance at treatment and storage facilities. Financial assurance requirements for disposal facilities differ significantly from the Federal requirements, however, no interim status disposal facilities are located in Rhode Island.

5.13 Choosing a Mechanism

Table 7 arrays the various financial assurance mechanisms according to their advantages, disadvantages, and anticipated pattern of use.

Table 7
Comparison of Alternative Financial Assurance Instruments

Instrument	Advantages	Disadvantages	Who Uses
Trust Funds	<ul style="list-style-type: none"> • availability • investment earnings 	<ul style="list-style-type: none"> • loss of capital • tax treatment 	<ul style="list-style-type: none"> • smaller owners/operators • less financially stable
Financial Test	<ul style="list-style-type: none"> • simplicity • low cost of administration 	<ul style="list-style-type: none"> • limits financial flexibility • cyclical companies susceptible 	<ul style="list-style-type: none"> • larger owners/operators
Surety Bonds	<ul style="list-style-type: none"> • fee tax deductible • capital retention 	<ul style="list-style-type: none"> • availability • borrowing ability inhibited 	<ul style="list-style-type: none"> • limited at first
Letters of Credit	<ul style="list-style-type: none"> • fee tax deductible • capital retention • simplicity 	<ul style="list-style-type: none"> • availability • borrowing ability inhibited 	<ul style="list-style-type: none"> • larger owners/operators • more financially stable
Insurance	<ul style="list-style-type: none"> • possible tax advantages • self-funding • loss protection 	<ul style="list-style-type: none"> • tax treatment uncertain • cost uncertain • availability 	<ul style="list-style-type: none"> • smaller owners/operators • limited at first
State Assumption	<ul style="list-style-type: none"> • simplicity 	<ul style="list-style-type: none"> • state assumes responsibility 	<ul style="list-style-type: none"> • municipalities

Owners and operators are urged to weigh these advantages and disadvantages carefully with their bankers, financial advisors, attorneys, accountants, and senior management officials before opting for one or another of the alternative mechanisms.

5.14 Sources of Information

5.14.1 Federal Regulations

The Federal regulatory requirements related to closure and post-closure financial assurance can be found in the sections of Title 40 of the Code of Federal Regulations shown in Table 8.

5.14.2 Additional Guidance

Additional guidance can be found in the EPA publication:

"Financial Assurance for Closure and Post-Closure Care: Requirements for Owners or Operators of Hazardous Waste Treatment Storage and Disposal Facilities" (Guidance Manual , ICF, Incorporated, 1982).

Background information and cost impacts of the regulations are discussed in:

Regulatory Impact Analysis of the Financial Assurance Regulations (Industrial Economics, Inc.: 25 September, 1981); and Background Document for Financial Assurance Regulations (U.S. EPA: December 21, 1980).

Table 8
Federal Regulatory Citations
for Financial Assurance Standards

Topic	Section*
Applicability	265.140
Definitions	265.141
Financial Assurance for Closure	265.143
Financial Assurance for Post-Closure	265.145
Use of One Mechanism for Both Closure and Post-Closure	265.146
Incapacity of Owners, Operators, Guarantors or Financial Institutions	265.148
Use of State-required Mechanisms	265.149
State Assumption of Responsibility	265.150
Wording of Instruments	264.151**

* Citations are from 40 CFR as revised in the Federal Register, April 7, 1982, Volume 47 pages 15032-15074, unless otherwise noted.

** Minor typographical errors were corrected in the Federal Register, May 10, 1982, Volume 47, page 19995.

CHAPTER 6

LIABILITY INSURANCE

This chapter describes the manner in which owners and operators of hazardous waste management facilities must demonstrate financial responsibility for bodily injury and property damage to third parties caused by sudden and nonsudden accidents. This material is presented in the following order:

- 6.1 Sudden Accidental Coverage
- 6.2 Nonsudden Accidental Coverage
- 6.3 Financial Test
- 6.4 Extensions
- 6.5 Variance And Adjustment Procedures
- 6.6 State Requirements
- 6.7 Sources of Information

Financial responsibility may be demonstrated by providing proof of insurance, passing a financial test (self insurance), or any combination of the two. Only states and the Federal government are not required to provide liability coverage.

Financial responsibility must be demonstrated throughout the active life of the facility until closure is certified complete.

6.1 Sudden Accidental Coverage

Coverage for sudden occurrences (accidents that are not continuous or repeated in nature) is required for all treatment storage and disposal facilities. The levels of coverage for

sudden accidental occurrences must be in the amount of at least \$1 million per occurrence with an annual aggregate of \$2 million. If insurance is used to cover all or part of this liability, proof must be submitted to each EPA Regional Administrator in which covered facilities are located in the form of a signed duplicate original of either: (1) the policy's Hazardous Waste Facility Liability Endorsement or (2) the Certificate of Liability Insurance. The wording for these documents is specified in the Federal regulations (refer to the end of this chapter for regulatory citations).

In states without phase I authorization, proof of coverage must be supplied to the EPA Regional Administrator by July 15, 1982. Facilities in states with phase I authorization, which includes all Region I states, must meet individual state deadlines.

6.2 Nonsudden Accidental Coverage

Coverage for nonsudden occurrences (accidents that happen over an extended time and are associated with continuous or repeated contaminant exposures) is required for all surface impoundments, landfills, and land treatment facilities. Levels of coverage must be at least \$3 million per occurrence with an annual aggregate of \$6 million.

In states without phase I authorization, the date by which an existing facility must submit proof of responsibility is based on the company's total sales or revenues as follows:

- If annual sales are greater than \$10 million, January 15, 1983;
- If sales are between \$5 million and \$10 million, January 15, 1984; and
- If sales are under \$5 million, January 15, 1985.

Facilities in states with phase I authorization, which includes all Region I states, must meet individual state deadlines.

When liability insurance is used, submittal requirements are identical to those for sudden accidental insurance: copies of either the Liability Endorsement or a Certificate of Liability Insurance with language as specified in the regulations, must be submitted.

6.3 Financial Test

Owners or operators may provide assurance for all or part of their financial liability requirements by passing a financial test. The test is based on the firm's most recent independently audited year-end financial statements and must be recertified on an annual basis. To certify satisfactory financial condition under the financial test, the owner or operator supplies to the

Regional Administrator: (1) a letter from the firm's chief financial officer; (2) an accountant's report confirming the results of the test; (3) the accountant's opinion, and (4) other information as may be requested by the Regional Administrator.

The wording of the letter from the firm's chief financial officer must be identical to that supplied in the regulations (see citations at the end of this chapter).

To pass the financial test, the owner or operator must meet either one of two sets of criteria, as listed in Table 9. The criteria differ in respect to item (d). They are based on the firm's most recent independently audited year-end annual financial statements.

If a firm fails to provide certification of satisfactory financial condition for any portion of the required liability coverage at any time during its active life, such coverage must be provided through an insurance policy within 30 days.

6.4 Extensions

A one-time extension of the time allowed for submission of proof of coverage through a financial test is allowed. To qualify, the owner's or operator's fiscal year must end during the 90 days prior to the normal due date for proof of coverage. The

Table 9
Criteria for Financial Test for Liability Coverage

Criteria (i)	Criteria (ii)
(a) <u>Tangible net worth</u> of at least \$10 million; and	(a) <u>Tangible net worth</u> of at least \$10 million; and
(b) <u>Assets in the United States</u> amounting to at least 90% of total assets or at least six times the amount of liability coverage to be demonstrated by the test; and	(b) <u>Assets in the United States</u> amounting to at least 90% of total assets or at least six times amount of liability coverage to be demonstrated by the test; and
(c) <u>Tangible net worth</u> at least six times the amount of liability coverage to be demonstrated by the test; and	(c) <u>Tangible net worth</u> at least six times the amount of liability coverage to be demonstrated by the test; and
(d) <u>Net working capital</u> at least six times the amount of liability coverage to be demonstrated by the test.	(d) <u>A current rating</u> for the most recent bond issuance of at least BBB as issued by Standard and Poor's or Baa as issued by Moody's.

extension will last no longer than 90 days past the end of the owner's or operator's fiscal year. The required content of an extension request may be found in the regulations cited at the end of this chapter.

6.5 Variance and Adjustment Procedures

An owner or operator may obtain approval from the Regional Administrator for a reduction in the required liability amounts normally required. Such approval depends on an evaluation of the degree and duration of risks associated with the ownership or operation of each facility or group of facilities, and on other technical and engineering information as determined necessary by the Regional Administrator.

The Regional Administrator may elect to increase the amounts of liability coverage required for any facility or group of facilities, and he may elect to impose nonsudden liability coverage requirements on treatment or storage facilities. Such a determination is based on an evaluation of the degree and duration of risks, as deemed necessary to protect human health and the environment. Any adjustment of the level of required coverage for a facility that has a permit is treated as a permit modification.

EPA is considering a proposal to delete variance and adjustment provisions from the Federal regulations.

6.6 State Requirements

The status of liability requirements in Region I states is as follows.

Massachusetts

Liability coverage requirements in Massachusetts are in the "Phase II discussion draft" stage. The regulations are equivalent to the Federal regulations but do not currently allow for the use of a financial test or submission of a certificate of insurance to provide proof of insurance. State authorities will be holding public hearings on incorporating these revisions into their requirements and plan to have received public comments by the end of May, 1982.

New Hampshire

New Hampshire is in the process of adopting the Federal regulations by reference. It is anticipated that adoption will occur in the Summer of 1982.

Connecticut

Connecticut has adopted the Federal regulations by reference. The effective date for the regulations is 90 days after the Federal effective date. For existing facilities, the phase in dates are April 15, 1983, 1984, and 1985.

Vermont

Vermont is using the Federal regulations as a minimum standard but have not adopted the regulations by reference. Facilities in Vermont will be evaluated on a case by case basis and additional requirements may be imposed.

Maine

Maine's regulations are in a draft stage and are currently under review by EPA. Maine intends to have its regulations finalized by late summer or early fall of 1982. They have tentatively adopted the Federal liability regulations but may amend the "claims made" type policy to include a six month discovery period.

Rhode Island

Rhode Island has not developed any liability requirements applicable to interim status treatment or storage facilities. Although Rhode Island's requirements for disposal facilities differ significantly from the Federal requirements, there are no interim status disposal facilities in the State.

6.7 Sources of Information

6.7.1 Federal Regulations

The Federal requirements for liability insurance described in this chapter can be found in the sections of Title 40 of the Code of Federal Regulations identified in Table 10.

Table 10

Federal Regulatory Citations for
Liability Insurance Requirements

Topic	Section
Applicability	265.140
Definitions	265.141(1)
Liability Requirement	265.147(1)
Wording of the Instruments	264.151(1,2)

(1) Revised April 16, 1982, Volume 47, Federal Register, page 16544.

(2) Minor typographical errors were corrected on May 10, 1982, Volume 47, Federal Register, page 19995.

6.7.2 Additional Guidance

The U.S. EPA is currently drafting a guidance manual describing Federal liability insurance requirements. The EPA Region I contacts given in Appendix C of this guide should be contacted to determine the availability of that document.

CHAPTER 7

GROUND-WATER MONITORING

This chapter describes the required content and implementation of groundwater monitoring programs at hazardous waste management facilities. This material is presented in the following order:

- 7.1 Applicability and Effective Dates
- 7.2 Groundwater monitoring systems
- 7.3 Groundwater Sampling and Analysis
- 7.4 Preparation, Evaluation and Response
- 7.5 Waivers
- 7.6 Approximate Costs
- 7.7 State Requirements
- 7.8 Sources of Information

7.1 Applicability and Effective Dates

Owners and operators of facilities that have surface impoundments, landfills or land treatment operations used to manage hazardous waste and that have qualified for interim status must prepare groundwater monitoring plans and implement groundwater monitoring programs in accordance with those plans.

Table 11 presents the effective dates of the Federal groundwater monitoring requirements and describes the significance of those dates.

Table 11

Effective Dates for Federal Groundwater Monitoring Requirements

Dates	Milestones	Description
November 19, 1980	Regulations Promulgated	The regulations allowed <u>one</u> year for the regulated community to establish a groundwater quality monitoring program as described in 40 CFR 265.91 to .94, Subpart F - Groundwater Monitoring.
November 19, 1981	First Year of Monitoring Begins	The regulations required that a groundwater monitoring program be established and that regular monitoring of the groundwater quality be initiated. This first year of monitoring is essential to establish background measurements of the groundwater quality in the upper most aquifer beneath of facility.
November 19, 1982	Second Year of Monitoring Begins	At the completion of the first year of monitoring, statistical analyses of the results of the monitoring program must be made to determine the background groundwater quality. The second year measurements of certain indicator parameters are to be compared to the established background data for statistically significant changes in the quality of the groundwater beneath the facility.

7.2 Groundwater Monitoring Systems

The owner or operator must install a groundwater monitoring system capable of detecting any hazardous waste or hazardous waste constituents emanating from the waste handling area into the uppermost aquifer. At least one monitoring well must be located hydraulically upgradient in order to provide background data on ambient groundwater quality. This monitoring well must not be affected by the facility and must provide representative data. A minimum of three groundwater monitoring wells must be located hydraulically downgradient of the waste handling area, at the limit of the waste management facility. The location, depth and number (more than three wells may be necessary) must be such that any hazardous waste or hazardous waste constituents emanating from the waste management areas would be immediately detected by statistical analysis. Facilities with more than one component or area for which groundwater monitoring is required need not monitor each component separately. Instead, a waste management area should be determined and the monitoring system installed at its perimeter.

All monitoring wells should be constructed so that surface water may not enter the well screen area through the annular space. The well screens should be sand or gravel packed and the annular space backfilled with cement grout.

7.3 Groundwater Sampling and Analysis

The owner or operator must develop and implement a plan delineating the procedures and techniques for sample collection, sample preservation and shipping, analytical procedures, and chain of custody control. The plan activities must, at a minimum, determine the concentrations or values of the following parameters:

- Drinking Water Suitability Parameters

Arsenic	Lindane
Barium	Methoxychlor
Cadmium	Toxaphene
Chromium	2,4,D
Fluoride	2,4,5-TP Silvex
Lead	Radium
Mercury	Gross Alpha
Nitrate (as N)	Gross Beta
Selenium	Coliform Bacteria
Silver	Endrin

- Parameters Establishing Groundwater Quality

Chloride	Phenols
Iron	Sodium
Manganese	Sulfate

- Parameters Used as Indicators of Groundwater Contamination

pH	Total Organic Carbon
Specific Conductance	Total Organic Halogen

The frequency with which samples must be taken and analyzed for these parameters is shown in Table 12. In addition, during the first year, at least four replicate measurements of the

groundwater contamination indicator parameters must be made from each upgradient well sample. From these initial background data, arithmetic mean and variances must be determined by pooling the replicate measurements.

Table 12
Required Sampling and Analysis Frequencies
at Groundwater Monitoring Wells

Parameter	During First Year	After First Year
Drinking Water Standards	4	none
Groundwater Quality Parameters	4	1
Groundwater Contamination Indicators	4	2

Background concentrations or values for all wells must be established and, at the time of sample collection, water level measurements must also be made and the water table elevations determined.

Results from all analyses and water-level observations must be reported to the Regional Administrator quarterly during the first year and annually thereafter. Complete records must be kept at the facility.

7.4 Preparation, Evaluation and Response

Within one year of the institution of the groundwater monitoring program, the owner or operator must prepare an outline of a groundwater assessment program which details whether hazardous waste or hazardous waste constituents have entered the groundwater. If such wastes have entered the groundwater system, the rate and extent of migration and the concentrations of the materials in the groundwater must be defined. The owner or operator of the facility must calculate the arithmetic mean and variance for each indicator parameter and compare them with the background data. The Student's T-Test should be used at a 0.01 level of significance to determine statistically different increases (or decreases) over the initial background values. An example of the Student's T-Test is presented as Appendix B to this report.

Any changes in the water quality in the upgradient wells must be reported to the Regional Administrator. Statistically significant changes in the water quality of the downgradient wells require that the owner or operator obtain and analyze additional samples immediately. The procedure for this analysis requires that the sample be split in two and the analysis of all additional samples be obtained to determine if the difference was due to error. If the analysis confirms that the difference is not due to error, the Regional Administrator or responsible state agency director must be informed within seven days.

Within 15 days of the notification of the appropriate authority, the owner or operator must submit a specific plan, certified by a qualified geologist or engineer, for a groundwater quality assessment program at the facility. The groundwater assessment plan must specify:

- The number, location and depths of monitoring wells;
- The sampling and analysis program;
- The evaluation procedures to be employed; and
- A schedule of implementation.

The owner or operator must implement the plan to assess groundwater quality and determine the rate and extent of migration of hazardous waste materials and the concentrations of hazardous wastes in the groundwater.

If the owner or operator of the facility determines that hazardous wastes or hazardous waste constituents have not entered the groundwater, the routine indicator evaluation program may be re-instituted and a report submitted to the Regional Administrator. If hazardous wastes have entered the groundwater aquifer, the owner or operator must continue to make quarterly determinations until final closure (if the groundwater quality assessment plan was implemented prior to final closure). The owner operator may cease to make determinations if the plan was implemented during the post-closure care period.

7.5 Waivers

The groundwater monitoring requirements may be fully or partially waived if the owner or operator can demonstrate that there is a low potential for the migration of hazardous waste or hazardous waste constituents from the facility through the groundwater system. In cases where the owner or operator suspects or knows that the facility has already impacted the uppermost aquifer in such a way that the indicator parameters would show statistically significant increases when evaluated, an alternate groundwater monitoring system may be utilized to determine the rate and extent of contaminant migration and the concentrations of hazardous wastes and hazardous waste constituents in the groundwater.

7.6 Approximate Costs

The estimated costs of implementing the Federal groundwater monitoring requirements are presented in this section for both installing groundwater monitoring wells and conducting water quality analysis programs.

7.6.1 Drilling and Well Installation Costs

Factors affecting the final costs of monitoring well installation include:

- The type of material to be penetrated during the drilling (bedrock or unconsolidated material);

- The depth to the uppermost aquifer; and
- The number of monitoring wells necessary to effectively monitor the facility.

A survey of well drillers in the New England states indicates that costs will range between \$18.00 to \$30.00 per foot of well depending on the material drilled and the type of drilling rig used. Average costs are shown in Table 13.

Table 13
Average Well Installation Costs

Type Drilling Rig	Material Drilled	Cost/Foot
Auger (solid/hollow stem)	Unconsolidated	\$18.00
Rotary (Air/Mud/Water)	Unconsolidated	\$24.00
Rotary (Air/Mud/Water)	Bedrock	\$30.00
Cable Tool	Unconsolidated	\$27.00

The use of auger or cable tool drilling rigs is not appropriate in bedrock due to the auger's inability to penetrate lithofied material and the amount of time required by cable tool rigs to penetrate rock. Auger rigs are most appropriate for relatively shallow drilling in unconsolidated materials (less than 50 feet) where large boulders are not encountered. Rotary drilling is not appropriate in most areas where depth and speed are required.

Based on the average costs shown on Table 13, a typical facility monitoring system installation with the following characteristics:

- four monitoring wells each 30 feet deep, 2.25-inch diameter
- 20 feet to water
- unconsolidated glacial material
- auger drilling

could be expected to cost approximately \$1,500.00

7.6.2 Water Quality

Sample analysis for the required Federal groundwater parameters has been estimated through a survey of laboratories in the northeastern part of the country. Due to the services provided by many surveyed labs, customers are not restricted to local facilities as most laboratories will provide shipping and preservative materials. In addition, many labs offer special rates for RCRA requirement packages under yearly analysis contracts. These types of contracts appear to be the most economical of all laboratory services available. The range of costs for the individual analysis blocks required by RCRA are shown below.

Groundwater Suitability Parameters	\$400 to \$525
Water Quality Characterization	\$ 65 to \$ 95
Contamination Indicator Parameters	<u>\$ 95 to \$120</u>
TOTALS	\$560 to \$740

First Year Costs

Analytical costs during the first year could be expected to be approximately \$16,000 to \$21,000 for a four-well facility, estimated as follows:

Suitability Parameters (quarterly)	4 X \$560 to \$740 = \$ 2,240 to \$ 2,960	
Characterization Parameters (quarterly)	4 X \$ 65 to \$ 95 = \$ 260 to \$ 380	
Indicator Parameters (quarterly/split 4 X)	16 X \$ 95 to \$120 = \$ <u>1,520</u> to \$ <u>1,920</u>	
Cost per well	\$ 4,020	\$ 5,260
Cost for 4 wells	\$16,080	\$21,040

As the drinking water suitability parameters need not be determined after the first year and sampling frequencies are less, costs in the second and following years would drop significantly for the same facility, estimated as follows:

Characterization Parameters (semi-annually)	2 X 65 to 95 = \$130 to \$ 190	
Indicator Parameters (semi-annually/split 4 X)	8 X 95 to 120 = \$ <u>760</u> to \$ <u>960</u>	
Cost per well	\$ 890	\$1,150
Cost for 4 wells	\$3,560	\$4,600

7.7 State Requirements

This section describes the differences that exist between the Federal groundwater monitoring requirements and the requirements of the states in EPA Region I.

Rhode Island

Rhode Island's requirements are equivalent to the Federal requirements.

Connecticut

Connecticut's requirements are equivalent to the Federal requirements. Groundwater monitoring plans are approved by the Connecticut DEP which is currently developing guidelines for approval. Connecticut also has its own well specifications.

If an owner or operator assumes that groundwater monitoring results would indicate that hazardous constituents are entering the groundwater, he/she may install and operate an alternate system. This system would be designed to define the characteristics, areal extent, and rate of flow of the contaminant plume. DEP approval is required for this type of system.

Vermont

Vermont may require of the owner or operator of an existing or closed hazardous waste management site or facility to undertake such studies as may be necessary, including but not limited to, soils investigation, and subsurface hydrology and geology investigations. In addition, any person exercising control over a hazardous waste or a waste suspected to be hazardous may be required to obtain a detailed chemical and physical analysis of the waste.

New Hampshire

New Hampshire's requirements are equivalent to the Federal requirements. Sample analyses in New Hampshire must be measured against evaluation criteria and methodology previously approved by the Bureau in consultation with the WSPCC. These criteria must be able to detect whether hazardous wastes or their constituents have entered the groundwater, the rate of migration and the concentration of the constituents.

Maine

In the state of Maine, a minimum of one test pit or boring per acre on site is required to properly evaluate subsurface conditions. Borings must penetrate the entire thickness of unconsolidated materials and a minimum of 5 feet into the underlying bedrock. Abandoned bore holes and test pits must be sealed to prevent surface water infiltration or groundwater movement between aquifers.

Piezometric measurements are required for all aquifers underlying the site. A minimum of one piezometric station per acre should be installed. A series of monthly piezometric readings over a 6 month time period, including the spring high groundwater period, will usually be necessary as a minimum for an adequate study of groundwater movement.

The following information is required for licensing in Maine:

- A bedrock contour map including a report on the nature of the bedrock and the alignment of structural elements in the bedrock;
- A surficial geologic map including a report on surficial deposits, and representative cross-sections to show three-dimensional relationships;
- A groundwater contour map (two foot contour interval); and
- A ground water flow net analysis, to determine the movement of groundwater into, within and from the site, and the direction of possible leachate flow. The analysis shall consist of equipotential and flow lines in both horizontal and vertical directions.
- A report on soil attenuative capacities, including information on cation exchange capacities, permeabilities, grain size, and pH of the soils beneath the proposed landfill.
- A water balance analysis.
- Background concentrations and limits of detection of all possible hazardous contaminants.
- A groundwater monitoring plan including as a minimum:
 1. Monitor well specifications;
 - Location.
 - Elevation of land surface and the top of the well casing to the nearest tenth of a foot.
 - Depth to the bottom of the well.
 - Screened interval (depth to top and bottom of well screen).
 - Type and size of casing.
 - Type and size of screen.

- collection;
2. Procedures and techniques of sample
 3. Sample preservation and shipment;
 4. Chain of custody control; and
 5. Analytical procedures.

Prior to construction of the landfill a full chemical, physical and biological analysis is required for all wells, springs and surface water bodies within 1000 feet of the site.

Massachusetts

Massachusetts authorities have developed detailed criteria for the installation of groundwater monitoring wells.

A water table contour map showing presumed flow directions must be developed using measured groundwater elevations from each sampling period. At least annually (by April 30th) the data will be evaluated to determine whether the requirements for well locations continue to be satisfied. If the requirements are not satisfied the well locations must be modified to bring the monitoring system into compliance.

7.8 Sources of Information

7.8.1 Federal Regulations

The Federal regulatory requirements discussed in this chapter can be found in the specific sections of Title 40 of the Code of Federal Regulations cited in Table 14.

Table 14
Federal Regulatory Citations for
Ground-Water Monitoring Requirements

Topic	Section
Applicability	265.90*
Ground-water Monitoring System	265.91
Sampling and Analysis	265.92
Preparation, Evaluation and Response	265.93**
Recordkeeping and Reporting	265.94***

* Paragraph (e) added on January 11, 1982, 47 Fed. Reg. 1254. It provides a waiver of the ground-water monitoring requirements for certain surface impoundments used to neutralize corrosive wastes.

** The requirement for preparation of ground-water quality assessment program outlines was delayed on February 23, 1982, 47 Fed. Reg. 7841, until August 1, 1982.

*** The compliance date for the initial-year quarterly ground-water monitoring parameter readings was delayed on February 23, 1982, 47 Fed. Reg. 7841, until August 1, 1982.

7.8.2 State Regulations

All Region 2 states have issued groundwater monitoring regulations equivalent to the Federal regulations with additional requirements as described in Section 7.6 of this chapter. However, readers are advised to contact their state environmental protection authorities to determine if they may be required to comply with additional state regulations.

7.8.3 Additional Guidance

Further guidance concerning groundwater monitoring can be found in EPA's guidance manual:

"Interim Status Groundwater Monitoring Program Evaluation", EPA Publication No. SW-954, April, 1982.

Other publications containing potentially useful information include:

"Monitoring Groundwater Quality: Monitoring Methodology", D.K. Todd et.al, Publication No. EPA-600/4-76-026, USEPA Environmental Support Laboratory, Las Vegas, Nevada, 1976;

"Groundwater and Wells", Johnson Division: UOP, Inc., St. Paul, Minnesota, 1975; and

"Groundwater", R.A. Freeze and J.A. Cherry, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1979.

APPENDIX A
SAMPLE PLANS

Appendix A presents illustrative examples of required plans and submittals developed for a hypothetical treatment and storage facility authorized to operate under interim status. This material is presented in the following order:

- A.1 Site Description
- A.2 Closure Plan
- A.3 Closure Cost Estimate
- A.4 Latest Adjusted Closure Cost Estimate
- A.5 Closure Financial Assurance
- A.6 Liability Insurance Certification
- A.7 Groundwater Monitoring Plan

Because the facility described is to be closed as a storage and treatment facility, neither a post-closure plan nor a post-closure cost estimate is required.

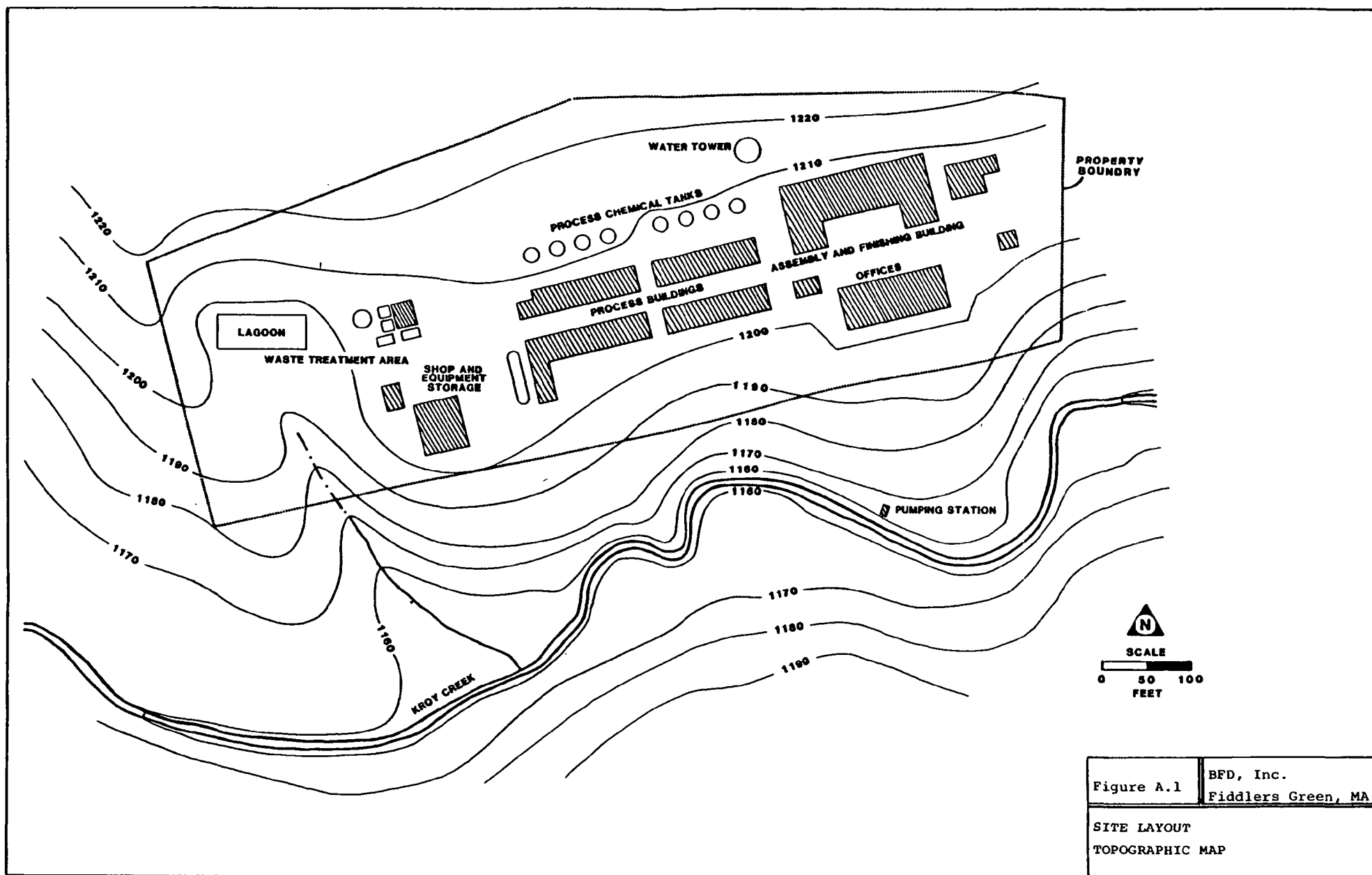
The site description presented in Section A.1 is only intended to provide relative background information for the reader. The required content of site descriptions submitted with RCRA Part B permit applications is considerably greater.

A.1 Site Description

BFD, Inc. is presently engaged in the production of electronic components used in the manufacture of computers, calculators, and word processing units. These components include printed circuit boards, liquid crystal display units, and silicon micro-processor chips. The facility was opened in the fall of 1961. Figure A.1 presents a plan view of the existing facility.

Since 1975, all process wastewater has been discharged to the regional sewerage authority system after treatment on-site. Under the agreement reached with the authority, sanitary waste and cooling water are allowed to be discharged without any on-site treatment.

Approximately 3500 gallons per day of wastewater contaminated with cyanide and hexavalent chromium are generated at the facility. During treatment of the wastewater, about 2800 pounds of sludge, classified as hazardous waste type F006 by EPA, are generated each day. The materials removed from the treatment tanks, clarifier and settling/storage lagoon are disposed of off-site at a secure chemical landfill. Figure A.2 is a schematic of the treatment systems and Figure A.3 is a scale drawing of the lagoon.



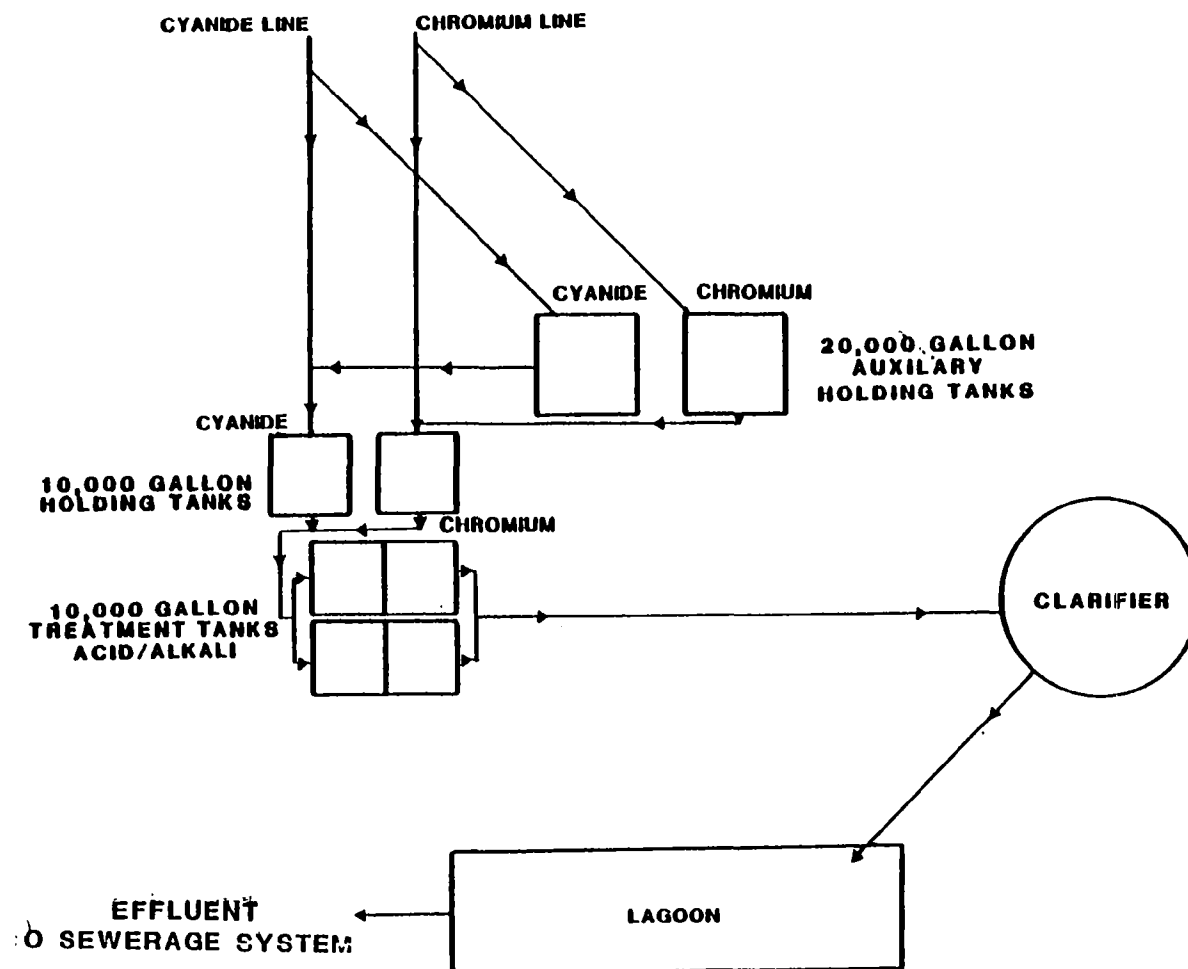


Figure A.2 Treatment System Schematic

SETTLING/STORAGE LAGOON

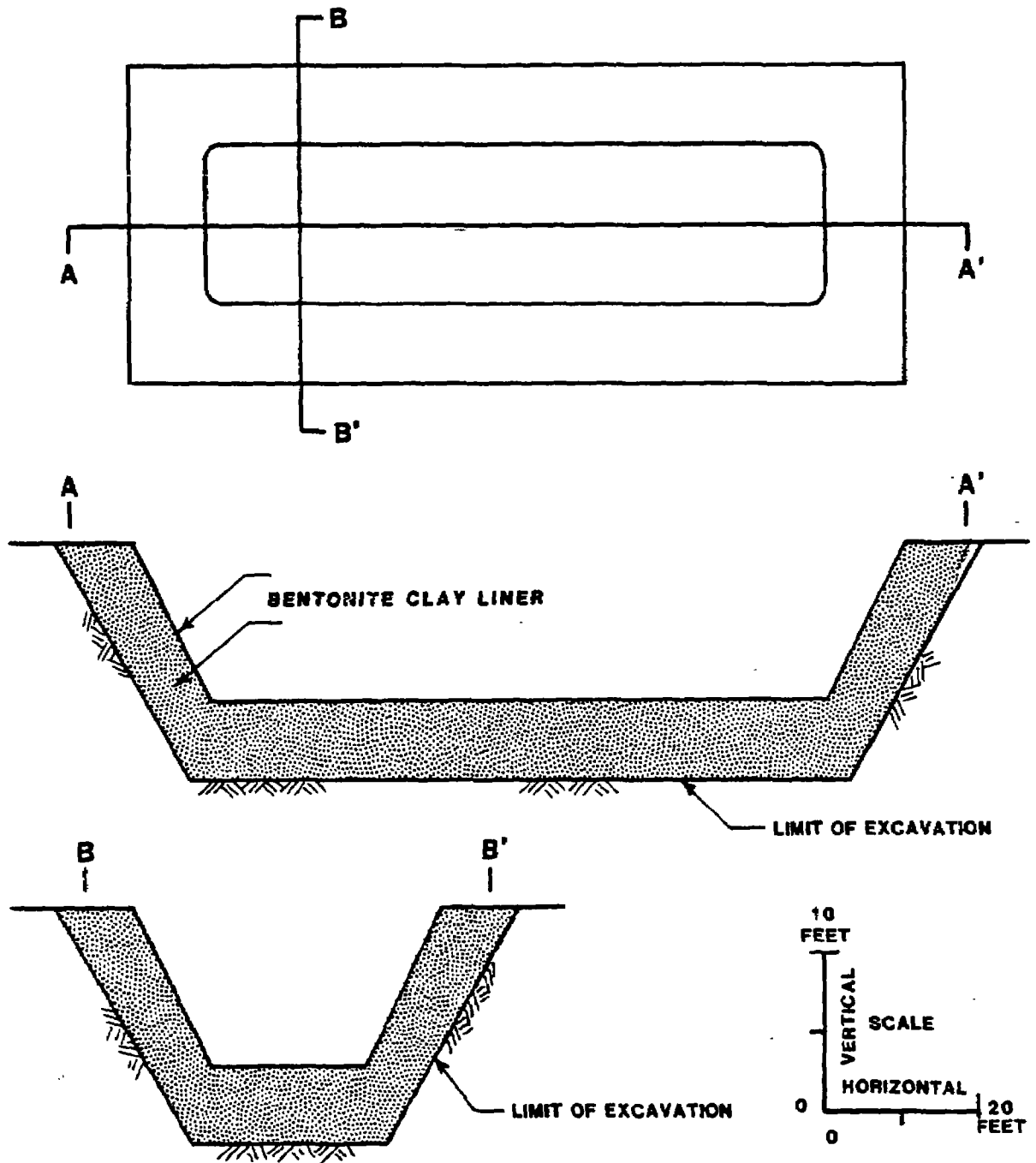


Figure A.3

BFD, Inc.
Fiddlers Green, MA

WASTE STORAGE/SETTLING LAGOON

At times of high production or treatment system outages, there is a possibility that the flow to the treatment facility may exceed its capacity. To off-set that possibility, two 20,000 gallon auxiliary holding tanks are available to accept peak flows.

A.2 Closure Plan

A.2.1 Closure Performance Standard

This closure plan for BFD, Inc. is designed to conform to the closure performance standard. Specifically, the plan insures that the BFD storage and treatment facility will not require further maintenance and controls, minimizes threats to human health and the environment, and eliminates post-closure escape of hazardous waste, hazardous waste constituents, leachate, contaminated runoff, or waste decomposition products to the ground or surface waters or to the atmosphere. The following discussion describes in detail efforts to be made at BFD to satisfy the closure performance standard.

A.2.2 Partial Closure

Partial closure is not planned during the life of the facility. However, partial closure may become necessary if process or operating changes result in retirement of portions of the current storage and treatment system.

If partial closure were to be required, a partial closure plan would be developed and the closure plan revised accordingly.

A.2.3 Maximum Waste Inventory

The maximum waste inventory of the BFD storage and treatment facility is as follows:

- 275,000 gallons of liquid and sediment in the surface impoundment;
- 21,000 gallons in the polymer precipitate clarifier tank;
- 20,000 gallons in the two acid-alkaline treatment tanks;
- 20,000 gallons in the two cyanide-chromate holding tanks; and
- 40,000 gallons in the two auxiliary holding tanks.

The maximum waste inventory for the facility is 376,000 gallons.

A.2.4 Waste Disposal and Decontamination of Equipment

Within 90 days after generation of the final volume of hazardous wastes, final closure will be initiated. Closure will be completed within 180 days of this occurrence. At closure, all hazardous wastes will be treated in BFD's on-site treatment system and pumped into the existing lagoon. A maximum of 101,000 gallons of liquid wastes would be treated in this manner, however, it is anticipated that less than 60,000 gallons would actually be in the storage and treatment tanks at the time of closure.

Following waste treatment, all tanks, pumps and piping will be steam-cleaned to remove contaminants and residues. This will serve to decontaminate the tank interiors and associated auxiliary equipment. All rinse waters will be pumped into the lagoon. Final rinse waters will be analyzed to assure that decontamination is complete.

Rinsewaters will be analyzed at an independant certified laboratory. Analyses will be conducted for the hazardous constituents of BFD's wastestream. These are listed below:

- Cadmium
- Chromium
- Copper
- Cyanide
- Flouride
- Lead
- Nickel
- Tin
- Silver
- Zinc

If any of these materials are detected in the rinsewater at concentrations higher than existing background levels in the municipal water supply, the equipment will be recleaned and rinsewaters reanalyzed until all traces of contaminants are absent from the rinsewaters.

Present plans call for dismantling the decontaminated equipment and selling it to reclaim any salvage value.

Present plans call for dismantling the decontaminated equipment and selling it to reclaim any salvage value.

A.2.5 Lagoon Closure

The first step in closure of the BFD lagoon is dewatering. The dewatering of standing liquids in the impoundment will be a decanting process, as it is anticipated that there will not be a large percentage of settleable solids. The treated wastewater will be discharged into the regional sewerage system. The remaining residual solids and sediments will be removed as a slurry. Dewatering of the surface impoundment will be stopped when the remaining water volume is the minimum necessary to transport the sediment as a pumpable slurry. An airjet will be used to resuspend the sediment after which a vacuum tank-truck with internal mining capability will pump the slurry from the impoundment. Throughout the entire sediment removal process, precautions will be taken to insure that liner integrity is preserved.

The clay liner will then be excavated and removed for off-site disposal as a hazardous waste. It is estimated that the entire 1000 cubic yards of clay liner will be removed and disposed of in this manner.

Uncontaminated fill material available on the BFD site will be used to fill the depression of the former lagoon. The entire

restoration area will be regraded, using contractual earth moving services, and allowed to revegetate naturally.

Accumulated data from the groundwater monitoring program in place at BFD will constitute verification that no soil and/or groundwater contamination has occurred. If, however, groundwater contamination is detected at a future date, closure plans will be revised at that time in accordance with agreements reached with EPA Region I or Massachusetts State authorities, as appropriate.

BFD, Inc. will provide the Region I Administrator with certification that the facility has been closed in accordance with the specifications contained in the approved closure plan. An independent professional engineer will also certify that closure activities were performed in accordance with the approved closure plan.

A.2.5 Schedule for Closure

Closure is scheduled for the year 2005. The EPA Regional Administrator or Massachusetts Department of Environmental Quality Engineering Commissioner, as appropriate, will be notified by BFD at least 180 days before beginning closure. The proposed schedule for closure is shown in Figure A.4. Closure will be supervised and certified by the plant operator and certified by a registered professional engineer.

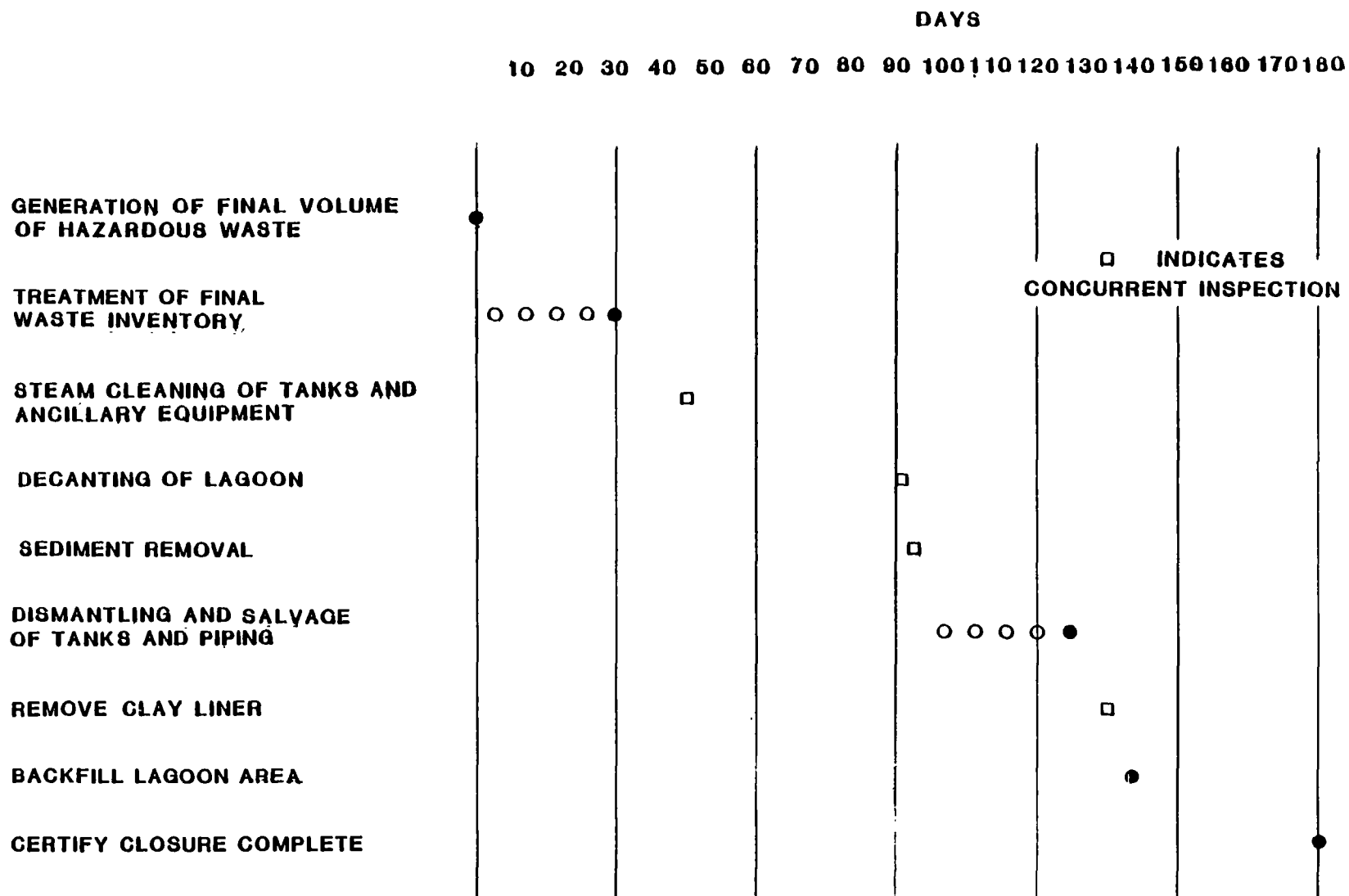


FIGURE A.4 ANTICIPATED CLOSURE SCHEDULE FOR BFD STORAGE AND TREATMENT FACILITY

A.3 Closure Cost Estimate

May 10, 1981 Revision #0

The latest cost estimate for conducting closure at the BFD, Inc. treatment and storage facility is \$78,193. The closure cost estimate is based upon treatment of the maximum inventory of wastewater that could be on-site during the operating life of the facility (376,000 gallons) and disposal of resulting F006 sludges. This closure cost estimate is higher than the normal anticipated cost of closure based on the closure plan, as only 260,000 gallons is expected to be on-site at the time of closure. The closure costs are summarized by activity in Table A.2.

The closure cost estimate will be kept on file at the BFD, Inc. facility. It will be revised whenever a change in the closure plan affects the cost of closure. It will be adjusted annually, by June 9 of each year, to reflect changes in closure costs brought about by inflation. The Department of Commerce's Annual Implicit Price Deflator for Gross National Product will be used to make this adjustment. This "latest adjusted cost estimate" will be retained on-site together with the "latest cost estimate" throughout the active life of the facility.

Table A.2
Estimated Closure Costs

Item	Cost
1. Treatment of wastes	\$ 5,050
2. Equipment decontamination	2,020
3. Rinsewater analysis and disposal	2,315
4. Equipment disposal	0
5. Lagoon decanting	680
6. Sludge removal and disposal	2,800
7. Liner removal and disposal	46,600
8. Lagoon back-filling	4,180
9. Professional certification	2,000
10. Administrative costs	<u>2,340</u>
11. Total costs	\$67,985
12. Contingencies (15% of #11)	<u>10,198</u>
13. Total cost estimate	\$78,183

The following pages present a step-by-step sequence of closure activities and associated costs.

A.3.1 Treatment of Wastes

Wastes will be treated on-site using existing neutralization and clarification equipment. Treatment of the maximum amount of wastewater in the storage and treatment system, 101,000 gallons, at the design operating rate of 3500 gallons per day will require operation of the treatment system for 29 days.

Operating costs for the treatment system, which include fully-burdened labor, utilities, polymer chemicals, laboratory analyses and maintenance, average \$0.05 per gallon. Total costs to treat the wastewater would be:

$$101,000 \text{ gallons} \times \$0.05/\text{gallon} = \$5050$$

A.3.2 Equipment Decontamination

The total storage and treatment tank volume to be steam cleaned is 101,000 gallons. Means Construction Cost Guide, 1981 edition, estimates that equipment rental, labor and operation of a 2000 gph steam-cleaner will cost \$0.02 per gallon of capacity cleaned. Total decontamination costs would be:

$$101,000 \text{ gallons} \times \$0.02/\text{gallon} = \$2020$$

A.3.3 Rinsewater Analysis and Disposal

Rinsewater will be pumped, as generated, into a tank truck, analyzed to verify adequate decontamination, and hauled off-site by a contractor for disposal at an approved hazardous waste treatment/disposal facility. Approximately 1 gallon of rinsewater would be generated for every eight gallons of tank volume cleaned. Total rinsewater generation would be:

$$101,000/8 = 12,625 \text{ gallons}$$

Disposal costs, estimated from disposal contractor quotes, would be \$0.12 per gallon, including pickup and transportation charges. Total rinsewater disposal costs would be:

$$12,625 \text{ gallons} \times \$0.12/\text{gallon} = \$1515$$

Off-site analysis of the final rinsewaters generated to verify complete decontamination would cost an estimated \$200 per sample for AA/Flame Photometric inorganic analyses. For an estimated 2 samples, replicate analytical costs have been quoted at \$800 total. Total rinsewater analysis and disposal costs would be:

$$\$1515 + \$800 = \$2315$$

A.3.4 Equipment Disposal

As all equipment will be decontaminated during closure, no disposal will be required.

A.3.5 Lagoon Decanting

The lagoon will be decanted, after allowing approximately 50 days for maximum solids settling to occur. The wastewater will be decanted using suction pumps owned by BFD. Approximately 40 hours of the treatment plant operator's time at \$17.00 per hour (fully burdened) would be required to operate the decanting equipment. Total labor costs would be:

$$40 \text{ hours} \times \$17/\text{hour} = \$680$$

Decanted liquids will be discharged into the regional sewerage system. Sewerage charges for disposal of wastewater from the lagoon would have been previously paid as a part of the facility's water and sewer bill.

A.3.6 Sludge Removal and Disposal

Based on operational records, an estimated two-foot sludge blanket (approximately 14,000 gallons) will remain after the lagoon is decanted. Disposal costs for removal, transportation and disposal of sludge currently average \$0.02 per gallon. Total sludge removal and disposal costs would be:

$$14,000 \text{ gallons} \times \$0.20/\text{gallon} = \$2800$$

A.3.7 Liner Removal and Disposal

The 1000 cubic yards of clay liner will be excavated and transported to a secure chemical landfill for disposal by contractors. ALERT, Inc. of Sleepy Hollow, Connecticut has quoted excavation and transportation costs fo \$15.60 per cubic yard. An additional \$1000 equipment mobilization and decontamination charge is added by ALERT, resulting in total excavation and transportation costs of:

$$\$1000 + 1000 \text{ yd}^3 \times \$15.60/\text{yd}^3 = \$16,600$$

Disposal costs at the nearest secure chemical landfill, SCA in Boston, have been quoted at \$30.00 per cubic yard. Total liner disposal costs would be:

$$1000 \text{ yd}^3 \times \$30/\text{yd}^3 = \$30,000$$

Total liner removal and disposal costs would be:

$$\$16,600 + \$30,000 = \$46,600$$

A.3.8 Lagoon Backfilling

Under local ordinances, the lagoon depression must be filled at closure to conform to existing ground contours. Costs for excavating, hauling, spreading and compacting fill soil available on the northwest corner of the facility have been quoted by Snedley Construction in Fiddler's Green, Massachusetts at \$1.90 per cubic yard. The excavated lagoon depression will require approximately 2200 cubic yards of backfill soil resulting in a total cost of:

$$2200 \text{ yd}^3 \times \$1.90/\text{yd}^3 = \$4180$$

A.3.9 Professional Certification

Approximately 40 hours of an independent registered professional engineer's time, estimated at \$50.00 per hour, will be required to perform closure inspections and certify closure complete. Total costs would be:

$$40 \text{ hours} \times \$50/\text{hr} = \$2000$$

A.3.10 Administrative Costs

Approximately 120 hours of BFD administrative time will be involved in managing and certifying closure at a fully-burdened rate of \$19.50 per hour resulting in total administrative costs of:

$$120 \text{ hours} \times \$19.50/\text{hr} = \$2340.$$

DISCLAIMER

This manual has been reviewed by the U.S. Environmental Protection Agency, and approved for release. The mention of trade names or commercial products in this manual does not constitute endorsement or recommendations for use.

A.4 Latest Adjusted Closure Cost Estimate
May 20, 1982

Latest closure cost estimate: \$78,183

1980 Annual Implicit Price Deflator: 177.36

1981 Estimated Annual Implicit
Price Deflator (March, 1982): 193.77

Inflation factor: $194/177 = 1.096$

Latest Adjusted Cost Estimate: $1.096 \times \$78,183 = \underline{\underline{\$85,692}}$

A.5 Financial Assurance for Closure

BFD, Inc. has provided the EPA with financial assurance that adequate funding will be available to conduct closure by means of the financial test specified in 40 CFR 265.143(e). Copies of the required certifications, as submitted to the USEPA Regional Administrator on June 25, 1982 with BFD's Part B RCRA permit application , are attached as follows:

- Attachment 1: Certification by the Chief Financial Officer of BFD, Inc.
- Attachment 2: The CPA's Report regarding BFD, Inc.'s Fiscal Year 1982 financial statements
- Attachment 3: The CPA's Report verifying the Chief Financial Officer's Certification

Attachment 1
Page 1 of 4

June 12, 1982

Mr. Lester Sutton
Regional Administrator
Region I
U.S. Environmental Protection Agency
JFK Federal Building
Boston, Massachusetts 02203

Dear Mr. Sutton:

I am the Chief Financial Officer of:

BFD, Inc.,
23 Industrial Place
Fiddlers Green, Massachusetts 12345

This letter is in support of this firm's use of the financial test to demonstrate financial assurance, as specified in Subpart H of 40 CFR Parts 264 and 265.

1. This firm is the owner or operator of the following facilities for which financial assurance for closure or post-closure care is demonstrated through the financial test specified in Subpart H of 40 CFR Parts 264 and 265. The current closure and/or post-closure cost estimates covered by the test are shown for each facility:

BFD, Inc.,
23 Industrial Place
Fiddlers Green, Massachusetts 12345

EPA ID. No. MST 123456789, Closure Cost Estimate \$85,692.

2. This firm guarantees, through the corporate guarantee specified in Subpart H of 40 CFR Parts 264 and 265, the closure or post-closure care of the following facilities owned

Attachment 1
Page 2 of 4

or operated by subsidiaries of this firm. The current cost estimates for the closure or post-closure care so guaranteed are shown for each facility:

NONE

3. In states where EPA is not administering the financial requirements of Subpart H of 40 CFR Parts 264 and 265, this firm, as owner or operator or guarantor, is demonstrating financial assurance for the closure or post-closure care of the following facilities through the use of a test equivalent or substantially equivalent to the financial test specified in Subpart H of 40 CFR Parts 264 and 265. The current closure and/or post-closure cost estimates covered by such a test are shown for each facility:

NONE

4. This firm is the owner or operator of the following hazardous waste management facilities for which financial assurance for closure or, if a disposal facility, post-closure care, is not demonstrated either to EPA or a state through the financial test or any other financial assurance mechanism specified in Subpart H of 40 CFR Parts 264 and 265 or equivalent or substantially equivalent state mechanisms. The current closure and/or post-closure cost estimates not covered by such financial assurance are shown for each facility:

NONE.

This firm is not required to file a Form 10K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

Attachment 1
Page 3 of 4

The fiscal year of this firm ends on February 28, 1982. The figures for the following items marked with an asterisk are derived from this firm's independently audited, year-end financial statements for the latest completed fiscal year, ended February 28.

Alternative I

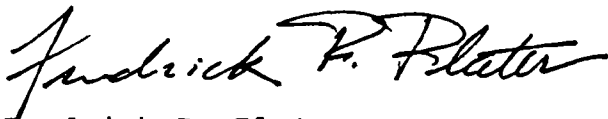
1. Sum of current closure and post-closure cost estimates	\$ 85,692
*2. Total liabilities	61,020,000
*3. Tangible net worth	17,600,000
*4. Net worth	23,300,000
*5. Current assets	18,980,000
*6. Current liabilities	10,800,000
7. Net working capital (Line 5 minus Line 6)	8,180,000
*8. The sum of net income plus depreciation, depletion and amortization	15,500,000
*9. Total assets in U.S. (required only if less than 90% of firm's assets are located in the U.S.)	All U.S.

	<u>Yes</u>	<u>No</u>
10. Is line 3 at least \$10 million?	x	
11. Is line 3 at least 6 times line 1	x	

Attachment 1
Page 4 of 4

	<u>Yes</u>	<u>No</u>
12. Is line 7 at least 6 times line 1	x	
*13. Are at least 90% of firm's assets located in the U.S.? If not complete line 14	x	
14. Is line 9 at least 6 times line 1		
15. Is line 2 divided by line 4 less than 2.00		x
16. Is line 8 divided by line 2 greater than 0.15	x	
17. Is line 5 divided by line 6 greater than 1.50	x	

I hereby certify that the wording of this letter is identical to the wording specified in 40 CFR 264.151(f) as such regulations were constituted on the date shown immediately below.



Fredrick P. Plater
President, BFD, Inc.
June 12, 1982

Attachment 2

(FLATT, BLACK AND ASSOCIATES LETTERHEAD)

April 20, 1982

Mr. Fredrick Plater
President
BFD, Incorporated
23 Industrial Place
Fiddlers Green, Massachusetts 12345

Dear Mr. Plater:

We have examined the consolidated balance sheets of BFD, Inc., and subsidiaries as of February 28, 1982, and the related consolidated statements of income, shareholders' equity, and changes in financial position for the year then ended. Our examinations were made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the financial statements referred to above present fairly the consolidated financial position of BFD, Inc., and subsidiaries as of February 28, 1982, the consolidated results of their operations and the consolidated changes in financial positions for the year then ended, in conformity with generally accepted accounting principles applied on a consistent basis.

Respectfully,

A handwritten signature in cursive script, appearing to read "Jane Flatt".

Jane Flatt
Certified Public Accountant
Flatt, Black and Associates

Attachment 3

(FLATT, BLACK AND ASSOCIATES LETTERHEAD)

June 25, 1982

Mr. Fredrick Plater
President
BFD, Incorporated
23 Industrial Place
Fiddlers Green, Massachusetts 12345

Dear Mr. Plater:

We have compared the data contained in your letter of June 12, 1982 to Mr. Lester Sutton, the USEPA Region I Administrator, which you specify was derived from the independently audited, year-end financial statements of BFD, Inc. as of February 28, 1982, with the amounts in those financial statements.

In our opinion, the data contained in the letter, referred to above presents fairly the consolidated financial position of BFD, Inc., and subsidiaries as of February 28, 1982 and the consolidated results of their operations for the year then ended, in conformity with generally accepted accounting principles applied on a consistent basis. No matters came to our attention which caused us to believe that the data in the letter referred to above should be adjusted.

Respectfully,

A handwritten signature in cursive script, appearing to read "Jane Flatt".

Jane Flatt
Certified Public Accountant
Flatt, Black and Associates

A.6 Certificate of Liability Insurance

BFD, Inc., has obtained a liability insurance policy covering both sudden and nonsudden accidents that may occur at its Fiddlers Green facility. (Nonsudden insurance is required because of BFD's on-site lagoon.) A copy of the certificate of liability insurance is attached.

HAZARDOUS WASTE FACILITY
CERTIFICATE OF LIABILITY INSURANCE

1. Fiddler's Green Insurance Company, Inc., (the
"Insurer"), of

50 Main Street
Fiddlers Green, Massachusetts 12345

hereby certifies that it has issued liability insurance covering
bodily injury and property damage to BFD, Inc., (the "insured"),
of

23 Industrial Place
Fiddlers Green, Massachusetts 12345

in connection with the insured's obligation to demonstrate
financial responsibility under 40 CFR 264.147 or 265.147. The
coverage applies at

EPA Facility No. MST 123456789
BFD, Inc.
23 Industrial Place
Fiddlers Green, Massachusetts 12345

for sudden and nonsudden accidental occurrences. The limits of
liability are

Each occurrence	\$1,000,000 (sudden)
Annual aggregate	\$2,000,000 (sudden)
Each occurrence	\$3,000,000 (nonsudden)
Annual aggregate	\$6,000,000 (nonsudden)

exclusive of legal defense costs. The coverage is provided
under policy number EL-0074, issued on July 14, 1982. The
effective date of said policy is July 15, 1982.

2. The Insurer further certifies the following with respect to the insurance described in Paragraph 1:

(a) Bankruptcy or insolvency of the insured shall not relieve the Insurer of its obligations under the policy.

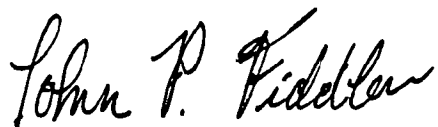
(b) The Insurer is liable for the payment of amounts within any deductible applicable to the policy, with a right of reimbursement by the insured for any such payment made by the Insurer. This provision does not apply with respect to that amount of any deductible for which coverage is demonstrated as specified in 40 CFR 264.147(f) or 265.147(f).

(c) Whenever requested by a Regional Administrator of the U.S. Environmental Protection Agency (EPA), the Insurer agrees to furnish to the Regional Administrator a signed duplicate original of the policy and all endorsements.

(d) Cancellation of the insurance, whether by the insurer or the insured, will be effective only upon written notice and only after the expiration of sixty (60) days after a copy of such written notice is received by the Regional Administrator of the EPA Region in which the facility is located.

(e) Any other termination of the insurance will be effective only upon written notice and only after the expiration of thirty (30) days after a copy of such written notice is received by the Regional Administrator of the EPA Region in which the facility is located.

I hereby certify that the wording of this instrument is identical to the wording specified in 40 CFR 264.151(j) as such regulation was constituted on the date first above written, and that the Insurer is licensed to transact the business of insurance, or eligible to provide insurance as an excess or surplus lines insurer, in one or more States.

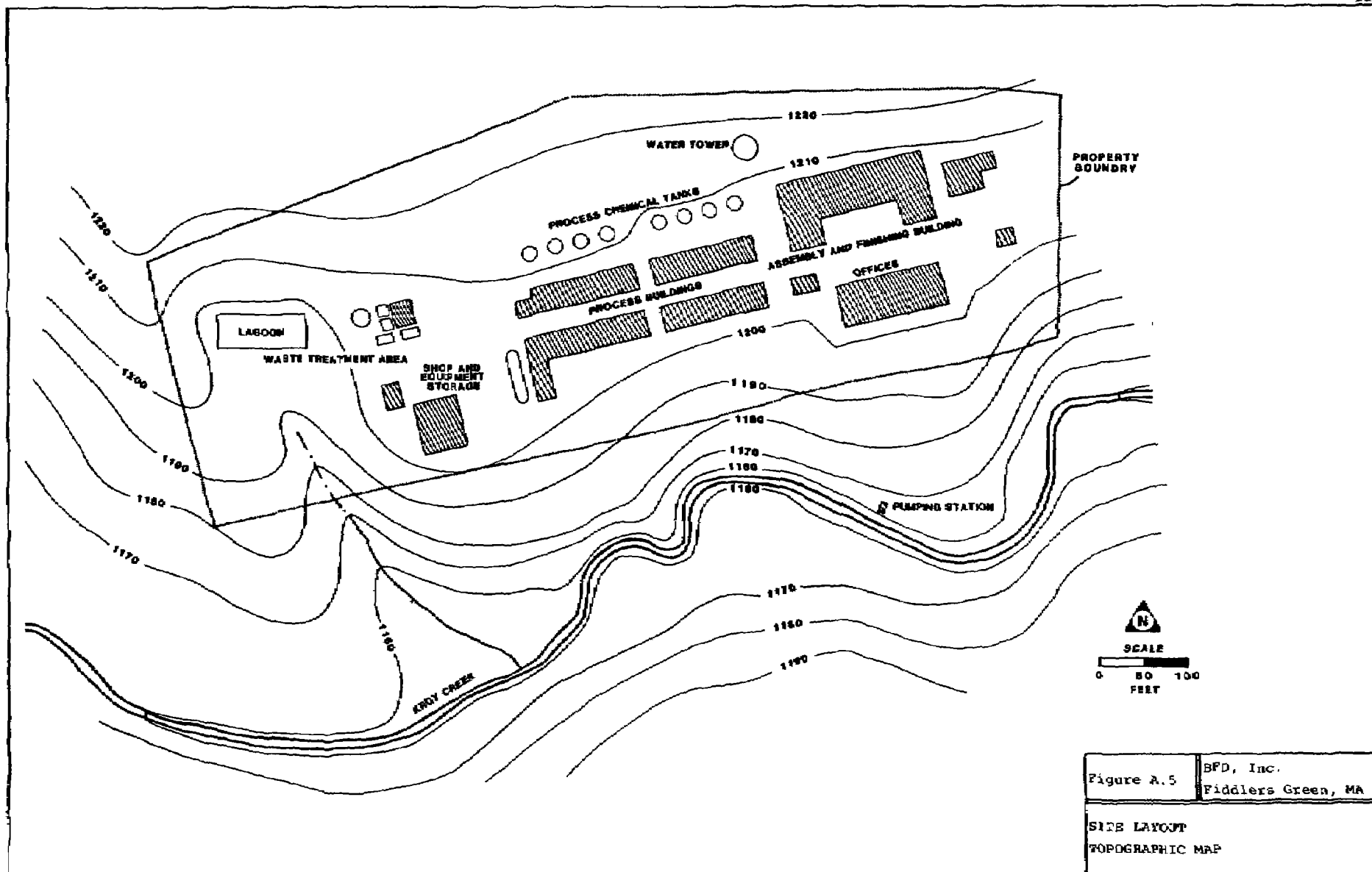
A handwritten signature in cursive script, reading "John P. Fiddler". The signature is written in dark ink and is positioned above the printed name and title.

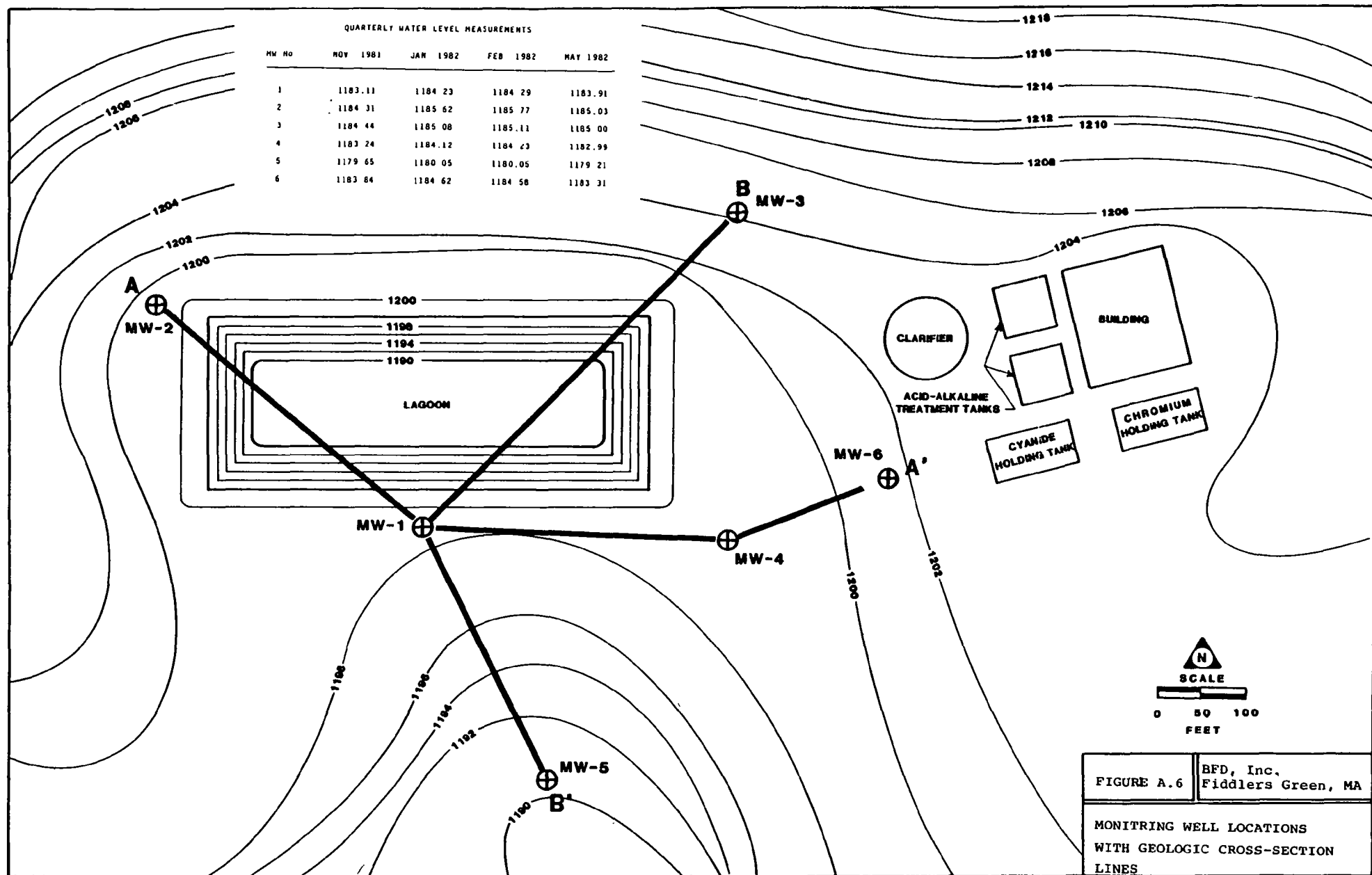
John Fiddler
Vice President
Authorized Representative of
Fiddlers Green Insurance Co., Inc.
50 Main Street
Fiddlers Green, Massachusetts 12345

A.7 Groundwater Monitoring Plan

This document outlines the ground-water monitoring system, and sampling and analysis program, developed for the BFD plant to satisfy the requirements of 40 CFR 265, Subpart F. This regulation requires the owner or operator of a surface impoundment, used to manage hazardous waste, to implement a monitoring program capable of determining the facility's impact on ground-water quality in the uppermost aquifer underlying the facility. The waste management area, shown in Figures A.5 and A.6, contains the only hazardous waste impoundment at the site.

Test borings were conducted to establish the geological materials in the waste area and to serve as monitoring wells. Drilling and well construction were performed by Ditch and Sons Drilling Company under the supervision of BFD's consultant, Succombe Drye and Associates. Locations of borings are shown in Figure A.6, and boring logs and geologic cross-sections are shown in Attachment 4. The material beneath the site is glacial outwash, and the lithology is highly variable over short distances. Sand, silt, and silty clay are the principal constituents. The presence of silt or clay may locally inhibit the vertical migration of contaminated ground water, but lateral interconnection with coarser material presents the possibility of contaminants reaching the deeper sand aquifers.





Monitor Wells

The uppermost aquifer is defined as the brown fine sand and silty sand, situated beneath the topsoil to a depth of between 4 and 20 feet below the surface throughout the waste area. Monitor wells MW-2 and MW-3 are upgradient monitors, and will provide background water quality data for the uppermost aquifer. Monitor wells MW-1, MW-4 and MW-6 are located at the perimeter of the waste treatment area, and water level elevations (Figure A.6) show them to be downgradient of the waste facilities. In addition, MW-5 is located downgradient at the head of a small valley containing stream tributary to Kroy Creek.

Well MW-1, which will provide early detection of seepage from the lagoon, has a dual completion to identify: (1) leakage into the upper aquifer and (2) leakage into the sand which is separated from the upper aquifer by a layer of silty clay. A single completion to the total depth was avoided to prevent the possibility of cross-contamination, and the depth of the intake area was necessitated by the depth of the excavation and fill beneath the lagoon. MW-4, 5 and 6 were completed down to layer of clay or silty clay which would restrict vertical flow. Completion to greater depth would dilute samples with water from zones less likely to be contaminated. A potentiometric contour map is included in Attachment 4 showing the apparent direction of groundwater flow.

Sampling and Analysis Plan

Sample Collection

Each well is fitted with a length of 0.25 inch I.D. teflon tubing which is permanently installed inside the well casing. The bottom of the tubing is at the middle of the well screen. Prior to sample collection, a volume of water equivalent to three times the volume of standing water in the casing is removed by bailing, with the bailer being carefully washed in distilled water immediately before use. When the water level has recovered to within one foot of the initial level, a sample is collected by inserting the tubing into a stopper fitted to the sampling flask; a hand vacuum pump is also connected to the flask, and the sample is withdrawn by suction lift. The sample is then transferred from the sampling flask to labelled polyethelene containers which are completely filled to exclude contact with the air.

Preservation and Shipment

Samples are immediately packed in insulated boxes containing dry ice, and shipped by Federal Express to Quahog Laboratories for testing. Holding period restrictions for all parameters are adhered to, and verified through the chain of custody procedure.

The only exceptions are pH and conductivity, which are measured at the time of sampling in order to assure compliance with the 24 hour holding period. A Hach portable conductivity meter and pH meter are used for these purposes.

Analytical Procedures

Samples received by Quahog Laboratories will be analyzed using EPA approved techniques as described in "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020. Quarterly samples will be analyzed for the following parameters during the first year of sampling:

Arsenic	Nitrate (as N)	2, 4-D
Barium	Selenium	2,4,5-TP
Cadmium	Silver	Coliform Bacteria
Chromium	Endrin	Gross Alpha
Fluoride	Lindane	Gross Beta
Lead	Methoxychlor	Radium
Mercury	Toxaphene	

In addition, the samples will be analyzed for the following parameters during the first year quarterly sampling and in all subsequent semi-annual samplings:

Chloride	Phenols	pH
Iron	Sodium	Total Organic Carbon
Manganese	Sulfate	Total Organic Halogen

Conductivity is determined in the field as discussed above.

For each parameter in the second list, four replicate measurements will be made for each sample obtained from the up-gradient wells during the first year. From these, the initial background arithmetic mean and variance of the parameter concentrations will be determined. Four replicate measurements will also be made for these parameters during the first year and all subsequent years on samples obtained from the upgradient and downgradient wells; these will be used in conjunction with background values to determine significant increases (or decreases in the case of pH) using the Student's t-test.

Chain of Custody

Chain of custody forms will be used to assure proper identification of samples and adherence to holding period requirements. A sample form is shown as Attachment 5.

Sampling Schedule

Samples will be obtained from all monitor wells on a quarterly basis for the first year, and on a semi-annual basis in all subsequent years.

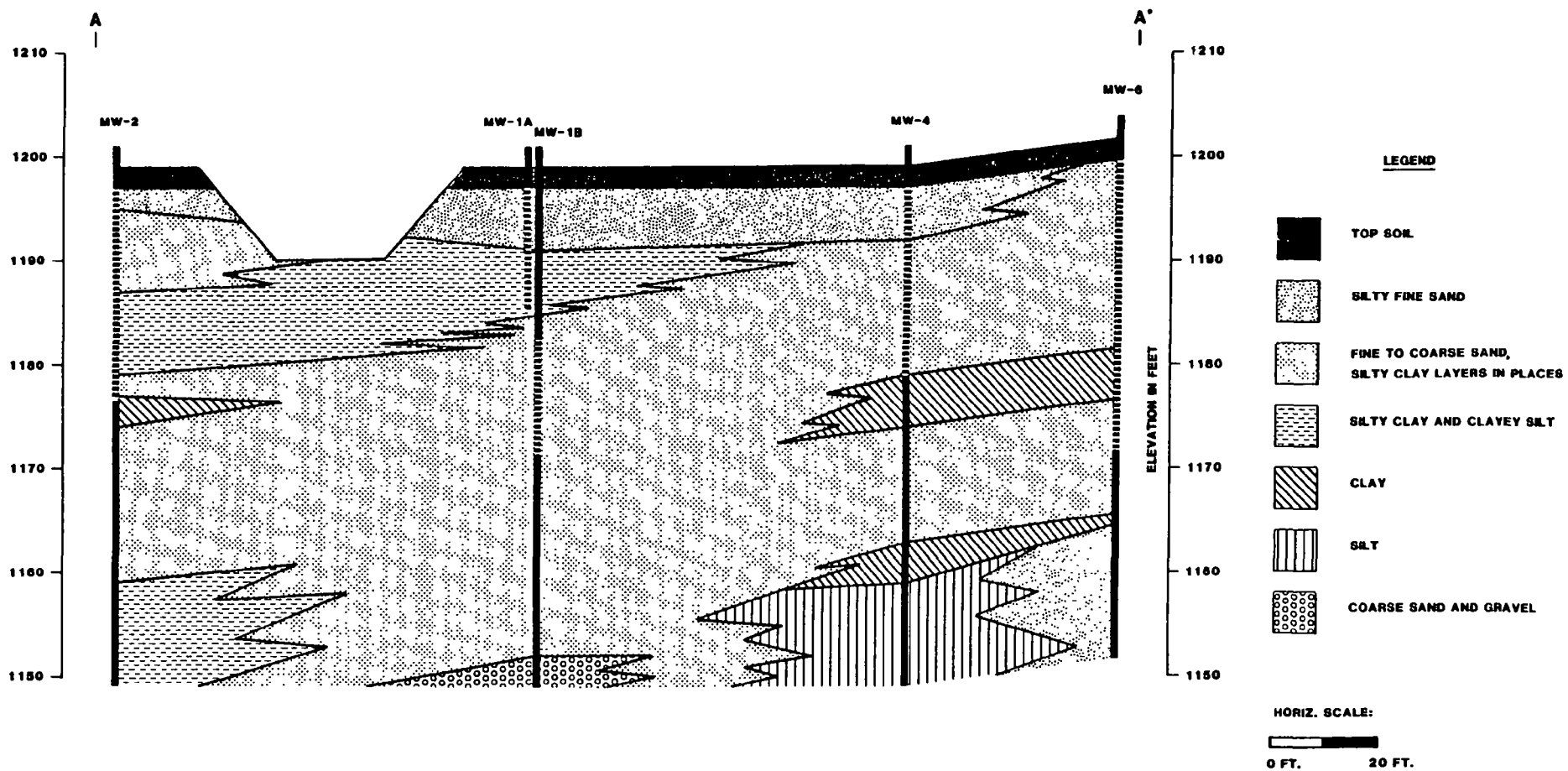
Record Keeping and Reporting

Analytical results, including ground water elevations taken at the time of sampling will be kept at the site. Results of quarterly analyses during the first year will be reported to the

EPA Regional Administrator within 15 days of the completion of the analyses. Results of semi-annual analyses, along with statistical comparisons with the background arithmetic mean, will be reported to the EPA Regional Administrator once every year beginning in January 1983.

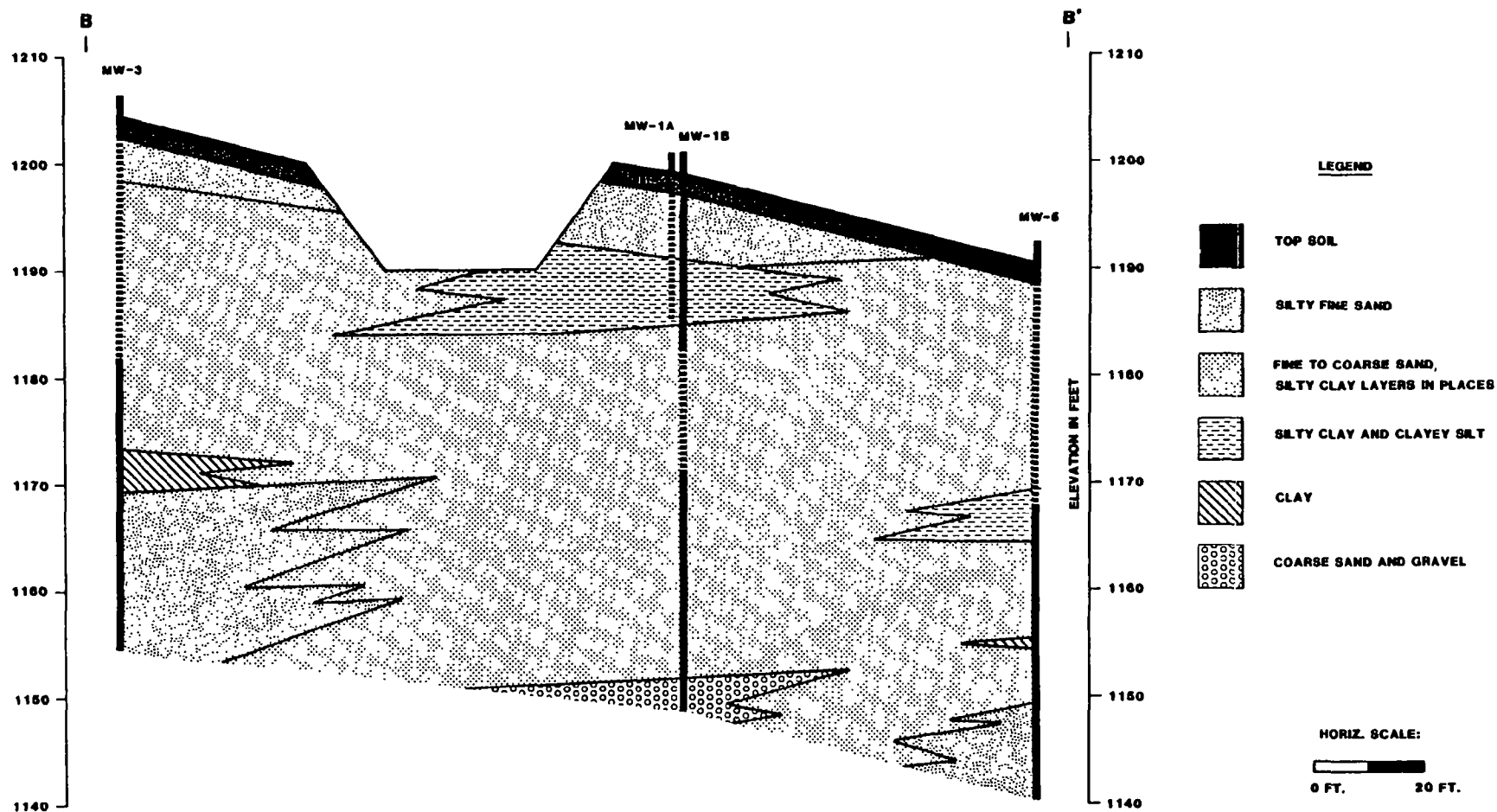
Outline of Groundwater Quality Assessment Program

If the statistical analyses described in the Sampling and Analysis Plan indicate a significant change in the listed parameters, the Groundwater Quality Assessment Plan will be implemented to determine the extent and rate of groundwater contamination. Upon determination of significant change, all of the monitor wells will again be sampled and analyses performed to confirm the preliminary results. If increases in the parameters (or decrease in the case of pH) are confirmed, all of the wells will be sampled thereafter on a quarterly basis and analyzed for the parameters listed for semi-annual determination in the Sampling and Analysis Plan. In addition, water samples will be obtained from Kroy Creek near the plant pumping station (see Figure 1) on a quarterly basis, and analyzed for the above mentioned parameters. This program will be continued until plant closure.



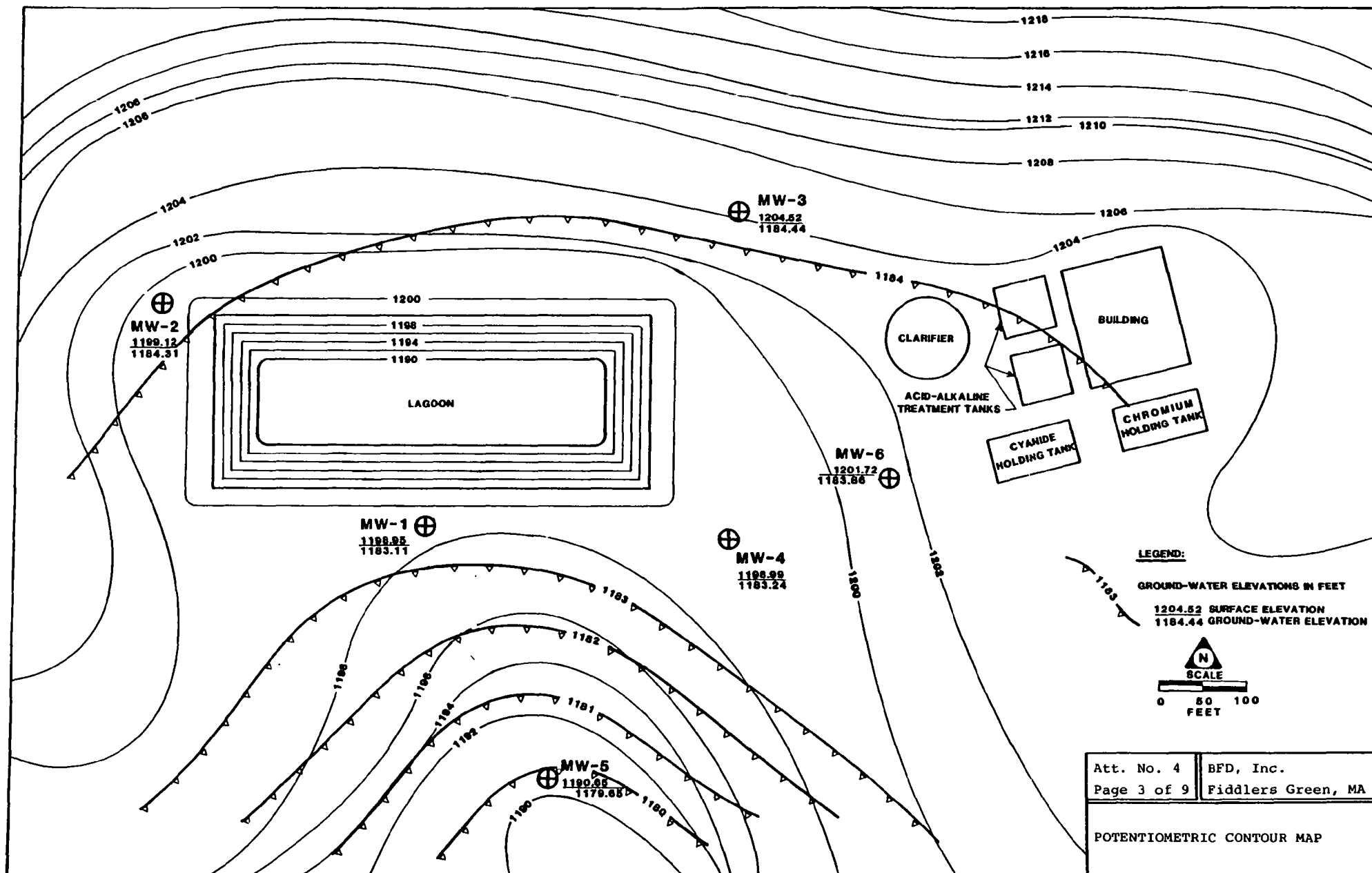
Att. No. 4	BFD, Inc.
Page 1 of 9	Fiddlers Green, MA

GEOLOGIC CROSS-SECTION A-A'



Att. No. 4	BFD, Inc.
Page 2 of 9	Fiddlers Green, MA

GEOLOGIC CROSS-SECTION B-B'

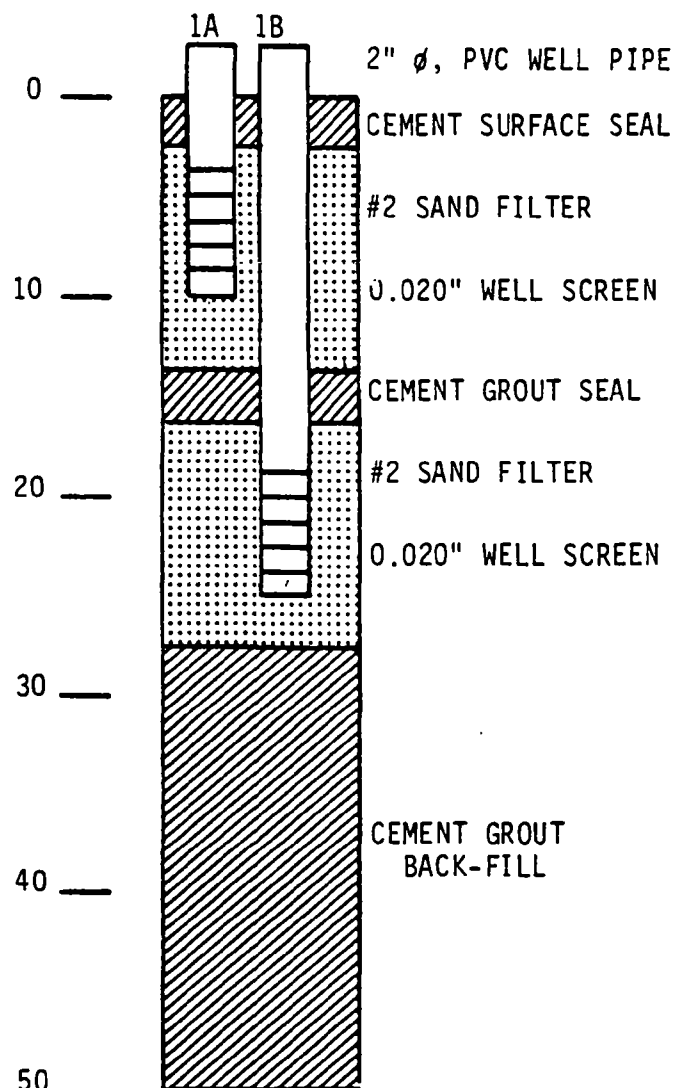


LITHOLOGIC LOG

0 - 2	BROWN TOP SOIL
2 - 8	BROWN FINE SAND AND SILT
8 - 14	YELLOW-ORANGE SILTY CLAY (LAMINATED)
14 - 26	BROWN FINE SAND WITH THIN RED-BROWN SILTY CLAY LAYERS
26 - 29	BROWN COARSE SAND
29 - 47	TAN FINE TO MEDIUM SAND
47 - 50	BROWN COARSE SAND AND GRAVEL

Boring and well completed -
15 November, 1981

Water level at 16' below land
surface



BORE HOLE DIAMETER - 6"
MUD ROTARY DRILLING USING
BENTONITE DRILLING FLUID
FINISHED AT 50' BELOW LAND
SURFACE

**BORING LOG AND WELL COMPLETION
MW-1**

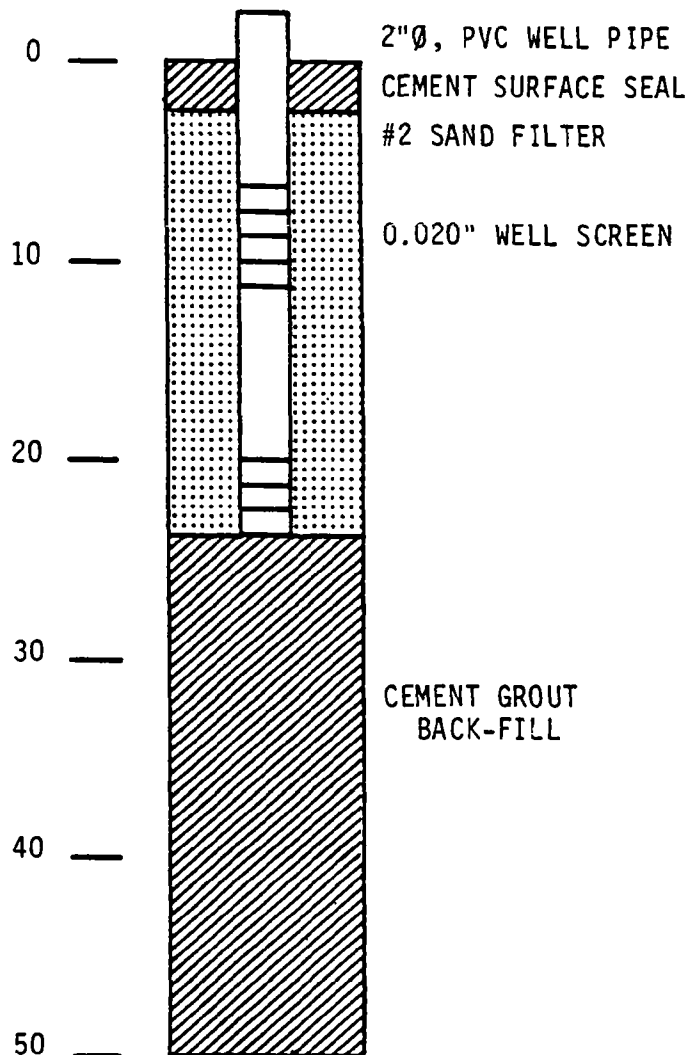
Attachment 4
Page 5 of 9

LITHOLOGIC LOG

0 - 2 BROWN TOP SOIL
2 - 4 BROWN FINE SAND AND SILT
4 - 12 BROWN MEDIUM TO COARSE SAND
12 - 20 ORANGE SILTY CLAY
20 - 22 BROWN FINE SAND
22 - 25 YELLOW CLAY
25 - 29 BROWN FINE SAND
29 - 40 TAN FINE TO MEDIUM SAND
40 - 50 GRAY SILTY CLAY

Boring and well completed -
14 November, 1981

Water level at 15'-1" below land
surface



BORE HOLE DIAMETER - 6"
MUD ROTARY DRILLING USING
BENTONITE DRILLING FLUID
FINISHED AT 50' BELOW LAND
SURFACE

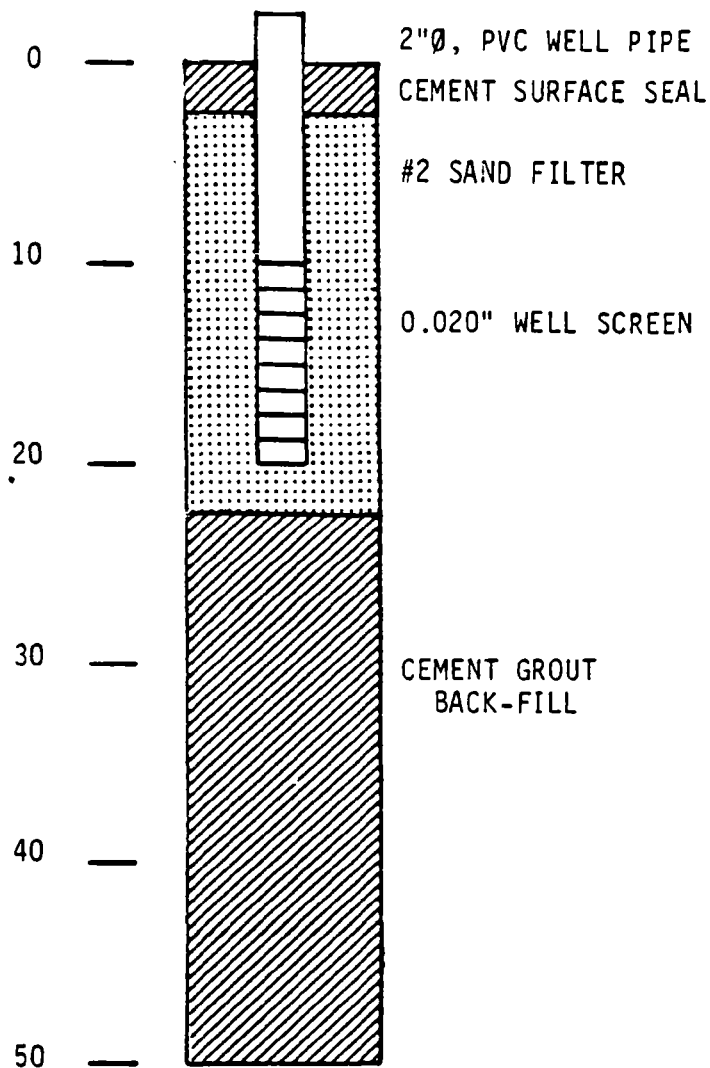
**BORING LOG AND WELL COMPLETION
MW-2**

LITHOLOGIC LOG

0 - 2 BROWN TOP SOIL
2 - 6 BROWN FINE SAND AND SILT
6 - 13 RED-BROWN COARSE SAND
13 - 22 BROWN FINE SAND WITH THIN
SILTY CLAY LAYERS
22 - 31 TAN MEDIUM SAND
31 - 35 YELLOW CLAY
35 - 50 BROWN FINE SAND WITH SILT

Boring and well completed -
16 November, 1981

Water level at 19'-10" below land
surface



BORE HOLE DIAMETER - 6"

MUD ROTARY DRILLING USING
BENTONITE DRILLING FLUID

FINISHED AT 50' BELOW LAND
SURFACE

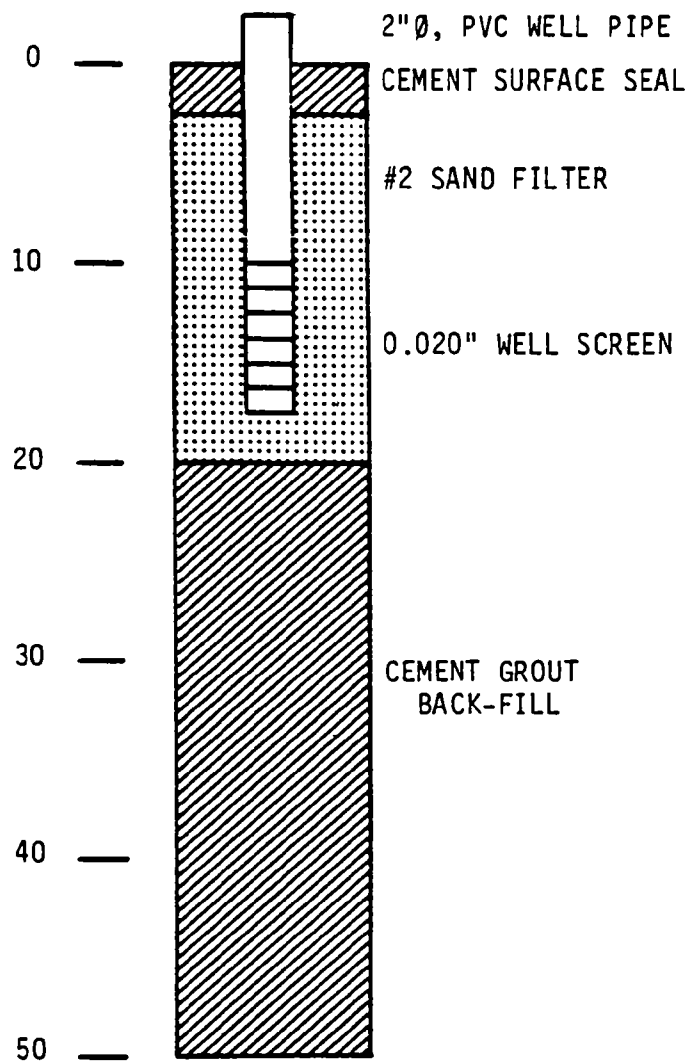
**BORING LOG AND WELL COMPLETION
MW-3**

LITHOLOGIC LOG

0 - 2 BROWN TOP SOIL
 2 - 7 BROWN FINE SAND AND SILT
 7 - 20 BROWN FINE SAND (CLEAN)
 20 - 27 ORANGE-YELLOW CLAY
 27 - 36 BROWN FINE SAND
 36 - 40 YELLOW CLAY
 40 - 50 GRAY SILT

Boring and well completed -
 17 November, 1981

Water level at 15'-8" below land
 surface



BORE HOLE DIAMETER - 6"

MUD ROTARY DRILLING USING
 BENTONITE DRILLING FLUID

FINISHED AT 50' BELOW LAND
 SURFACE

BORING LOG AND WELL COMPLETION

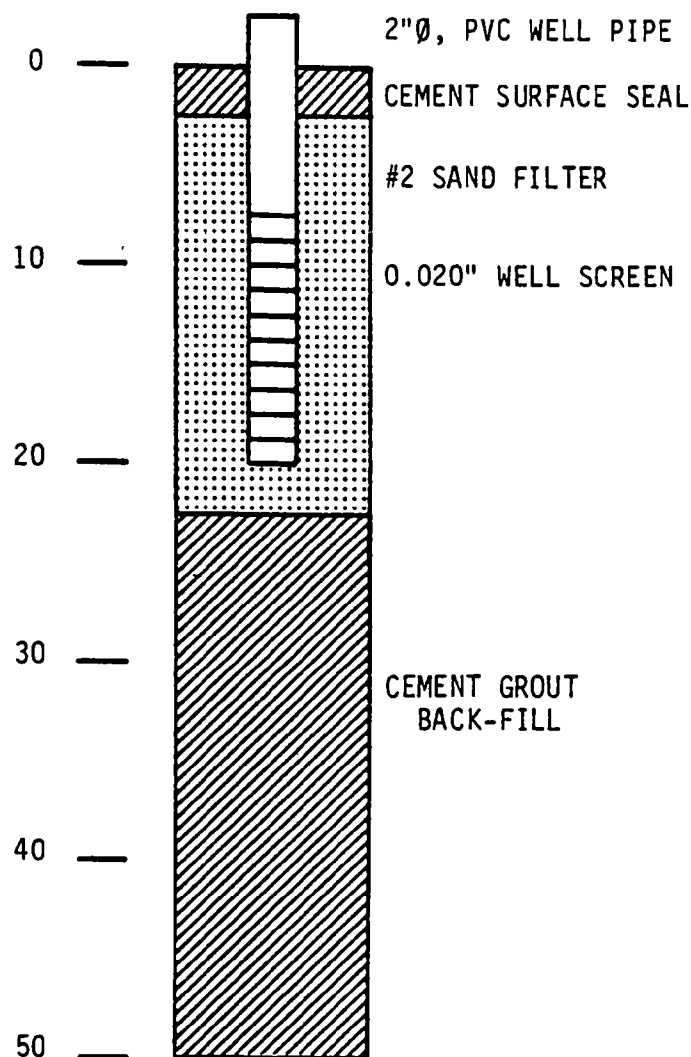
MW-4

LITHOLOGIC LOG

0 - 2 BROWN TOP SOIL
2 - 5 BROWN FINE SAND
5 - 16 BROWN MEDIUM TO FINE SAND
16 - 21 ORANGE FINE SAND
21 - 26 YELLOW CLAYEY SILT
26 - 35 BROWN FINE SAND
35 - 36 YELLOW CLAY
36 - 41 BROWN FINE SAND
41 - 50 GRAY SILTY FINE SAND

Boring and well completed -
18 November, 1981

Water level at 11' below land
surface



BORE HOLE DIAMETER - 6"
MUD ROTARY DRILLING USING
BENTONITE DRILLING FLUID
FINISHED AT 50' BELOW LAND
SURFACE

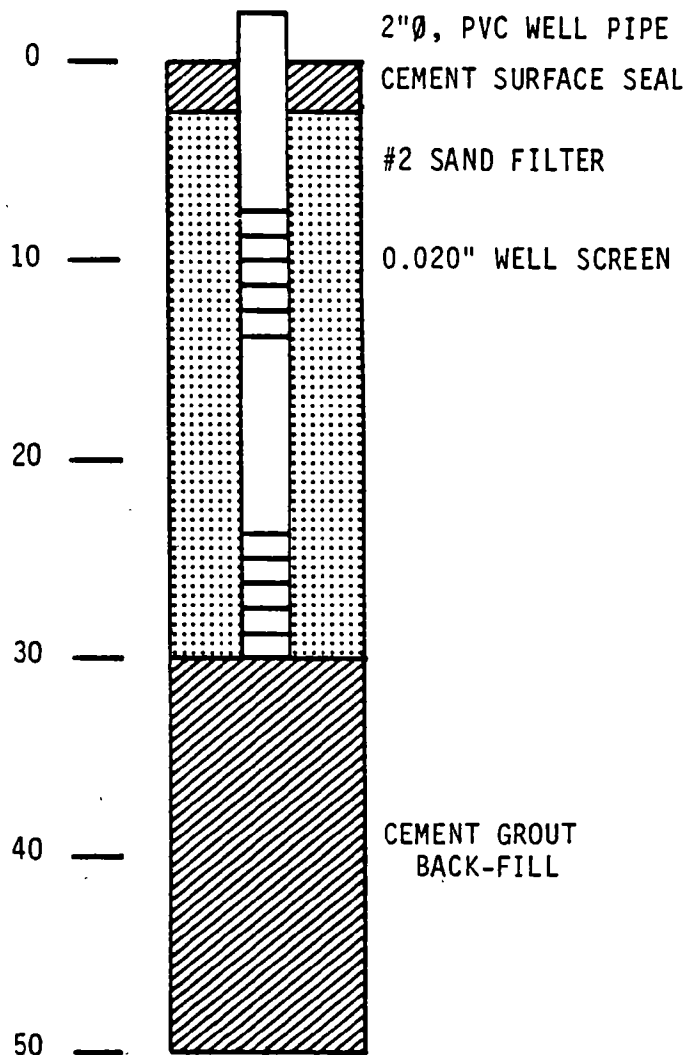
BORING LOG AND WELL COMPLETION
MW-5

LITHOLOGIC LOG

0 - 2 BROWN TOP SOIL
2 - 10 BROWN FINE SAND
10 - 16 ORANGE COARSE SAND
16 - 20 BROWN FINE SAND
20 - 25 ORANGE-YELLOW CLAY
25 - 36 BROWN FINE SAND
36 - 37 YELLOW CLAY
37 - 50 GRAY SILTY FINE SAND

Boring and well completed -
19 November, 1981

Water level at 17'-4" below land
surface



BORE HOLE DIAMETER - 6"
MUD ROTARY DRILLING USING
BENTONITE DRILLING FLUID
FINISHED AT 50' BELOW LAND
SURFACE

**BORING LOG AND WELL COMPLETION
MW-6**

Attachment 5

Chain of Custody Form

Well No.: _____

Sample No: _____

Date of Sampling: _____

Time of Sampling: _____

Sample taken by: _____

Sample delivered to: _____

Of: _____

Date of delivery: _____

Time of Delivery: _____

Sample Condition as Received: _____

Results returned with
this form to: _____

Of: _____

On date: _____

Time: _____

APPENDIX B

STUDENT'S T-TEST

The RCRA regulations require that a statistical analysis be performed on the values of the indicator parameters, as determined from the sampling and analysis of the required monitoring wells. These operations will allow the determination of background water quality and the comparison of later analysis results for indications of change in the groundwater quality.

Initial background water quality data is obtained by pooling the results of the replicate measurements made during the first year of monitoring for the upgradient monitoring wells. From these data, the mean and variance of each indicator parameter (pH, specific conductance, total organic carbon, total organic halogen) are determined based on at least four replicate measurements for each well. The results of these determinations will be used to compare with measurements made during the second year of monitoring utilizing the Student's T-test.

B.1 First Year Analysis

During the first year of monitoring, the initial background mean and variance for each indicator parameter is determined. The Student's T-test requires that summary statistics be used in the comparison and it is necessary to obtain the mean (\bar{x}) and the variance (s^2) for each parameter for input into Student's equation. The mean (average) is calculated by the following:

$$\bar{x} = \frac{(x_1 + x_2 \dots x_n)}{n}$$

where:

\bar{x} = mean of the sample set (x_1 to x_n)
 n = the number of readings in the sample set
 x = the value of individual members of the sample set

The indicator parameter values for all four quarters of the monitoring period are used. If more than one monitoring well is used, the overall mean value is determined by summing the data from each well for each indicator parameter.

The variance (s^2) is a measure of variability and is the average of the squares of the differences between the actual measurements and the calculated mean. The variance is defined as the sum of the squares of the difference between the mean and the actual value, divided by one less than the number of readings. Variance is calculated by:

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

where:

s^2 = sample variance

x_i = value of each measurement

\bar{x} = data set mean

Σ = "the sum of" a set of numbers

n = the number of readings

An example of the determination of the mean (\bar{x}) and variance (s^2) follows. As in the mean calculations, more than one well in the system requires that the results be pooled and the total variance calculated.

	VALUE	MEAN	DIFFERENCE	DIFFERENCE SQUARED
1st Quarter	4.8	6.4	-1.6	2.56
	6.8	6.4	0.4	0.16
	6.3	6.4	-0.1	0.01
	5.7	6.4	-0.7	0.49
2nd Quarter	6.1	6.4	-0.3	0.09
	6.9	6.4	0.5	0.24
	8.2	6.4	1.8	3.24
	7.5	6.4	1.1	1.21
3rd Quarter	6.2	6.4	-0.2	0.04
	5.5	6.4	-0.9	0.81
	4.3	6.4	-2.1	4.41
	5.7	6.4	-0.7	0.49
4th Quarter	6.0	6.4	-0.4	0.16
	8.9	6.4	2.5	6.25
	8.6	6.4	2.2	4.84
	4.7	6.4	-1.7	2.89
	<hr/>			<hr/>
	102.2			27.90

The mean is calculated by:

$$\bar{x} = \frac{102.2}{16} = 6.39 \text{ rounded to } 6.4$$

And the variance:

$$s^2 = \frac{27.90}{16-1} = 1.86$$

B.2 Second Year Analysis

After the initial background values of the indicator parameters are determined (first year analysis), sample mean and variance for the four replicate measurements made at least semi-annually during the second year for each upgradient and each downgradient well must be calculated. These determinations are made in the same manner as described above for each indicator parameter. The mean of each indicator parameter for each well must be individually compared to the initial background of each indicator parameter using Student's T-test at the 0.01 level of significance.

The Student's T-test is a statistical method used to determine the significance of a change between the initial background value and subsequent measurements. The subsequent measurements must be made at least semi-annually for each well for each indicator parameter. The mean of the background values for each parameter and the variance are calculated after the first year and are represented by \bar{x}_b and s_b^2 , respectively. For the individual monitoring well under consideration, the mean and variance are represented by \bar{x}_m and s_m^2 , respectively. The T-test requires these summary data (\bar{x}_b , s_b^2 , \bar{x}_m , s_m^2) to calculate the T-STATISTIC (t^*) and the COMPARISON T-STATISTIC (t_c). The t^* value is compared to the t_c value in order to

reach a conclusion as to whether there has been any significant (statistical) change in the indicator parameter value. The T-Test is performed as follows:

$$t^* = \frac{\bar{x}_m - \bar{x}_b}{\sqrt{\frac{s_m^2}{n_m} + \frac{s_b^2}{n_b}}}$$

Negative t^* values are converted to positive by disregarding the sign.

The determination of the COMPARISON T-STATISTIC (t_c) requires finding t_b and t_m from a table of Degrees of Freedom and Level of Significance. Degrees of freedom are ($n_b - 1$) and ($n_m - 1$) for background and monitoring data respectively. If there are 16 data points in the background data, there are ($16-1=$) 15 degrees of freedom. The same is true of the monitoring data. If 8 points are measured, there are ($8-1=$) 7 degrees of freedom.

Since the RCRA regulations require a level of significance of 0.01, t_b and t_m are determined by locating the value of the level of significance for 0.01 with the appropriate degree of freedom. Refer to Table C-1 for the critical t-values for the levels of significance.

Special weightings are required to complete the determination of the t_c value. These weights, defined as W_b and W_m , are calculated as:

$$W_b = \frac{s_b^2}{n_b}$$

$$W_m = \frac{s_m^2}{n_m}$$

The COMPARISON T-STATISITIC (t_c) is therefore calculated as:

$$t_c = \frac{W_b t_b + W_m t_m}{W_b + W_m}$$

The T-STATISITIC (t^*) is then compared to the COMPARISON T-STATISITIC (t_c) using the following decision rules:

- If t^* is equal to or larger than t_c , then conclude that there most likely has been an increase in the indicator parameter. (For pH, it is a decrease if the t^* as originally calculated was negative, and an increase if the original t^* was positive.)
- If t^* is less than t_c , then conclude that there has most likely been no change in the indicator parameter.

B.3 Example T-Test

This example uses the background water quality data for pH presented earlier in this appendix. For this example, only one monitoring well will be considered.

Table C.1
Critical T-Values at the 0.01 Level of Significance

DEGREES OF FREEDOM	0.01 LEVEL OF SIGNIFICANCE
<hr/>	
1	31.821
2	6.965
3	4.541
4	3.747
5	3.365
6	3.143
7	2.998
8	2.896
9	2.821
10	2.764
11	2.718
12	2.681
13	2.650
14	2.624
15	2.602
16	2.583
17	2.567
18	2.552
19	2.539
20	2.528
21	2.518
22	2.508
23	2.500
24	2.492
25	2.485
26	2.479
27	2.473
28	2.467
29	2.462
30	2.457
40	2.423
50	2.406
60	2.390
120	2.326

Monitoring well pH test results are:

6.6
6.6
6.7
6.6

From the background data presented earlier the mean (\bar{x}) is:

$$\bar{x}_b = \frac{(4.8 + 6.8 + \dots 4.7)}{16} = 6.4$$

The variance is:

$$s_b^2 = \frac{27.90}{16-1} = 1.86$$

For the monitoring data, the mean is

$$\bar{x}_m = \frac{(6.6 + 6.6 + 6.7 + 6.6)}{4} = 6.625$$

The variance is:

$$s_b^2 = \frac{((6.6-6.625)^2 + (6.6-6.625)^2 + (6.7-6.625)^2 + (6.6-6.625)^2)}{(4 - 1)}$$

For the T-test

$$t^* = \frac{\bar{x}_m - \bar{x}_b}{\frac{s_m^2}{n_m} + \frac{s_b^2}{n_b}}$$

$$t^* = \frac{6.39 - 6.45}{\frac{0.0025}{4} + \frac{1.86}{16}}$$

$$t^* = 0.175$$

From Table C-1:

t_b with 15 degrees of freedom a significance level of 0.01

$$t_b = 2.602$$

t_m with 3 degrees of freedom, a significance level of 0.01

$$t_m = 4.541$$

The weights are:

$$W_m = \frac{s_m^2}{n_m} = \frac{0.0025}{4} = 0.000625$$

$$W_b = \frac{s_b^2}{n_b} = \frac{1.86}{16} = 0.11625$$

Therefore:

$$t_c = \frac{W_b t_b + W_m t_m}{W_b + W_m} = \frac{(0.11625 * 2.602) + (0.000625 * 4.541)}{(0.11625 + 0.000625)}$$

$$t_c = 2.612$$

As t^* (0.175) is less than t_c (2.612) there has been no statistically significant change in the indicator parameter.

APPENDIX C
FEDERAL AND STATE CONTACTS

The following should be contacted for additional information or guidance related the hazardous waste regulations described in this report.

C.1 EPA Contacts

Gary Gosbee	(617) 223-1591
Mary Sanderson	(617) 223-1591
Ken Wenger	(617) 223-5775

C.2 State Contacts

Connecticut

Barry Giroux	(203) 566-5712
George Dews	(203) 566-5712
Paul Marin	(203) 566-3654

Maine

John Krueger	(207) 289-2251
Robert Demkowicz	(207) 289-2251
George Kaplan	(207) 289-2251

Massachusetts

Steven Dreeszen	(617) 292-5630
Hank Southworth	(617) 292-5630
Larry Giarrizzo	(617) 292-5630

New Hampshire

Chuck Knox	(603) 271-4623
Dan Allen	(603) 271-3289
Michael Donahue	(603) 271-3289

Rhode Island

Barry Muller	(401) 277-2808
Tom Wright	(401) 277-2808
Stephen Majkut	(401) 277-2808

Vermont

Dick Valentinetti (802) 828-3395