

SITE INC.

Draft Only

**REMEDIAL ACTION PLAN
FOR SOIL REMEDIATION**

AT

**CUROCO STEEL SYSTEMS
536 CLEVELAND AVENUE
ALBANY, CA. 94710**

SUBMITTED TO:

**ALEMEDA COUNTY DEPARTMENT OF HEALTH SERVICES
ATTENTION : LARRY SETO**

PREPARED

BY

**SITE INC.
1240 BAYSHORE HWY., #305
BURLINGAME, CALIFORNIA 94010
(415) 348-5505**

SUBCONTRACTOR: ENSOTECH INC.

Friday, December 7, 1990

SHAWN SABHARWAL
Preparer's Name

INTRODUCTION

It is estimated that approximately 380 cubic yards of metal (chromium, lead, and zinc) contaminated soil and 25 cubic yards of TPH contaminated soil require treatment at the CUROCO STEEL SYSTEMS site. The metals contaminated soil will be remediated on-site using Ensotech's ENSOL/LANDTREAT process. The hydrocarbon contamination will be remediated on-site using Ensotech's LANDTREAT/PETROXY process. All soils will be remediated using the MOBILE ENVIRONMENTAL TREATMENT SYSTEM (METS). (Diagram APPENDIX A)

BACKGROUND

For many years CUROCO STEEL SYSTEMS had discharged paint chips and overspray in their rear yard and along the tracks of Southern Pacific railroad. This paint debris is mainly composed of chromium, lead, and zinc. A token clean-up of contaminated soils took place in 1985. New management was informed in January 1989 of these past activities. Bay Area Environmental investigated the CUROCO site in 1989, verifying that contamination exists in the rear of the CUROCO plant. ENVIRON CORP. has further classified this area, defining hazardous and non-hazardous areas for treatment and disposal (see APPENDIX B).

SUMMARY OF WORK DESCRIPTION

SITE Inc. shall prepare all Health and Safety Plans and any other such plans necessary to meet regulatory compliance. All work will be performed in strict compliance with the approved site Health and Safety Plan.

1. Remove separately the soil within the hazardous and non-hazardous areas; place in the storage zone. These areas have been defined by ENVIRON and will be sampled during excavation to verify levels of contaminants.
2. Load and transport hazardous soil to a Class I landfill facility.
3. Treat material from non-hazardous area. Perform sampling and analysis and obtain Class III landfill approval for disposal. Transport and dispose of material.
4. Remove soil from tank pit. Treat to acceptable levels by County for use as backfill. Sample and analyze to obtain County approval for backfill.
5. Dewater during excavation activities and store on-site in Baker storage tanks. Treat water if necessary and dispose in an appropriate manner.
6. Restore site.
Material for backfill shall be placed in lifts or horizontal layers not exceeding eight (8) inches in uncompacted thickness, and each lift shall be compacted to a density of not less than ninety (90) percent of maximum dry density as determined by the procedure set forth in ASTM Designation D1557.

WORK DESCRIPTION

PROCESSES DESCRIPTION

A brief description of treatment is as follows:

The remediation process will comply with BAAQMD rules regarding this operation. Treatment verification samples will be taken for each 50 yards processed to insure compliance with established treatment criteria.

ENSOL/LANDTREAT CHEMICAL FIXATION PROCESS FOR METALS

Ensotech, Inc. will use a chemical fixation and solidification process (CFS) to treat metals contamination. This process is based upon the reaction between sulfides, silicates, and silicate setting agents to produce a solid matrix. The process consists of a two-part inorganic chemical system which reacts with all polyvalent metal ions and certain other waste components. It also reacts within itself to form a chemically and mechanically stable solid waste.

The matrix itself, as produced, is actually a pseudo-mineral. It is based on tetrahedrally coordinated silicon atoms alternating with oxygen atoms along the backbone of a linear chain. The charged side (oxygen) groups, when reacted with polyvalent metal ions, resulting in a strong ionic bonding between adjacent chains to form a cross-linked, three-dimensional polymer matrix which is similar to

natural pyroxene minerals. The result: high stability, high melting point, and a rigid, friable structure very similar to many soils.

The process consists of three type of interactions. The first is very rapid reactions between silicates and nearly all polyvalent materials ions, producing insoluble metal silicates (non-toxic). These reactions occur immediately and generally continue for the first 1 to 3 minutes. The second interaction is the reaction between silicates and reactive components of the setting agent. Results are limited solubility and high reserve capacity of such ions that the reactions take place slower under controlled conditions (similar to buffering capacity in acid-base reactions). The reaction can occur quickly (seconds to minutes) to prevent settling of constituents wanted entrained (immobilized). The third type of interaction is the reaction between the setting agent and the waste and/or water, as it undergoes a series of hydrolysis, hydration, and neutralization reactions.

In general, the volume added (silicates, sulfide, and setting agents) to their waste by the treatment process is less than 5% by volume. For comparison, using cement to solidify wastes would increase the volume by about 100% to include all of the liquid portion of the waste contained within the given structure.

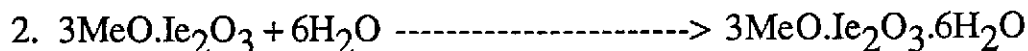
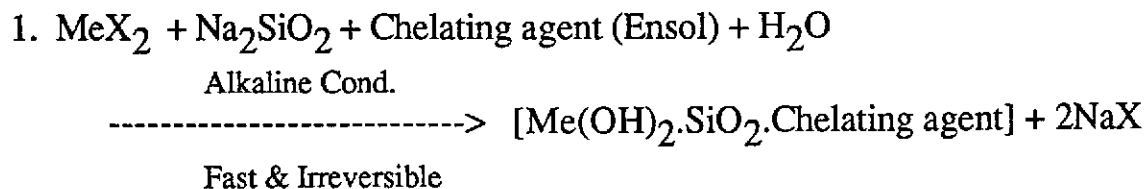
Fixation formulations are varied as a function of the contaminants and soil conditions using existing data bases. These data bases are developed by the firms actually applying the technology for specific projects, and therefore not readily accessible to firms trying to break into this area.

ENSOL is a proprietary product of Ensotech. It reacts with heavy metals to form insoluble metal silicates via two mechanisms. ENSOL contains both sodium silicate and a proprietary chelating agent.

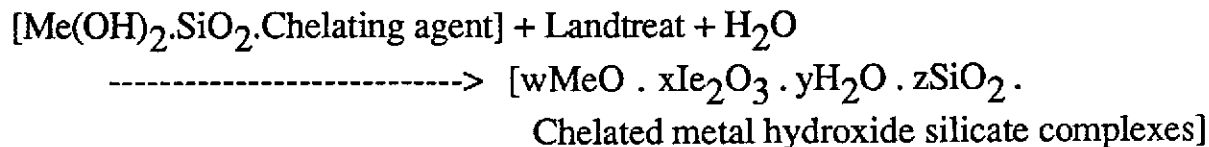
Sodium silicate reacts with soluble metals under alkaline conditions to produce metal hydroxide - silicate complexes. These complexes then react with the chelating agent. The reaction is rapid and, essentially, irreversible due to the low solubility and high stability of the metal hydroxide silicate complex.

The chelating agent is an organic polymer containing heteroatoms with free electron pairs. Each molecule contains several "active sites" along its polymeric backbone and each active site has two pairs of free electrons for metal bonding. Two active sites on the same or adjacent polymer molecule will react with each metal ion, forming a total of four coordinate covalent bonds with the metal ion. These bonds are very stable and will not dissociate even under acidic conditions, such as that used in the CAM WET test.

The last step of the fixation involves further solidifying the chelated metal hydroxide silicate complexes and producing a non-leachable final product through the addition of Ensotech's patented product, LANDTREAT. LANDTREAT is an insoluble polysilicate with large adsorptive capability and active surface area. It retains the excessive chelating agent on its surface to act as a preventive mechanism against any future soluble metals occurrence in the soil. The reaction sequence in the fixation of metals is as follows:



3



Where Me: divalent metals
X: monovalent anions
Ie: ion exchanger

The final product of the fixation process is a chemically inert, multi-bound metal silicate complex which has excellent long-term stability and will pass the California WET Test. Over 99% reduction of the solubility has been observed.

ENSOTECH'S LANDTREAT/PETROXY ORGANIC REMEDIATION METHOD

The Ensotech soil remediation method uses LANDTREAT and hydrogen peroxide to oxidize the hydrocarbons (volatile as well as non-volatile hydrocarbons).

LANDTREAT, a synthetic polysilicate, provides a large surface area for adsorption of Volatile/non-Volatile Organic Compounds (VOC) which prevent their escape into the atmosphere. Because of this adsorptive capability, hydrogen peroxide is adsorbed onto the LANDTREAT particles resulting in a slow release over time, enabling the treatment process to continue for several hours after application. Another unique characteristic of LANDTREAT is its catalytic surface which makes the process highly reactive, bringing about rapid and complete oxidation of all hydrocarbons (VOC and non-VOC) and other organics. This catalytic surface is largely provided by crystal lattice defects known as Frankel defects. With the adsorptive and catalytic properties of LANDTREAT, and the

oxidative property of hydrogen peroxide, complete and safe oxidation of all fuel hydrocarbons and other organics is achieved through the Ensotech method.

The reaction products of the Ensotech soil remediation method are all non toxic and non-hazardous. The reaction between hydrogen peroxide and hydrocarbons produces carbon dioxide and water while hydrogen peroxide and LANDTREAT produce basic calcium carbonate/bicarbonate which is naturally present in soil.

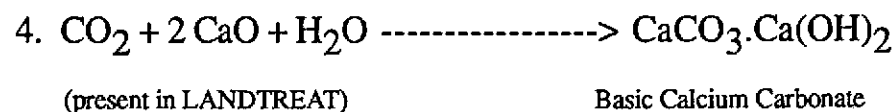
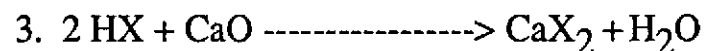
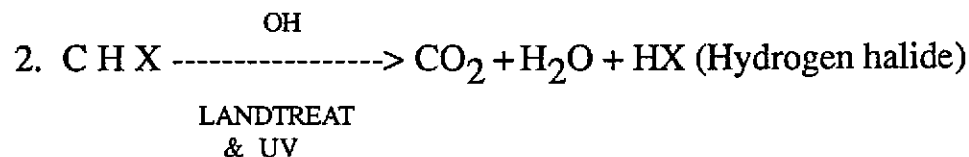
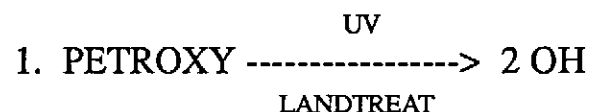
The chemical reactions between hydrogen peroxide and fuel hydrocarbons can be written as follows:

1. $RCH_2CH_3 + \text{Landtreat} \text{-----} \rightarrow RCH_2CH_3 \text{ (adsorbed)}$
2. $\text{Petroxy}(H_2O_2) + \text{Landtreat} \text{-----} \rightarrow \text{Petroxy (adsorbed)}$
3. $\text{Petroxy (adsorbed)} \xrightarrow{\text{catalyst}} H_2O \text{ (desorbed)} + O \text{ (desorbed)}$
4. $2O + RCH_2CH_3 \text{ (adsorbed)} \text{-----} \rightarrow H_2O + RCH_2COH \text{ (adsorbed)}$
5. $O + RCH_2COH \text{ (adsorbed)} \text{-----} \rightarrow RCH_2COOH \text{ (adsorbed)}$
6. $2O + RCH_2COOH \text{ (adsorbed)} \text{-----} \rightarrow H_2O \text{ (desorbed)} + CO_2 \text{ (desorbed)} + RCOH \text{ (adsorbed)}$

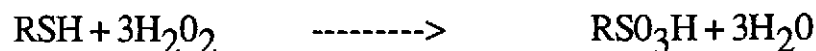
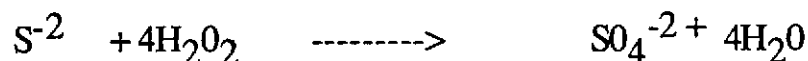
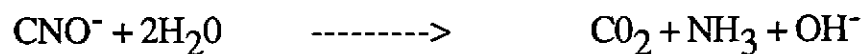
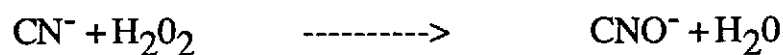
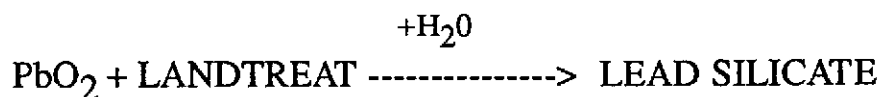
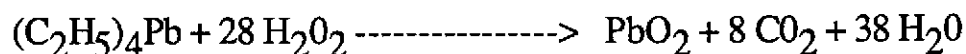
Where R is alkyl, branched or straight-chained fuel hydrocarbon. Aromatic structures, such as benzene and its derivatives, undergo ring opening first, and then follow the above sequence. Steps four (4) through six (6) continue until complete degradation is achieved.

The Landtreat/Petroxy process is also applicable to a host of other organic contaminants. The list includes: halogenated hydrocarbons, chlorinated hydrocarbons, ethylene dibromide (EDB), polychlorinated biphenyls (PCB's), pentachlorophenyls (PCP's), phenolic compounds such as cresylic acid, dioxins, and related pesticides.

The treatment of soils with these contaminants is a chemical oxidation process essentially the same as the Landtreat/Petroxy method of destroying volatile fuel hydrocarbons, with the addition of an ultraviolet radiation source:



Hydrogen peroxide also reacts with tetraethyl (organic) lead, cyanides, sulfides, and mercaptans through these reactions:



Where CN^- is the cyanide ion

S^{-2} is the sulfide ion

RSH is a mercaptan

When the soil is sprayed with hydrogen peroxide, an aerosol of hydrogen peroxide stays on top of the soil surface. This aerosol "blanket" prevents the escape of volatiles during mixing, thus no odors are produced. It is also in this aerosol space that photochemical oxidation of the hydrocarbons takes place.

Hydrogen peroxide makes the soil oxygen-rich, thereby facilitating the biodegradation of hydrocarbons by aerobic bacteria. The presence of oxygen also inhibits the growth of anaerobic bacteria (those that produce foul smelling by-products) and partly accounts for the lack of odors where the Ensotech process is utilized.

TREATMENT OPERATIONS

Before the treatment of the contaminated soil begins, the site will be prepared for treatment operations. A Site Health and Safety Plan will be prepared and all personnel will be made aware of the contents of the plan and its provisions.

Areas of hot zone, contamination reduction zone and support zone will be identified and marked. Emergency exits (escape routes), storage areas and decontamination areas will be provided. The METS unit will be used to enable the treatment to take place in an enclosed environment.

The overall activities are planned and scheduled by the Project Manager. The Field Supervisor reports directly to the Project Manager. All personnel on-site and their activities are managed, directed and coordinated by the Field Supervisor.

The contaminated soil is loaded into the main hopper of the METS unit with a front end loader. The soil is moved on a conveyor belt through an adjustable exit door to measure volume. The soil then enters the reaction chamber, where it is mixed with LANDTREAT by a power driven auger and is sprayed by hydrogen peroxide/ENSOL. The air in the reaction chamber is filtered and is collected by a blower through two outlets. This air is then passed through four active carbon beds and is discharged into the air.

After a controlled retention time, the treated soil is ejected from the other end and is stockpiled using another front end loader.

During the process, the ambient air is monitored on a continual basis

all around the zone of activity, especially downwind to determine any air emission and its migration away from the site. The treated soil is also monitored every 15 minutes for any hazardous vapors . The final discharge of air into atmosphere is monitored continuously and is logged every 10 minutes to determine carbon bed saturation.

Operation Personnel

The overall operation planning and coordination with the regulatory agencies and clients is the responsibility of the Project Manager.

The work party will consist of following personnel:

<u>TITLE</u>	<u>FUNCTION</u>
Project Manager Geologic Consultant	Organize job, coordinate between agencies, client, interested parties, and laboratory; perform sampling.
Field Supervisor Quality Controller	Arrange personnel and equipment, organize job, supervise work. Hot zone air sampling and Quality Control.
Site Safety Officer	Monitor and enforce safety on-site, stop work if hazardous condition exists.
METS operator	Start-up, operate and shut down of the

METS unit

Equipment Operators	Loading untreated soil to the METS unit and stockpiling treated material.
Worker	Prepare Hydrogen Peroxide, ENSOL, LANDTREAT replenishment; Decontaminate equipment and personnel; back up and replacement for each other.
Worker	
Worker	

The work party will be given preparatory instructions and training off site and will be briefed on the contents of this plan at the site prior to commencing operations.

During work, all personnel are given frequent breaks (5 minutes after each 1 hour of work) to avoid heat stress. One person assigned to a certain type of work can be substituted by another person with similar training and experience. For example, the person loading LANDTREAT can replace the worker mixing peroxide and vice versa.

Site Preparation for Operation

The initial preparation of the site is the responsibility of the Project Manager assisted by the Field Supervisor, who will schedule, order and follow-up the following activities:

- 1) Insuring the property is properly fenced and the fencing is covering with black plastic sheeting, establishing gates, entrance, safety escape and assure water supply connection.
- 2) Erecting the berms according to the Site Health and Safety

Plan.

- 3) Mobilization of the equipment and tools, including front loaders, trackhoe, fork lifts, safety supplies, storage trailers, etc.
- 4) Positioning the METS unit, the chemicals and other supplies according to the operation plan layout.

METS Operating Set Point

1. Operation Variables and their Function

Optimum treatment of contaminated soil can be achieved by varying the following operation parameters of the METS unit:

- a) The soil feed rate can be controlled by changing the speed of the conveyor belt via the conveyor belt hydraulic valve, and the size of the hopper exit door.
- b) The LANDTREAT feed rate can be controlled by changing the speed of the feeder via its electrically driven motor.
- c) The spray rate of the hydrogen peroxide/ENSOL can be controlled by changing the flow rate of the centrifugal pump via its manually operated valve.
- d) The retention time inside the mixing and reaction chamber can be controlled by changing the speed of the auger via its respective hydraulic valve.

In addition to the hydraulic control valves, an on-off valve is also provided for each motor for emergency shut off. All these valves are

clearly tagged.

2. Tentative Settings of Variables

Actual operating settings will vary from one site to another depending on the nature of the contaminants, their concentrations and the soil properties. The main criteria, which will determine the soil feed rate, is the emission level from the treated soil at the outlet of the METS unit. The air emission will be monitored in accordance with the BAAQMD using an OVA, a Dreager pump, and Monotox meters. If the treated soil registers 50 ppm or greater of volatile organic compounds when measured at a distance of up to three inches from the surface of the treated soil, the soil feed rate is reduced until the above criteria is complied with. If inorganically contaminated exhaust exists, a scrubber will be attached in order to minimize these emissions.

Soil Sampling Program

Sampling Procedures

The treated and untreated soil samples will be collected using a sledge hammer driven sleeve sampler. The outer barrel of the sampler holds a six (6) inch long by two (2) inch diameter sleeve. The soil, forced into the sampler barrel by the hammering action will be collected in the inner sleeve providing a soil core. The sleeve will be removed from the sampler barrel, capped with teflon caps, sealed with electrical tape, labeled, placed in an ice chest and transported to a State Certified Analytical Laboratory for analysis.

All samples are labeled with permanent markers on plastic coated labels.

Label information is as follows:

- company name and address
- field identification number
- lab identification number
- date
- time
- sampled location
- collectors signature

The sampler and sample sleeves will be washed with a Trisodium Phosphate solution and rinsed prior to each sampling.

Chain of Custody

Chain of custody forms are filled out for the samples collected given to a State Certified Laboratory. The forms include the following information:

- contact person and phone number
- client name and address
- site name and address
- lab number
- field number
- date sampled
- time sampled
- type of sample
- priority ranking
- sample description and location
- number of containers
- analyses required
- field observations

Sample Analysis

The treated samples will be analyzed for Chromium, Lead, Zinc by California WET or TCLP analysis and some samples will be analyzed for Petroleum Hydrocarbons by EPA 5030 and 8240. The soil will be considered remediated when the action levels, as established by landfill acceptability and the County, have been reached.

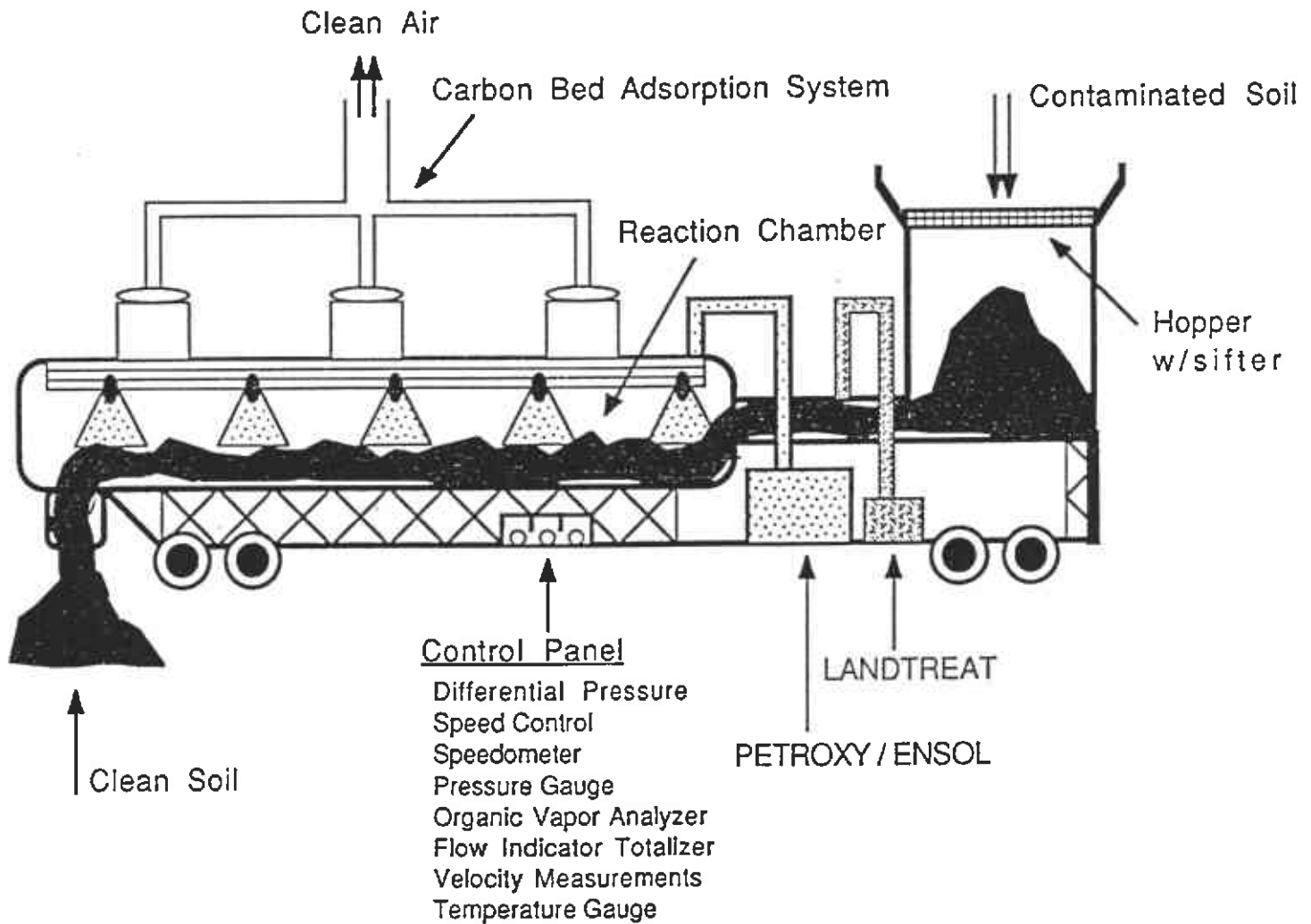
SITE CLOSURE

Equipment will be decontaminated. All materials and supplies on-site resulting from remedial activities will be removed.

APPENDIX

A

Mobile Environmental Treatment System (METS)



**APPENDIX
B**

12782.48
47831808

CO.

3756+41.2-12"x24"
Str. W 11.17

Curve # 53
TC = 21° 03' 15"
ST = 812.04'

WESTERN
FORGE & FLANGE

CUROCO

3751+33.51 - C.C. 1°40'

3750+53.36 - C.C.S. 2'

INTERSTATE

80

Postal Telegraph Line

Western
Trucks
Railroad Tracks

HIGHWAY

3748+53.6-18"x69' Conc

3748+03.36 - E.C.

ADHESIVE
PRODUCTS CO.

3747+025 Signal Bridge 11.35

3744+46.83-21' Reinf. Conc. Sewer
3744+23 - F.B.W. 30' B.D.D. Trestle

3743+98.5 F.B.W.

Opp 3743+81.6 PS.

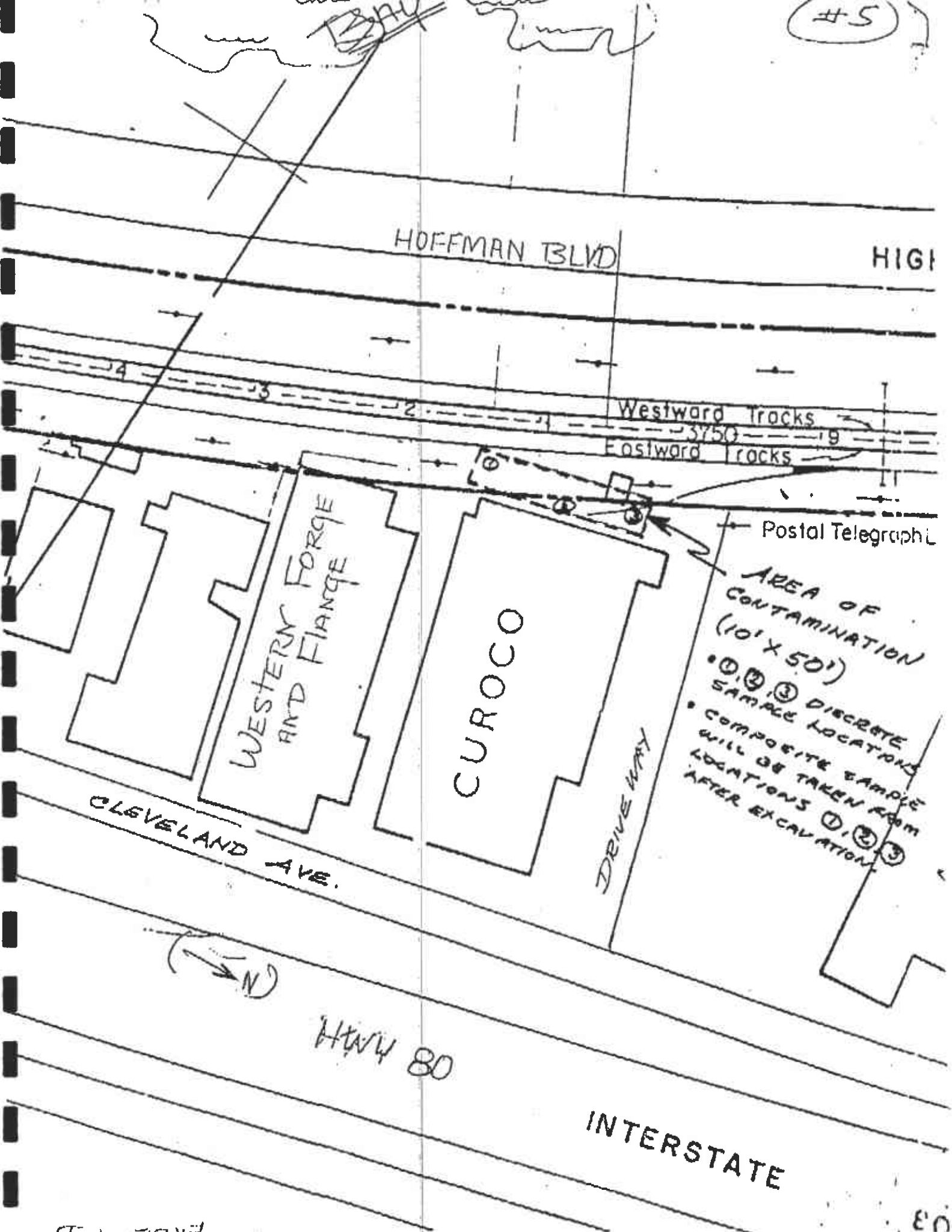
JACUZZI

Parking

BROS

Al.
Cont.

(#5)



HOFFMAN BLVD

HIGH

Westward Tracks

Eastward Tracks

WESTERN FORGE AND FLANGE

CUROCO

DRIVE WAY

Postal Telegraph

AREA OF CONTAMINATION (10' x 50')

- ①, ②, ③ DISCRETE SAMPLE LOCATIONS
- COMPOSITE SAMPLE WILL BE TAKEN FROM LOCATIONS ①, ②, ③ AFTER EXCAVATION

CLEVELAND AVE.

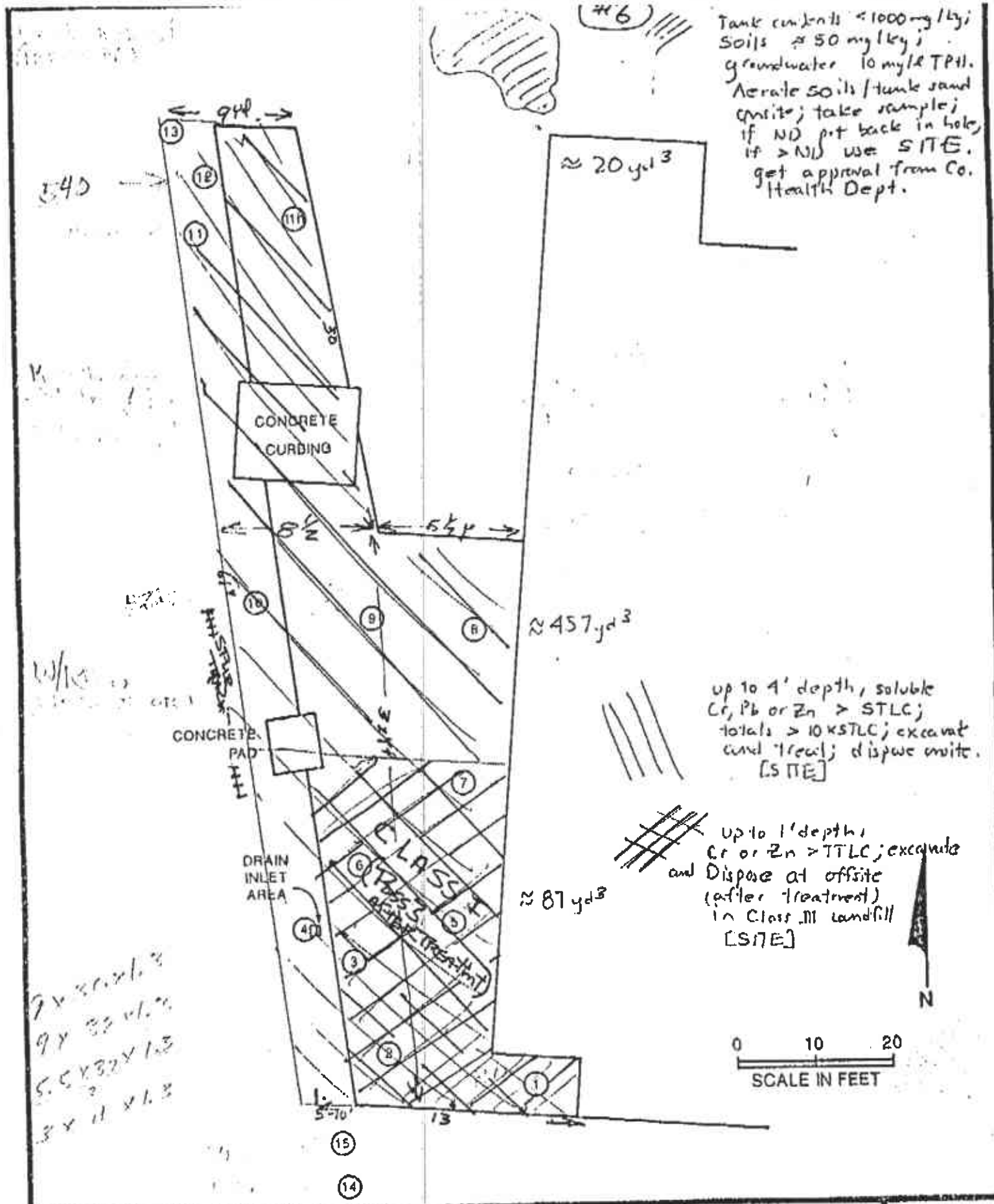
HWY 80

INTERSTATE



#6

Tank contents < 1000 mg/Ly;
 Soils ≈ 50 mg/Ly;
 groundwater 10 mg/L TPH.
 Aerate soils / tank sand
 onsite; take sample;
 if ND pit back in hole;
 if > NIS use SITE.
 get approval from Co.
 Health Dept.



up to 4' depth, soluble
 Cr, Pb or Zn > STLC;
 totals > 10xSTLC; excavat
 and treat; dispose onsite.
 [SITE]

up to 1' depth
 Cr or Zn > TTLC; excavate
 and Dispose at offsite
 (after treatment)
 in Class III landfill
 [SITE]

9x 30x 1.3
 9x 32x 1.3
 5.5x 32x 1.3
 3x 11x 1.3

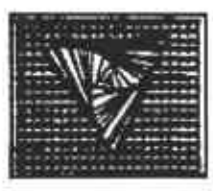
030151

APPENDIX
C

State of California • Department of Health Services • Toxic Substances Control Program

Alternative Technology Division

P.O. Box 942732 • Sacramento, California • 94234 - 7320 • (916) 324-1807, 327-4494 (FAX)



FAX COVER PAGE



Date: 11/29 Time: _____

TO: Pritam Sabarwal

Phone: _____

Page 1 of 4

FROM: Tej Pahwn

Phone: W. (916) 322-9224

CONFIDENTIAL URGENT REQUESTED INFORMATION

COMMENTS

Proceedings of

**The Sixth Annual
HAZARDOUS MATERIALS MANAGEMENT
CONFERENCE WEST**

Held as part of the
HAZARDOUS MATERIALS MANAGEMENT CONFERENCE & EXHIBITION/WEST
Long Beach Convention Center, Long Beach, California
November 6-8, 1990

Alan John Borner, General Program Chairman

***HazMat*⁹⁰
WEST**

OVERVIEW OF SOIL REMEDIATION TECHNOLOGIES IN CALIFORNIA

by

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California Department of Health Services
Alternative Technology Division
Remedial Technology Unit
400 P Street
Sacramento, California

The Remedial Technologies Unit (RTU) within the California Department of Health Services (CDHS) assesses and promotes alternative treatment technologies for hazardous waste site cleanup. The unit's ultimate goal is to ensure that contamination at hazardous waste sites is safely and effectively treated, and thereby reduce the volume of hazardous wastes being disposed in on-site and off-site landfills. To facilitate implementation of alternative site cleanup technologies, RTU actively participates in technology demonstration projects, performs engineering evaluations of new and innovative treatment technologies, assists regional offices to identify and select treatment alternatives to be evaluated for "superfund" site cleanups, and provides technical and permit assistance to the regional offices and to proponents of research, development, and demonstration projects. A major portion of RTU resources are devoted to treatment technology demonstrations, which involve a number of tasks including development of testing and analytical protocols to evaluate the technology, compliance with the California Environmental Quality Act (CEQA), issuance of treatment facility permits or variances, and coordination with other involved regulatory agencies.

Since its inception in 1987, RTU has been involved in over a hundred proposed treatment technology demonstrations, including bench, pilot and full scale demonstrations. Unfortunately about half of these projects never came to fruition, due to a number of factors including permit requirements, project schedules, and technical or economic feasibility of the technology. RTU has successfully completed field work on 26 treatment technology demonstrations and has on-going involvement in about 25 other projects which are in various phases of development. For the 26 completed projects, demonstration reports have been completed on 12 projects and have been drafted for 13 others. Technologies for treating contaminated soils that have been evaluated through the RTU demonstration program include above ground bioremediation, metals stabilization, incineration, soil washing, and hydrogen peroxide oxidation. Following are brief descriptions and summaries of results for some of the successful demonstration projects we have conducted involving biological, stabilization, incineration, and physical treatment technologies:

ABOVE GROUND BIOLOGICAL TREATMENT PROCESSES FOR HYDROCARBON CONTAMINATED SOILS

The most common method of accelerating the natural soil remediation process is to excavate the contaminated soil, form a treatment bed or pile, inoculate it with an aqueous solution containing nutrients and, in some cases, actively provide oxygen. In some cases proprietary aerobic bacterial cultures are added to accelerate the process. Treatability studies are often required for large sites. These studies determine the optimal nutrient, pH, and moisture levels to ensure rapid degradation of the contaminants. Oxygen uptake rates, which are necessary to properly design an active aeration system, can also be determined. For small sites, the treatability studies are often omitted because of high costs and the dependability of the bioremediation process. Nutrients are added on an empirical or calculated basis, pH may or may not be adjusted and water is added on an intuitive basis to keep the soil moist, but absent of free (gravity) water. Oxygen is supplied passively, by mechanical agitation, or by a forced air vent system.

Added nutrients not chemically bound by the soil matrix can be used by indigenous bacteria to synthesize new cell material. The amount of nutrients needed for cell synthesis can be calculated. Based on an average elemental dry cell composition of $C_5H_7O_2N$, the weight based, cellular, nitrogen to carbon ratio is 0.23 and the phosphorus to carbon ratio is 0.052. To determine the minimum quantity of nutrients required for bacteria to consume a known concentration of petroleum hydrocarbons, two other pieces of information are needed, the carbon content of the hydrocarbon contaminant(s) and the cell yield (the fraction of degraded hydrocarbon that is incorporated into cell structure).

Fuels are composed of alkanes, alkenes, aromatics, oxygenated compounds and miscellaneous other additives. The weight percent carbon in these compounds vary. Alkanes range from 75-86% carbon, benzene is 92% carbon, and oxygenated compounds can have such lower carbon content. For calculation purposes, it is convenient to assume an average fuel carbon content of 85%. If it is assumed that approximately 50% of the consumed fuel is incorporated into structure and the remainder is used to provide energy for cell synthesis and maintenance, a cell yield of 0.83 grams dry weight cells per gram TPH consumed can be calculated. Based on these calculations, the nutrient addition rates for bioremediation of fuel contaminated soil are 10 mg/kg nitrogen and 2.2 mg/kg phosphorus for every 100 mg/kg of fuel hydrocarbon measured as TPH. However, it should be noted that phosphorus is often added in excess, since it can be made unavailable for bacterial growth, chemically bound or precipitated by iron, aluminum and calcium in the soil.

CASE STUDY #1 - GROUNDWATER TECHNOLOGY INC./CALTRANS, LAKEPORT DEMONSTRATION

Contaminated soil excavated during the repair of leaking underground used oil tanks at the California Department of Transportation (Caltrans) Maintenance yard at Lakeport yard was remediated by stimulating naturally occurring native organisms in an above ground treatment system. The project was conducted by Groundwater Technology Inc. (GTI) under contract to Caltrans.

CASE STUDY #3 - LAB SCALE DEMONSTRATION - ENSOTECH ENSOL/LANDTREAT PROCESS

The bench-scale demonstration study was conducted using nine artificially contaminated soils, each one containing a single metal species at a concentration of at least ten times the Soluble Limit Threshold Concentration (STLC), two actual site soils and an artificial soil containing three metal mixtures. These metal contaminated soils were treated with Ensotech's patented products LANDTREAT and ENSOL, and then analyzed for soluble metals to determine the treatment efficiencies. Split samples were taken by the California Department of Health Services.

The nine artificially contaminated soils were made by dissolving each of the following salts in 800 mL deionized water, then mixing it with 4 kilograms of clean soil.

Cadmium Chloride	Cupric Sulfate
Lead Nitrate	Nickel Chloride
Zinc Chloride	Mercuric Nitrate
Silver Nitrate	Silver Sulfate
Cobalt Chloride	Chromium Chloride

Each spiked soil was thoroughly mixed by hand, using a spatula, and then dried overnight at 103°C. After cooling, each spiked soil was crushed by a hammer and sieved using a #20 mesh sieve (2 mm dia.). The finished soil was then labeled and placed in a zip lok bag.

Soluble metals analysis using the Waste Extraction Test (WET)* and total metals analysis were conducted on each spiked soil sample. Only soluble metals analysis was conducted on the treated samples. Additional spiking was necessary whenever a low soluble metals (for example, less than 10 times the STLC) result was obtained for the spiked soil.

The treatment procedure involved sequentially mixing a 1200 gram sample of metal contaminated soil with a predetermined quantity of ENSOL and LANDTREAT after adjusting the soil sample pH to 8.5. Soluble metals analysis were performed on samples after treatment with ENSOL and after treatment with ENSOL + LANDTREAT. Results of the lab scale treatability tests are tabulated below. Also presented below are the percent weight additions of reagents used in each of the treatments.

ENSOTECH, INC. - ABOVE GRANT BENCH TEST RESULTS						
METAL	TOTAL METALS, mg/kg		SOLUBLE METALS (W.E.T.), mg/l			STLC mg/l
	Expected	Actual	Untreated	ENSOL	ENSOL + LANDTREAT	
Cadmium	100	132	10.3	0.11	<0.06	1
Copper	2500	3620	341	<0.2	<0.2	25
Lead	1000	1002	100	0.9	0.33	5
Nickel	2000	2590	160	0.6	0.21	20
Zinc	9000	9330	762	88	117	250
Silver	7000	6985	570	0.31	<0.2	5
Mercury	400	276	5.7	0.28	0.29	0.2
Cobalt	5000	4550	458	5.7	1.4	80
Chromium (T)	27000	22860	1888	756	354	560
Chromium (Hex)			66	<0.1	<0.1	5
Mix 1/3 Cu, Pb, Ni						
Copper	1207	963	89	<0.2	<0.2	25
Lead	334	284	40	<0.2	<0.2	5
Nickel	863	705	62	<0.2	<0.2	20
Site Sample #1						
(sandblast grit, lead)		254	17.8	<0.2	<0.2	5
Site Sample #2						
(soil, copper)		2800	275	<0.2	<0.2	25

* Soluble Limit Threshold Concentration (STLC) is defined in Section 66194 of the California Code of Regulations. It is determined by the Waste Extraction Test (WET) also defined in California regulations. If the STLC is exceeded in a waste or waste or waste extract, the waste is hazardous.