

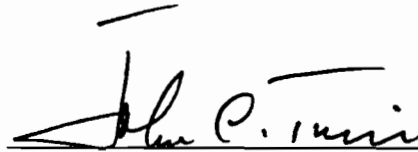
Engineering Evaluation

and

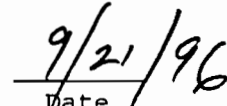
Cost Analysis

Nemo Work-station Site

Approved



John C. Twiss, Forest Supervisor



Date

I. EXECUTIVE SUMMARY

It is purported that Ethylene Dibromide and Lindane mixed with diesel fuel, both classified as hazardous substances, were buried in various pits behind the Nemo Work-station site located in Nemo, South Dakota. Different alternatives have been reviewed as to when and what degree of mitigations to conduct. Little data has been collected to indicate the hazardous material is migrating into the groundwater system or soil. The objectives are to verify the hazard and remove it. Based on costs and objectives the alternative to remove the material now has been recommended.

II. SITE CHARACTERIZATION

A. SITE DESCRIPTION AND BACKGROUND

1. SITE LOCATION:

The Nemo Work-station site is located within the Black Hills National Forest in Section 27, Township 3 North, Range 5 East BHM, South Dakota. The site is located on government property in Lawrence County with an elevation of about 4700 feet MSL and with an approximate Latitude of 44°11'31", Longitude 103°30'23". The sites are located just west of the USFS Nemo Work Station in Nemo, South Dakota. Reference appendix location map.

2. TYPE OF FACILITY AND OPERATIONAL STATUS:

The Forest Service used eight pits to dispose of excess and damaged equipment and materials. Employees remembered disposing of EDB and Lindane mixed with diesel fuel contained in 5 gallon-army style metal fuel cans into burial pits. Four of the pits were used in the 1970's for the burial of ethylene dibromide (EDB) and Lindane mixed with diesel fuel. It is estimated that between 200 and 250 fuel cans were buried. Possibly empty cyanide barrels discarded from surrounding mines were disposed of in the pits as well. Other materials which could be in the eight pits would range from a work trailer, wall lockers, to hand tools and scrap building materials, culverts, and rubble.

Ethylene dibromide (EDB) has been listed as a hazardous substance in the Federal Regulations. "The pesticide is associated with a dread disease - cancer. EDB has recently been down graded from "Suspected Human Carcinogen" to "Animal Carcinogen".

The USFS Nemo Work Station has been used for years by the Forest Service in managing the surrounding national forest. The work station has seen continued activities for at least the past 50 to 75 years.

The area is still being used by the Forest Service. Excess materials are being temporarily stored while waiting for final disposal. It is anticipated that the area will continue to be used by the Forest Service. It was common practice for dump sites to be located near the workstations to dispose of excess or damaged materials.

Previous investigations and assessments were made by the US Bureau of Reclamation Engineering & Construction Services which produced a Preliminary Assessment report on December 23, 1994.

3. STRUCTURES/TOPOGRAPHY:

The Nemo work station site covers an overall area of approximately 20 acres. The site includes eight (8) backfilled dump sites, which have a combined area of 0.5 acres. Four (4) of these sites are suspected of containing the material in question. These sites have a combined area of 0.23 acres. Three of the dump sites (pits #1, 2, & 3) are located together at the top of a saddle. The fourth dump site (pit #4) is located approximately 820 feet to the southwest near the bottom of a draw. Two of the dump sites (pits #5 & 6) are located southwest of pit #2 & 3 approximately 150 feet. Two of the dump sites (pits #7 & 8) are located southeast of pit #3 approximately 100 feet. Reference appendix map sketch attached.

Pit #1 is located at the top of the saddle behind the work station. The area is currently being used as a dirt access trail. Surface drainage in the vicinity of the pit flows to the north toward the work station and Nemo. The area has grasses and regeneration of pine on it.

Pit #2 is over the saddle to the southeast of pit #1. This area is currently being used by the USFS to store building current and excess materials. Surface drainage flows to the southeast towards pit #3. The area has grasses and regeneration of pine on it.

Pit #3 is located southeast of pit #2. A stone storage building (historical structure) is located east of the pit. The area is currently being used by the USFS to store building materials. Surface drainage in the area flows to the southeast. The area has grasses and regeneration of pine on it.

Pit #4 is located approximately 820 feet southwest of the stone building near pit #3. The area is presently part of a large clear area or meadow. The area had been disturbed and reseeded. Surface drainage in the area is to the east down a draw. The draw is located approximately 30 feet to the south and east of the pit. The area is grass covered.

Pit #5 & 6 is located southwest of pit #2. Surface drainage in the area flows to the southeast. The area has grasses and regeneration of pine on it.

Pit #7 & 8 is located southeast of pit #3. A stone storage building (historical structure) is located north by northwest of the pit. The area is currently being used by the USFS to store materials. Surface drainage in the area flows to the southeast. The area has grasses and regeneration of pine on it.

4. GEOLOGY/SOIL INFORMATION

Geologic formations in the area of the pits are not permeable. Wells in the area flow between 3 and 4 gallons per minute. The water table in the area is normally flowing toward the nearby creeks. The geologic formations have high levels of iron pyrite and arsenic within them and as a result the groundwater also has high levels of these substances. A limestone formation (Madison) is located east of Nemo and is an excellent aquifer with a high permeability.

5. SURROUNDING LAND USE AND POPULATIONS:

The majority of land use in the area is timber production. The near by valleys are utilized for "non-intensive" ranching and/or recreational residences. Tourism is the basic commercial use in the community of Nemo with a campground and restaurant.

The pathway of exposure would most likely be by the migration through the groundwater. Contaminant transport via surface water has potential if contaminated groundwater should surface or enter the nearby Box Elder Creek. Contaminant transport of soil or air at present is not likely.

The population surrounding the area is representative of the Black Hill's population at large.

The Nemo community has an estimated population of less than 75 people. The surrounding area density within one (1) mile radius is estimated at less than 25 people per square mile though there are numerous residences near the actual site.

Most residences receive their water from shallow wells and in some cases from springs.

The effected site has no historical significance.

6. SENSITIVE ECOSYSTEMS:

The site is not in or associated with any sensitive ecosystems.

7. METEOROLOGY:

The total annual precipitation at the Pactola Dam weather station was 27.68 inches 1991. The maximum monthly precipitation of 8.28 inches occurred in May of that year. The average annual temperature for 1991 was 40.7 degrees F. The Pactola Dam weather station is approximately 8 miles south of the Nemo Work station site. The USFS weather station on site does not have adequate data yet. The site is in a forested environment which reduces the ground level wind speeds.

B. PREVIOUS REMOVAL ACTIONS

No previous removal actions have been done.

C. SOURCE, NATURE, AND EXTENT OF CONTAMINATION

Roger Showman, a Forest Service employee, remembered disposing of EDB and Lindane which had been mixed with diesel fuel. The mixture was contained in 5 gallon-army style metal fuel cans. It is estimated that between 200 and 250 of the fuel cans were buried with the possibility of barrels containing the mixture as well. The mixture was probably disposed of in pits #1, 2, 3, & 4.

Dave Fieroh, a local resident, remembers the burial of materials in pits #1, 2, 3, & 4 at about 1973. Pit #1 he thought was about 18 feet deep. He also described four more pit location, pits #5, 6, 7, & 8. He did not know what was buried in the pits.

Toni Balisteri identified pits 5, 6, 7, & 8 as containing culverts, concrete and miscellaneous steel items.

For pit site locations, reference appendix map.

The pits will be located by individuals familiar with the site, by observation of vegetative and geologic changes, and a magnetometer survey of the areas in question.

Pits will be monitored during the removal stages for determining the nature and extent of the contamination and for their conformity to what is anticipated. Adjustments to the removal effort will be made during the monitoring process.

D. ANALYTICAL DATA

No quantifiable data has been collected at this point in time. Data will be collected as material is discovered. Currently well water testing in the immediate area indicate that the waste materials are not migrating to the wells. Long term monitoring has not been done. Well monitoring has been initiated.

E. STREAMLINED RISK EVALUATION

Contamination of the groundwater is the most likely mitigation pathway. The buried fuel cans could be leaking or begin leaking in the future. Waste material could then enter the ground water. Wells in the area flow between 3 and 4 gallons per minute. The water table in the area is normally flowing toward the nearby creeks. The geologic formations in the area of the pits are not permeable. There are numerous residences near the sites which receive their water from shallow wells and in some cases from springs.

Contaminant transport via surface water was not observed. There is potential of contaminant transport from materials if contaminated groundwater should surface or enter the nearby Box Elder Creek.

Soil contaminant transport could occur if the fuel cans leak and material surfaces to the ground surface level.

Air contaminant transport is remote even if the cans should start to leak due to the materials being buried. During removal air transport is possible if cans should leak.

II. IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

A. STATUTORY LIMITS ON REMOVAL ACTIONS

This project is not expected to be over \$2 million and 12 month statutory limits for Fund-financed removal actions pursuant to section 104(c)(1) of the CERCLA.

B. DETERMINATION OF REMOVAL SCOPE

The scope of action is total site cleanup of the known listed hazardous materials within the limits and guidelines of Federal and State laws, to remove potential risk to the water supply of the Nemo area.

C. DETERMINATION OF REMOVAL SCHEDULE

Removal schedule is slated for the summer of 1996 during the dry season. All remedial action should be completed by October 1 of 1996. Time slated is anticipated at 60 calendar days. Removal schedule will be influenced by the site. If the material is contained in the metal containers and not leaking more latitude can be given for removal. If the material is leaking already or from removal action time would be accelerated.

E. PLANNED REMEDIAL ACTIVITIES

Continue sampling wells in the area up to a year after removal. Remove hazardous material. Evaluate contaminated material for removal purposes. Have the hazardous material removed to a legal certified site.

III. IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Alternative: 1) No Action at present time until groundwater contamination is detected, 2) Excavate, remove and dispose of all hazardous substances and contaminated material.

A. EFFECTIVENESS

Alternative 1:

Protectiveness:

- * does not have any long term effectiveness in protecting the public health and community;
- * does have effectiveness in protecting workers during implementation;
- * does not have any effectiveness in protecting the environment. The magnitude of risk for long term would increase if the containers start to leak.

Ability to Achieve Removal Objectives:

- * does not achieve level of treatment/containment expected;
- * does not achieve "no residual effect" on concerns;
- * does maintain control though extremely limited until long-term solution implemented. Alternative would not reduce the toxicity, mobility and volume through the treatment of site.

Alternative 2:

Protectiveness:

- * does have effectiveness in protecting the public health and community;
- * does have effectiveness in protecting workers during implementation;
- * does have effectiveness in protecting the environment; The magnitude of long term risk is negligible.

Ability to Achieve Removal Objectives:

- * does achieve level of treatment/containment expected;
- * does achieve "no residual effect" on concerns;
- * does maintain control until long-term solution implemented. (This is the long term solution.) Alternative would eliminate the toxicity, mobility and volume through the treatment of site.

B. IMPLEMENTABILITY

Alternative 1:

Technical Feasibility:

- * does not effect the technical feasibility.

Availability:

- * does not effect.

Administrative Feasibility:

- * does effect it due to long term monitoring.

Alternative 2:

Technical Feasibility:

- * easily monitored, constructed, and operational;
- * easily demonstrated performance/useful life;
- * easily adaptable to environmental conditions;
- * easily contribute to remedial performance;
- * easily implemented in 1 year.

Availability:

- * readily available equipment;
- * readily available personnel and services;
- * readily available outside laboratory testing capacity;
- * readily available off-site treatment and disposal capability;
- * easily implemented in 1 year.

Administrative Feasibility:

- * permits required;
- * easements or right-of-ways are not required;
- * impact on adjoining property negligible if any;
- * ability to impose institutional controls high;

C. COST

Alternative 1 costs \$5,250,334.00.

Alternative 2 costs \$175,115.00.

See Appendix for detailed analysis.

IV. COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Alternative 2 is 7 times less costly than Alternative 1.

Alternative 2 would have more effectiveness and greater magnitude of lowering risk than Alternative 1.

Alternative 2 would have greater ability to achieve the removal objective in short term compared to Alternative 1.

Alternative 2 would have greater implementability over-all compared to Alternative 1.

Alternative 2 would have greater savings in administration compared to alternative 1.

V. RECOMMENDED REMOVAL ACTION ALTERNATIVE

Recommended action is Alternative number 2.

Appendix

1995–1996

Threshold Limit Values (TLVs™)

for Chemical Substances

and Physical Agents

and

Biological Exposure Indices (BEIs™)



ACGIHSM

Proposed	Revised From	To
A4		
A2		
A4		
A4		
A4		
A4		
A4	A2	A3
A4		
A4		
A4		
A4	A2	A3
A4		
A4	A2	A3
A4	A2	A3
A3		
A3		
A4		
A3		
A4		
A4		
A4		
A1		
A4		
A3		
A3		
A3		
A4		
A3		
A1 (certain hard woods)		
A4		
A4	A2	A3

ED B now →

APPENDIX A: Carcinogenicity

The Chemical Substances TLV Committee has been aware of the increasing public concern over chemicals or industrial processes that cause or contribute to increased risk of cancer in workers. More sophisticated methods of bioassay, as well as the use of sophisticated mathematical models that extrapolate the levels of risk among workers, have led to differing interpretations as to which chemicals or processes should be categorized as human carcinogens and what the maximum exposure levels should be. The goal of the Committee has been to synthesize the available information in a manner that will be useful to practicing industrial hygienists, without overburdening them with needless details. The categories for carcinogenicity are:

A1 — Confirmed Human Carcinogen: The agent is carcinogenic to humans based on the weight of evidence from epidemiologic studies of, or convincing clinical evidence in, exposed humans.

A2 — Suspected Human Carcinogen: The agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are considered relevant to worker exposure. Available epidemiologic studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans.

A3 — Animal Carcinogen: The agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are not considered relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

A4 — Not Classifiable as a Human Carcinogen: There are inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals.

A5 — Not Suspected as a Human Carcinogen: The agent is not suspected to be a human carcinogen on the basis of properly conducted epidemiologic studies in humans. These studies have sufficiently long follow-up, reliable exposure histories, sufficiently high dose, and adequate statistical power to conclude that exposure to the agent does not convey a significant risk of cancer to humans. Evidence suggesting a lack of carcinogenicity in experimental animals will be considered if it is supported by other relevant data.

Substances for which no human or experimental animal carcinogenic data have been reported are assigned no carcinogenicity designation.

Exposures to carcinogens must be kept to a minimum. Workers exposed to A1 carcinogens without a TLV should be properly equipped to eliminate to the fullest extent possible all exposure to the carcino-

Carcinogenicity Designations—Proposed or Revised

Substance	Proposed	Revised	
		From	To
Ethyl acrylate		A2	A4
Ethanol	A4		
Ethyl bromide		A2	A3
Ethylene	A4		
Ethylene chlorohydrin	A4		
Ethylenediamine	A4		
Ethylene dibromide		A2	A3
Ethylene dichloride	A4		
Ethylenimine	A3		
Fenamiphos	A4		
Fensulfothion	A4		
Fenthion	A4		
Ferbam	A4		
Fibrous glass dust	A5		
Fluorides	A4		
Fonofos	A4		
Furfural	A3		
Gasoline	A3		
Glycidol	A3		
Halothane	A4		
Hexachlorobutadiene		A2	A3
Hexachlorocyclopentadiene	A4		
Hexachloroethane		A2	A3
Hexamethyl phosphoramidate		A2	A3
Hydrogen peroxide	A3		
Hydroquinone	A3		
Iron oxide	A4		
Kaolin	A4		
Lindane	A3		
Malathion	A4		
Methomyl	A4		
Methoxychlor	A4		
Methyl acrylate	A4		
Methyl bromide	A4		
Methyl chloride	A4		
Methyl chloroform	A4		
Methylene chloride		A2	A3
4,4'-Methylene dianiline		A2	A3
Methyl iodide		A2	None
Methyl methacrylate	A4		
Methyl parathion	A4		
Metribuzin	A4		
Mineral or rock wool	A4		
Monocrotophos	A4		
Morpholine	A4		
Naled	A4		
Naphthalene	A4		
Nickel, elemental and soluble compounds	A1		
Nitrapyrin	A4		
p-Nitroaniline	A4		

Carcinogenicity Des

Substance
Nitrobenzene
p-Nitrochlorobenzene
4-Nitrodiphenyl
Nitrogen dioxide
1-Nitropropane
2-Nitropropane
N-Nitrosodimethylamine
Nitrous oxide
Oil mist, mineral, mildly refined
Parathion
Pentachloronitrobenzene
Pentachlorophenol
Perlite
Phenol
N-Phenyl-beta-naphthylamine
o-Phenylenediamine
m-Phenylenediamine
p-Phenylenediamine
Phenylhydrazine
Phthalic anhydride
Picloram
Propane sultone
beta-Propiolactone
Propoxur
Propylene
Propylene dichloride
Propylene imine
Propylene oxide
Pyrethrum
Resorcinol
Rhodium and compounds
Ronnel
Rotenone
Rouge
Sesone
Silica—Amorphous, Diatom
Silica—Amorphous, Fume
Silica—Amorphous, Precipitated
Silica—Crystalline, Cristobalite
Silica—Crystalline, Quartz
Silica—Crystalline, Tridymite
Silicon carbide
Sodium azide
Sodium bisulfite
Sodium metabisulfite
Starch
Stearates
Styrene
Sucrose
Sulfotep

Alternative 1

PA: Professional Services

Cost is NPV

Activity	Professional Services	LOE (hrs)	Unit Cost (\$/hr)	Incl. 150% Overhead & Profit (\$/hr)	Total Cost (\$)
Work Plan Development	Mid	130	20	50.00	6500
Mobilization, travel, & demob (2 days, 4-5 team members)	junior - senior	80	21.25	53.13	4250
Field Sampling activities (4 days, 4-5 team members).	junior - senior	160	53.13	132.83	21253
PA Narrative Report Preparation	Senior	120	70	175.00	21000
Totals					53003

Alternative 1

PA: Professional Services, locating

Cost is NPV

Activity	Professional Services	Quantities (LS)	Unit Cost (\$/job)	Incl. 150% Overhead & Profit (\$/job)	Total Cost (\$)
Locating site yr 1	Contract	1	7500	18750.00	18750
Locating site yr 15	Contract	1	187500	120349.12	120349
Unit cost from Total Cost from line above. Site assumed to be 10X bigger. interest @3% added to OH&P colum. Factor = 0.641861947					
Totals					139099

Alternative 1

PA: Analytical Services: CLP laboratory

Cost is NPV

Analyte	Matrix	Method	Total No. of Samples	Cost per Sample (\$)	Total Cost (\$)
VOC	Soil Waste	8260	1600	130.30	208477
Site assumed to be 10X bigger Samples enlarged by the Square from alternative 2 (@16*10*10) Interest @3%, year 15. Factor = 0.641861947 applied to cost per sample.					
VOC	Soil Waste	8260	4	4875.22	19501
Labor to test.	1.5 hr / sample,	\$18/hr	4	2593.71	10375
yearly testing, twice per year for 4 wells each Interest @3%, for 15 years. Factor = 24.01583801 applied to cost per sample.					
Totals					238352

Alternative 1 **Removal Action: Equipment Costs**
 Cost is NPV

Equipment Item	Cost \$/WK	Quantity (WKS)	Total Cost (\$)
Backhoe 1 C.Y.	2247	9	20223
Backhoe loader	92	9	828
Flatbed 3 Ton	406	4	1624
Dozer 140 HP	2004	3	6012
Sub-Total of initial work:			28687
Assume future work is 500% more.			Sub-Total 143435
Interest @3%, year 15. Factor = 0.641861947 applied to future work.			92065
Totals			92065

Alternative 1 **Removal Action: Labor Costs**
 Cost is NPV

Type of Personnel	NO. of Weeks	NO. of HRS (8hr/day & 5 day/wk)	Unit Costs (\$/hr)	Incl. 150% Overhead & Profit (\$/hr)	Total Cost (\$)
Backhoe 1 Op	9	360	15.00	37.50	13500
Backhoe loader Op	9	360	15.00	37.50	13500
Flatbed 3 Ton Op	4	160	13.00	32.50	5200
Dozer 140 HP OP	3	120	15.00	37.50	4500
Laborer	9	360	10.00	25.00	9000
Sub-Total of initial work:					45700
Assume future work is 500% more.					Sub-Total 228500
Interest @3%, year 15. Factor = 0.641861947 applied to future work.					146665
Totals					146665

Alternative 1 **Removal Action: Waste Disposal Costs**
 Cost is NPV

Waste Item Disposal Method	Volume/No.	Cost/Item	Total Cost (\$)
Hazardous liquids/Incineration 50-GAL DRUMS 1ac size, 1ft deep @100% eff packing + 43 drum @35% eff packing.	6560	1088	7137280
Interest @3%, year 15. Factor = 0.641861947 applied to future disposal.			4581148
Totals			4581148

Summary Totals Alternative 1

PA: Professional Services	\$53,003
PA: Professional Services, locating	\$139,099
PA: Analytical Services: CLP laboratory	\$238,352
Removal Action: Equipment Costs	\$92,065
Removal Action: Labor Costs	\$146,665
Removal Action: Waste Disposal Costs	\$4,581,148
Summary Total (\$)	\$5,250,334

Alternative 2

PA: Professional Services

Activity	Professional Services	LOE (hrs)	Unit Cost (\$/hr)	Incl. 150% Overhead & Profit (\$/hr)	Total Cost (\$)
Work Plan Development	Mid	130	20	50.00	6500
Mobilization, travel, & demob (2 days, 4-5 team members)	Junior - Senior	80	21.25	53.13	4250
Field Sampling activities (4 days, 4-5 team members)	Junior - Senior	160	53.13	132.83	21253
PA Narrative Report Preparation	Senior	120	70	175.00	21000
Totals		490			53003

Alternative 2

PA: Professional Services, locating

Activity	Professional Services	Quantities (LS)	Unit Cost (\$/job)	Incl. 150% Overhead & Profit (\$/job)	Total Cost (\$)
Locating site	Contract	1	7500	18750.00	18750
Totals					18750

Alternative 2

PA: Analytical Services: CLP laboratory

Analyte	Matrix	Method	Total No. of Samples	Cost per Sample (\$)	Total Cost (\$)
VOC	Soil Waste	8260	16	203.00	3248
Totals					3248

Alternative 2

Removal Action: Equipment Costs

Equipment Item	Cost \$/WK	Quantity (WKS)	Total Cost (\$)
Backhoe 1 C.Y.	2247	6	13482
Backhoe loader	920	6	5520
Flatbed 3 Ton	406	4	1624
Dozer 140 HP	2004	1	2004
Totals			22630

Alternative 2

Removal Action: Labor Costs

Type of Personnel	NO. of Weeks	NO. of HRS (8hr/day & 5 day/wk)	Unit Costs (\$/hr)	Incl. 150% Overhead & Profit (\$/hr)	Total Cost (\$)
Backhoe 1 Op	6	240	15.00	37.50	9000
Backhoe loader Op	6	240	15.00	37.50	9000
Flatbed 3 Ton Op	4	160	13.00	32.50	5200
Dozer 140 HP OP	1	40	15.00	37.50	1500
Laborer	6	240	10.00	25.00	6000
Totals					30700

Alternative 2

Removal Action: Waste Disposal Costs

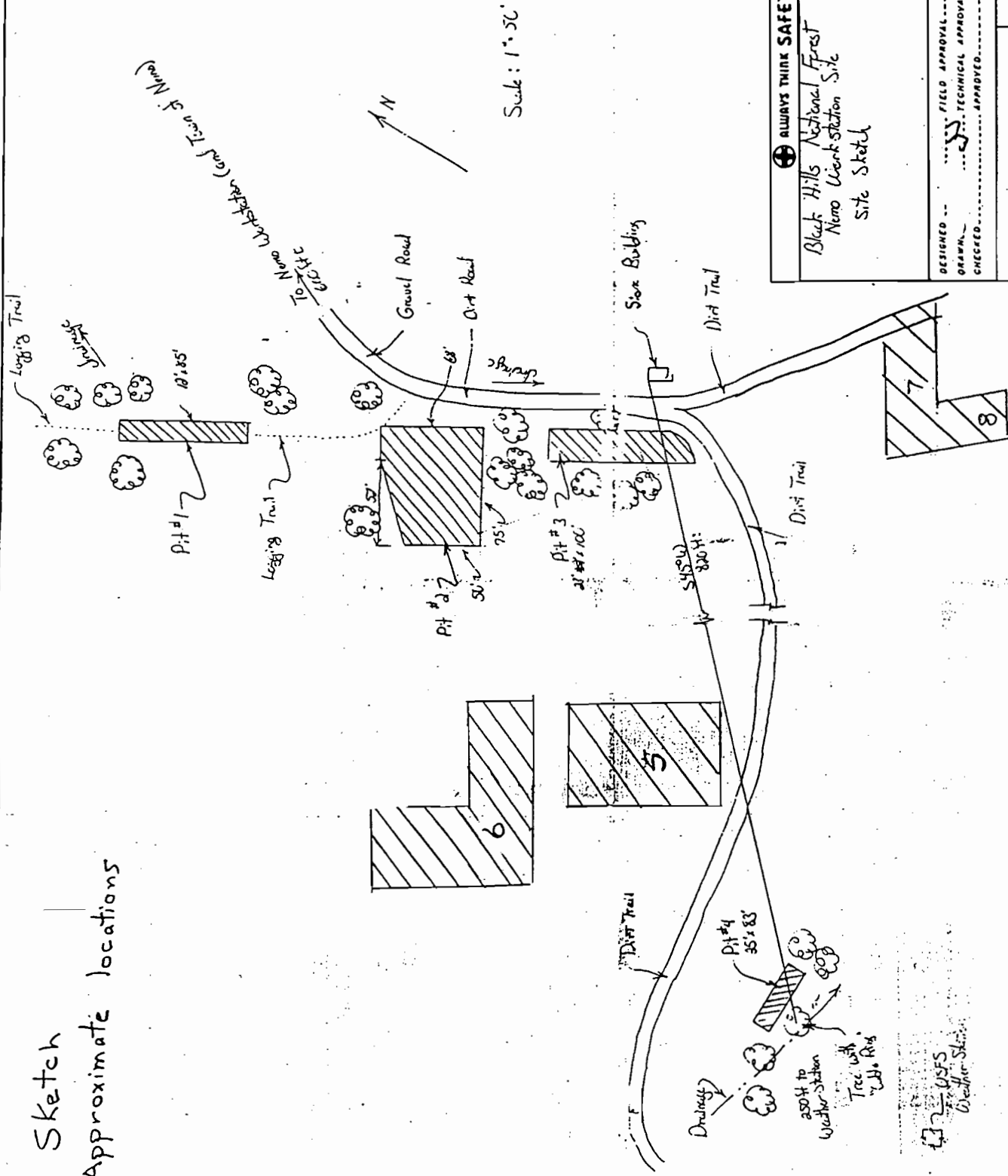
Waste Item Disposal Method	Volume/No.	Cost/Item	Total Cost (\$)
Hazardous liquids/Incineration 50-GAL DRUMS 35% eff packing	43 (2150 Gal)	1088 (\$250 adjusted 4 solids inceneration per Gary)	46784
Totals			46784

Summary Totals Alternative 2

All are NPV cost

PA: Professional Services	53003
PA: Professional Services, locating	18750
PA: Analytical Services: CLP laboratory	3248
Removal Action: Equipment Costs	22630
Removal Action: Labor Costs	30700
Removal Action: Waste Disposal Costs	46784
Summary Total (\$)	175115

Sketch Approximate locations



⊕ ALWAYS THINK SAFETY

Black Hills National Forest
Nemo Workstation Site
Site Sketch

DESIGNED
DRAWN
CHECKED

..... FIELD APPROVAL
..... TECHNICAL APPROVAL
..... APPROVED

USFS
Weather Station