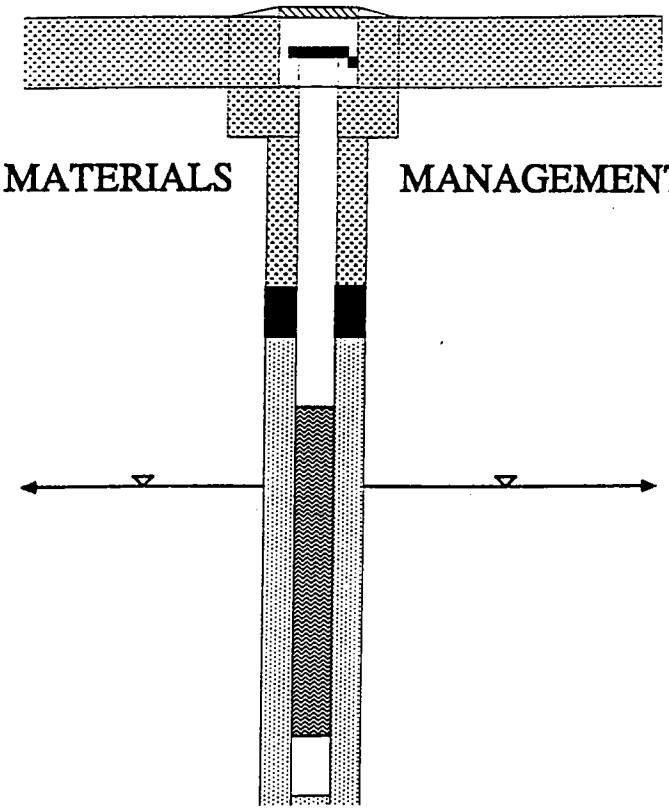
$5.00

HANDBOOK UT-50

GROUND-WATER AND VADOSE ZONE

MONITORING



HAZARDOUS MATERIALS MANAGEMENT PROGRAM

KERN COUNTY
ENVIRONMENTAL HEALTH SERVICES DEPARTMENT

Revised 2/93

TABLE OF CONTENTS

Section	**50.0**	**INTRODUCTION/PURPOSE**	1
Section	**51.0**	**APPLICATION FOR A PERMIT**	2
	51.1	Required Inspections	
	51.2	Plot Plan Review	
	51.3	Fees	
Section	**52.0**	**DRILLING**	3
	52.1	Drilling Restrictions	
	52.2	Drilling Methods	
Section	**53.0**	**CONSTRUCTION MATERIALS & REQUIREMENTS**	4
	53.1	Casing and Screen Material	
	53.2	Filter Packs	
	53.3	Well Seals	
	53.4	Allowable Grout Types	
	53.5	Well Development	
	53.6	Surface Construction Features	
Section	**54.0**	**GROUND WATER MONITORING WELLS**	8
	54.1	Site Assessment	
	54.2	Well Placement - UST Facilities	
	54.3	Water Levels	
	54.2	Monitoring Requirements - UST Facilities	
Section	**55.0**	**VADOSE ZONE MONITORING WELLS**	10
	55.1	Vadose Zone Description	
	55.2	Types of Vadose Zone Monitoring	
	55.3	Site Assessment	
	55.4	Well Placement - UST Facilities	
	55.5	Monitoring Requirements - UST Facilities	
Section	**56.0**	**CATHODIC PROTECTION WELLS**	13
	56.1	Construction	
	56.2	Sealing off Strata	
Section	**57.0**	**SAMPLING**	14
	57.1	Soil Sampling	
	57.2	Water Sampling	
Section	**58.0**	**WELL DESTRUCTION**	16
	58.1	Destruction of Monitoring Wells	
	58.2	Destruction of Cathodic Protection Wells	
Section	**59.0**	**REPORTING AND MONITORING RECORDS**	17
Section	**60.0**	**PERSONNEL QUALIFICATIONS**	17

APPENDIX 18

Well Drillers Registration Form
Monitoring Well Application
Description of ASTM Standards
Diagram - Vadose Zone Monitoring Well in Back fill
Diagram - Ground Water Monitoring Well
Diagram - Cathodic Protection Well

GROUND WATER AND VADOSE ZONE MONITORING WELLS

Section 50.0 Introduction/Purpose

This handbook explains the procedures and requirements for installing ground water and vadose zone monitoring wells as they pertain to hazardous materials and underground storage tank (UST) facilities. For guidance concerning UST sites where contamination has been discovered refer to Handbook UT-35, Site Characterization and Remediation.

No construction or destruction of a monitoring well at an Underground Storage Tank (UST) or Hazardous Materials site is allowed without first obtaining a permit from the Hazardous Materials Management Program (HMMP) of the Kern County Environmental Health Services Department. The applicant and/or all subcontractors must also obtain any other permits that may be required and comply with all applicable health and safety laws including OSHA regulations that pertain to personnel protection and safety.

In order to protect ground water resources, the following depth restrictions apply to wells installed to monitor ground water or soil, at an UST facility where contamination has not yet been discovered:

Well Type	Ground Water Depths
Ground Water Wells	Less than 20 feet from the surface.
Vadose Zone Wells	Greater than 10 feet below base of tank.

A written request must be submitted to this Department to obtain a variance from the above restrictions. This request must include site-specific geologic and hydrogeologic data to support the variance.

If contamination is encountered during the drilling, completion, or monitoring process the Environmental Health Services Department must be notified immediately.

Groundwater and vadose zone monitoring wells are to be constructed, maintained and destroyed in accordance with this manual, the latest revision of Department of Water Resources Bulletin 74-90, the California State Underground Storage Tank Regulations and the Kern County Well Ordinance. **Any deviation from these requirements must be requested in writing and receive approval prior to issuance of the permit.**

A current C-57 Contractor's License is required to construct or destroy groundwater or vadose zone monitoring wells. The following information must be on file with this Department before any drilling will be allowed.

1. Completed information sheet (see Appendix - Well Driller's Registration Form)
2. Pocket copy of current C-57 license
3. Proof of current Worker's Compensation and public liability insurance

Section 51.0 PERMIT APPLICATION

Applications for a permit to drill a monitoring well must be submitted to the HMMP at least 10 working days prior to the proposed starting date. Incomplete applications will not be reviewed; it is the applicants responsibility to provide all requested information. Answers of N/A will not be accepted. Applications must include a plot plan and design of the well(s).

Section 51.1 Required Inspections

The following inspections must be passed by HMMP:

1. Plot Plan/Site Review
2. Well Seals (bentonite and surface grout seal)
3. Final (well monument and identification)
4. Other, as required on the permit "special conditions"

It is unlawful to continue work past the stage at which an inspection is required unless the inspection has been waived or passed by the Department.

Section 51.2 Plot Plan Review

Plot plan reviews and/or site inspections will be performed to determine if the Permittee has addressed the following:

1. All sites must be checked for under/above ground pipes and utilities.
2. All sites must be inspected for proximity to domestic wells, sumps, canals and sanitary facilities.
3. Location and design of the monitoring wells in accordance with the site assessment. (See Section 54.0 Ground Water Monitoring, Section 55.0 Vadose Zone Monitoring and Handbook UT-35).
4. The proposed well may not be moved from the originally approved site without a new plot plan being submitted or site inspection being performed by the permitting authority.

Section 51.3 Fees

Fees for processing an application and making all required inspections will be charged based on the latest revision of the Kern County Fee Ordinance.

Section 52.0 DRILLING

Section 52.1 Drilling Restrictions

The following restrictions apply when drilling monitoring wells or borings:

1. If sampling is necessary, the equipment used in drilling groundwater or vadose zone monitoring wells must allow for the sampling of the bore hole without contaminating the samples with introduced air or fluid.

2. No monitoring well or boring shall penetrate a laterally extensive clay layer that is more than 5 feet thick. The well shall be terminated 1 to 2 feet into this clay layer unless otherwise approved.

3. All borings must be sealed with an approved material.

4. All drilling methods must be chosen on a site-specific basis considering the geology and sampling requirements.

5. The drilling work area must be secured to prevent unauthorized access.

Section 52.2 Drilling Methods

The following is a list of various types of drilling methods with recommendations and restrictions:

1. Hollow Stem Auger: fast, no contamination of the bore hole or samples, casing can be installed before augers are removed, recommended except for boulder beds and hard rock areas.

2. *Air Percussion: fast, no contamination of the bore hole or samples, casing can be installed before augers are removed, recommended except for hard rock areas, possible noise restrictions.

3. *Air Rotary: fast, and recommended for drilling in hard rock areas. It's use in unconsolidated material is very limited because of the inability to produce an undisturbed sample from the bore hole.

4. Cable Tool, Mud Rotary and Jetting drilling methods are not recommended in unconsolidated materials because they introduce fluid into the bore hole, therefore approval of these methods will only be granted on a site specific basis.

*If samples for volatiles are required, samples must be taken with a split spoon sampler or by some other method that will preserve the integrity of the sample. Samples from cuttings will not be accepted.

Section 53.0 CONSTRUCTION MATERIALS AND REQUIREMENTS

Section 53.1 Casing and Screen Material

1. Casing must be of sufficient strength to resist the forces imposed on it during and after installation. Casing shall be constructed of materials that do not affect the quality of the water or vapor to be sampled or monitored.

   The casing and screen materials must be chosen on a site-specific basis (based on the site assessment), taking in to account the length of time the material is to be exposed to the contamination, should contamination already exist or if a release should occur.

2. Casing and screening material can be composed of cast iron (ASTM 211), galvanized steel (ASTM A120), Teflon (no ASTM standard), polyethylene (ASTM F480), polypropalene (ASTM F480), or fluorocarbon resin (ASTM D3296, D3295). The most commonly used material is PVC (ASTM F480) or stainless steel (ASTM A312). The material chosen must be compatible with the substance being monitored and must meet the appropriate ASTM industry standards. (See Appendix for Description of ASTM Standards). Screens must be perforated at the factory.

3. Casing and screen joints must be attached by welding or by threading and coupling. **Organic solvents (glues) are not permitted.**

4. Casing must have a minimum inside diameter of 2 inches and bore hole must have a diameter that is at least 4 inches greater than the casing outside diameter. It has been the experience of this Department that equipment such as bailers and pumps may not be suitable for use in a well with inside casing diameter of less than 3 inches. Recommended casing inside diameters are 4"-6".

   Casing that is not in contact with the various contaminants can be of the minimum requirements, however, it must have the ability to withstand all normal forces acting upon it.

5. PVC screens can swell and soften after being immersed in pure petroleum product for several years, therefore size #20 (.02 inches) screen must be used in wells that are located in contaminated areas. If there is any indication that flow has been restricted by the swelling of the screen, the well must be properly destroyed.

6. Screens and casing are required to extend to the bottom of the boring and must have at least one foot of plugged blank casing at the bottom.

7. Vadose zone wells must have a minimum of 4 to 5 feet of blank casing at the top of the well so that an annular seal can be installed in wells located outside of the back fill and so that vapors from the surface do not effect the monitoring system of wells in back fill.

8. All well casings, casing fittings, screens and all other components that are installed in a well shall be thoroughly cleaned before installation.

Section 53.2 Filter Packs

A filter pack must be placed in all wells located in unconsolidated material. Filter packs are not required in wells drilled in hard rock or in vadose zone wells that are located in back fill. The following guidelines apply to all other monitoring wells:

1. The filter pack shall extend 2 feet above the top of the highest perforation.
   Exceptions:
   a. where the top two feet of the filter pack would provide a cross-connection between zones that are normally isolated or
   b. where the ground surface is less than ten feet above the highest anticipated ground water level.
2. The packing material shall be composed of clean well rounded grains of at least 95% silica material which has been size graded to stabilize the formation and permits effective well development.
3. The screen slot size used must hold back at least 90% of the filter pack.

Section 53.3 Wells Seals

1. Bentonite Plug

A clay seal two (2) to five (5) feet thick must be placed on top of all filter packs. If bentonite pellets or chips are used they must be hydrated with a minimum cure time of 1 hour, before continuing construction. If a bentonite slurry is used the minimum cure time is 24 hours before continuing construction. The remaining annular space is to be sealed with a cement grout from the top of the bentonite seal to the surface of the ground. The depth of all annular seals will be approved on the monitoring well permit under "special conditions".

2. Surface Seal

a. Ground Water Wells

A concrete seal must extend from the bentonite seal to the ground surface. Seals must be emplaced by tremie pipe if water is present in the annulus. This is accomplished down through the interior of the drill stem or by placing a tremie pipe down the annular space of the well to the desired depth. The sealing material is then pumped or gravity fed down the stem or pipe filling the annular space from the bottom. The stem or pipe is drawn out as the annulus is filled but should always remain in the sealing material. This practice will eliminate bridging down hole and assure a competent seal.

b. Vadose Zone Wells

Seals in vadose zone wells that do not encounter ground water can be emplaced by the gravity method without use of a tremie pipe if the greatest depth is less than 50 ft.

c. Cathodic Protection Wells (See Section 56.0)

Section 53.4 Allowable Grout Types

1. Neat cement grout shall be composed of one sack of Portland cement (94 pounds) to 4-1/2 to 6-1/2 (depending on cement type and additives used) gallons of clean water.

2. Sand-cement grout shall be composed of not more than two parts by weight of sand and one part of Portland cement to 4-1/2 to 6-1/2 (depending on cement type and additives used) gallon of clean water per sack of cement.

3. Sealing Material additives shall be limited to inorganic non-hazardous materials which are compatible with the stored hazardous substance. Additives shall not donate, capture, mask or alter the constituents which are to be analyzed.

4. Bentonite Clay can be used for the 2-5 foot plug above the filter pack and as an additive to other grouts with no more than 5% in the mixture. Bentonite can be used in either of the following forms:

   a. Mixed thoroughly in clean "Potable Quality" water with approximately 20% solids and emplaced by a tremie pipe.
   b. Dry Pellets may be poured down hole if the depth is less than 50' and no water is present, otherwise a tremie pipe must be used.

5. The minimum time for materials containing cement to "set" before construction operations on the well may be resumed, shall be in accordance with Department of Water Resources, Bulletin 74-90 or latest revision.

Section 53.5 Well Development

Groundwater monitoring wells shall be appropriately developed until the discharge is clear of sediment. Wells must be developed 72 hours or more after construction before taking water samples.

If there is contamination at the site, the water removed from the well during development may be a hazardous waste and therefore must be disposed of or treated, properly. If the water is determined to be hazardous waste and is disposed, copies of all appropriate manifests must be submitted to HMMP with well permit numbers. If water is to be treated, method of treatment must be approved by HMMP prior to issuance of the monitoring well permit.

Section 53.6 Surface Construction Features

1. Well heads shall be provided with either a locking cap or surface security structure that will prevent accidental damage, unauthorized access or vandalism.

2. The surface slab shall be a minimum of 2'X2'X6" and be a continuation of the annular seal. It shall be raised above the ground level and must slope away (1/4" per foot) from the opening to prevent water from entering the well. Wells that are constructed in the back fill shall have a 2'X2'X1.5' surface slab, all other requirements remain the same.

3. Traffic boxes and caps shall be air/water tight to prevent contamination.

4. The surface structure must have all of the following information permanently attached:

Exterior

1. Well identification number
2. Well type
3. Well cap must have standard monitoring well symbol on outside. (Black triangle within a white circle).

Interior

1. Well identification number
2. Well type
3. Well depth, casing diameter & type
4. Well reference point used to measure water depth
5. Type & depth of perforated intervals

NOTE: REPRESENTATIVE SAMPLES OF ADDITIVES, CEMENT, BENTONITE, AND FILTER MEDIA MUST BE RETAINED FOR 90 CALENDAR DAYS FOR POSSIBLE ANALYSIS FOR CONTAMINATING OR INTERFERING CONSTITUENTS.

Section 54.0 GROUND WATER MONITORING WELLS

Ground water monitoring wells are designed to detect the presence of product floating on or contaminants in the ground water. Wells must be located according to the known or anticipated groundwater flow direction. A monitoring well up gradient from a potential contamination source is typically used to monitor background parameters. Down gradient wells should be placed as close to contamination sources as is practical. The zone of influence for each well is to be calculated and considered when proposing single or multiple wells.

At sites where contamination has not been detected, ground water monitoring can only be used as a monitoring method if the ground water is less than 20' below the ground surface. Ground water monitoring wells must extend 20' below lowest historical ground water and at least 15' below the bottom level of the tank. If the impermeable zone is five feet thick or greater, the well must terminate one to two feet into the impermeable zone. **Any deviation from these requirements must be requested in writing and receive approval prior to issuance of the permit.**

Ground water monitoring wells can be installed inside or outside the excavation, depending on the hydrogeological setting of the site which is determined by a thorough site assessment.

Section 54.1 Site Assessment

Before ground water monitoring wells can be designed and installed a complete site assessment must be performed. This assessment should include:

1. The layout of the underground storage tank system.
2. Hydrological setting.
3. Exploratory borings to determine gradient, if not already known.
4. Evaluation of on and off-site factors that may affect the reliability of the ground water monitoring system such as, previous contamination and product characteristics.
5. Facilities with known contamination should be evaluated using the UT-35 handbook.

Section 54.2 Well Placement - UST Facilities

State regulations mandate that the number and location of wells be based on the site assessment. However, the following are minimum requirements if ground water monitoring is the sole monitoring method:

1. Single tank - two (2) wells, one at each end of the tank, within 10 feet of the tank.
2. Two to three tanks - 3 equally spaced wells.
3. Four or more tanks - four wells, at least two of which must be down gradient and the remainder equally spaced.
4. Piping - up to the discretion of the permitting authority, however the EPA recommends one well for every 30 to 40 feet of piping.

For sites where contamination has been discovered and site characterization is in progress, well placement must be addressed in the site characterization work plan as described in UT-35.

Section 54.3 Water Levels

In order to plan well screen designs the historical high and low groundwater levels must be determined. Historical data of all available water level records for wells within one mile of the site can be used to determine high and low water levels. The design of the well must be based on available water level measurements made over the last two years within 500 feet of the UST which perforate the zone of interest. If no historical information is available an exploratory boring must be drilled as specified in section 2649 (c) of the underground storage tank regulations.

Section 54.4 Monitoring Requirements - UST Facilities

Ground water monitoring must be conducted at least monthly or continuously or both:

1. Continuous monitoring must be able to detect the presence of at least 1/8" of free product on the surface of the ground water.

2. Ground water samples must be analyzed visually or by field and/or lab analysis. (Kern County Environmental Health Services may require lab analyses where visual observation or field analysis does not provide adequate detection.)

According to state regulations all of the following criteria must be met in order to use ground water monitoring as the sole monitoring method:

1. Hazardous substance stored in UST cannot mix with water and must have a specific gravity of less than 1.

2. Continuous or manual monitoring devices must be able to detect at least 1/8" of free product on the surface of the ground water in the wells. Performance must be certified by a third party using appropriate evaluation procedures.

3. Existing ground water level or highest anticipated ground water, must be less than 20' from the grounds surface.

4. Hydraulic conductivity of soils between UST system and monitoring well(s) (or devices) must be at least 0.01 cm/sec (e.g. soils consisting of gravels, coarse to medium sand, coarse silt or other permeable materials.)

5. Ground water proposed for monitoring has no present or potential future beneficial uses or is not hydraulically connected to ground or surface water which has actual or potential uses.

6. Monitoring wells or devices are located within the excavation zone or as close to the excavation as feasible.

Section 55.0 VADOSE ZONE MONITORING WELLS

Vadose zone monitoring wells monitor the unsaturated soil that is above the water table. They are normally located in the back fill of the tank excavation, but they can be outside of the tank hole in native soil.

Section 55.1 Vadose Zone Description

The vadose zone is the zone that overlies the water table. It is subdivided into three regions: The soil zone, the intermediate zone and the capillary fringe. In these regions, air and water are trapped within the soil pore spaces. Technologies are available that may detect, sample and determine the constituents of vapors and liquid in the vadose zone.

Section 55.2 Types of Vadose Zone Monitoring

Vadose zone monitoring is categorized as follows:

1. Vapor Monitoring

   Vapor monitoring techniques detect vapors or tracers within the soil pore spaces and can be passive or aspirated. The passive monitoring devices depend upon the natural migration of vapors to a sensor placed within the well casing, while the aspirated monitoring devices use a vacuum pump to draw the vapors towards the well. The vapor may also be collected in an appropriate container and sent to a laboratory for analysis. If the site is not suitable for passive monitoring, a vacuum pump that is capable of creating an adequate radius of influence shall be used to collect vapor samples.

   Vapor monitoring will be approved only if the vapors of the stored substance or tracers can be detected by vapor sensors or probes that have been demonstrated to work.

2. Soil-Pore liquid Monitoring

   In soil-pore liquid monitoring, liquid samples can be collected and analyzed for possible contaminants. The devices that are currently used are ceramic type lysimeters, membrane filters and hollow filter samplers. Other instruments are also available to gather "soil-pore liquid" information in the vadose zone without retrieving liquid samples. These instruments include tensiometers, resistance blocks and gamma-ray transmission. To date, soil-pore liquid monitoring has not yet been proven to be a reliable technique for early warning/leak detection for gasoline or hydrocarbon.

   The soil-pore liquid sampling method proposed shall demonstrate that sufficient water can be consistently collected for analysis in a monitoring program.

3. Other Vadose Zone Monitoring

Since vadose zone monitoring techniques are still being developed, other monitoring methods may be reviewed and approved by the HMMP on a case by case basis.

Section 55.3 Site Assessment

In order to have an effective vadose zone monitoring well system, a site assessment needs to be conducted by a registered hydrogeologist, geologist or engineer before the system is installed. A site assessment should include:

Vapor Monitoring

1. The volatility of the product stored.
2. The permeability of the back fill.
3. Information on any background contamination that could affect the reliability of the system.
4. Interferences such as precipitation, ground water and soil moisture.

Section 55.4 Well Placement - UST Facilities

The placement of vadose zone monitoring wells must be determined by the site hydrogeologic assessment. The wells must be designed to detect an unauthorized release at the earliest opportunity. Well placement depends on the set up of the UST system, the back fill permeability, the mobility and volatility of the stored substance and the type of sensor being used in the system.

For vapor monitoring wells the EPA recommends one well per tank located in the back fill, as close to the tank as possible or one well per 20 to 40 feet surrounding the tank and piping. If the back fill cannot be distinguished from the native soil, the monitoring wells shall be placed at locations where the vapors can be detected at the earliest possible time and other monitoring methods must be used simultaneously. The location of each monitoring point must be determined by the most probable path of movement of vapors.

Section 55.5 Monitoring Requirements - UST Facilities

Vapor Monitoring Wells

1. Must be monitored continuously.
2. Stored product or tracer must be sufficient volatility to be detected by monitoring devices.
3. Back fill or soil in which the wells are placed must be porous enough to allow the diffusion of vapors.
4. If there is background contamination it must not interfere with the detection method.
5. Monitoring devices must be designed to detect any significant increase in concentration above background of substances stored or tracer placed in the tank.
6. Wells in back fill must be able to detect any unauthorized release from the UST that may pond at the back fill/soil interface.

Soil-Pore Liquid and Other Vadose Zone Monitoring

1. Must be monitored weekly.
2. Stored substance must be detectable by release detection method employed.
3. Substance stored must not affect the materials that the detection system is made of or the operation of that system.
4. Local site conditions (precipitation, groundwater, soil moisture and background contamination) must not interfere with the operation or accuracy of the detection method.

Vadose zone monitoring may be used as the sole release detection method if:

1. The system can be located within the back fill.
2. Existing ground water or highest anticipated ground water is greater than ten feet below the bottom of the tank.

Section 56.0 CATHODIC PROTECTION WELLS - UST FACILITIES

Cathodic protection wells may be necessary when the underground storage tank(s) and/or piping are made of metal and are not coated or lined to isolate them from corrosion. A cathodic protection well is defined in Section 13711 of the Water Code as "...any artificial excavation in excess of 50 feet constructed by any method for the purpose of installing equipment for the electrical protection of metallic equipment - in contact with the ground, commonly referred to as cathodic protection."

As with any cathodic protection system that is installed to protect an underground storage tank facility, cathodic protection wells must be designed by a corrosion engineer who, has been certified by the NACE or equivalent, and has been registered as a professional engineer with the State of California. All well designs must be approved by this Department before a well permit will be issued.

Section 56.1 Construction

Cathodic protection wells should be constructed in compliance with the California Well Standard, Bulletin 74-90. The following list is to be used only as a general guideline. For additional information on construction materials and requirements, refer to Section 53.0. (See Appendix for Cathodic Protection Well diagram.)

1. Anodes are not cased and must be back filled by conductive material.
2. A vent pipe should extend from just above the anodes to the ground surface. Non-conductive back fill of washed granular material, such as gravel or sand; or grout should be placed in the annular space (see Section 53.4 for approved grout types).
3. Seal must be 2" or greater in radial thickness. Depth of the seal should be according to the following conditions:

    a. 50 feet below grounds surface or
    b. As required by permitting authority.
4. Any cylindrical material, such as vent pipes or anode access tubes are considered to be casing, and should meet the specifications listed in Section 53.1.

Section 56.2 Sealing Off Strata

If the cathodic protection well passes through zones of good quality water and zones of poor quality water, the seal must be placed such that the water from the poor water quality zones will not penetrate into the zones of good water quality. For specific guidelines, refer to the California Well Standard, Bulletin 74-90.

Section 57.0 SAMPLING

Section 57.1 Soil Sampling

All owners of existing underground storage tanks implementing vadose zone or groundwater monitoring are required to perform soil sampling and analysis on all borings at the time the wells are drilled. For sites where contamination has been discovered, refer to UT-35, as sampling will be determine on a site specific basis.

1. If contamination is encountered on a site where vadose or groundwater monitoring is the chosen monitoring method a site characterization will be required.
2. All drilling tools and soil and water sampling devices shall be thoroughly cleaned before each sample is taken.
3. Each site will be addressed on a site-specific basis for the type of soil and contaminants suspected.
4. Borings shall be drilled and sampled by methods that do not introduce liquids or air into the boring (i.e. Shelby tube or split spoon samplers are recommended) and allow accurate detection of perched and saturated zone groundwater.
5. All borings shall be described in detail using the Unified Soil Classification System and shall be logged by a registered geologist, civil engineer, or technician supervised by a registered geologist/civil engineer.
6. Soil samples shall be taken every five feet or less or where there is a change in the lithology. A soil sample must be taken at the termination depth of dry borings regardless of spacing. If contamination is discover, drilling must continue to at least 10 feet below the point at which is was detected.
7. Samples must be analyzed by a State-certified laboratory.
8. Sampling protocol must receive prior approval from the HMMP.
9. Borings not utilized for vadose or groundwater monitoring shall be sealed from the bottom of the boring to the ground surface with neat cement or sand cement by use of the tremie method.
10. If evidence of contamination is detected by sight, smell, or by analytical methods drilling shall be halted until the Environmental Health Services Department is notified at (805) 861-3636.
11. **All soil borings that may impact ground water are considered "test wells" and a permit from the Hazardous Materials Management Program must be obtained before further work is started.**

Section 57.2 Water Sampling

All ground water monitoring wells used to monitor UST's shall be monitored at a minimum of once a month. Water samples shall be field inspected for the presence of odor and the observance of product or sheen on the water.

1. Samples can be retrieved by manual bailers, vacuum or pneumatic pumps. Mechanical pumps can not be used if volatiles are present.
2. To prevent cross contamination, it is recommended to use a dedicated sampler for each well.
3. Before taking samples:

a. For high yield wells, 3 to 4 volumes of standing water shall be removed.
b. For low yield wells, pump dry and allow 80% recovery of total volume.

4. The water removed from the well may be hazardous waste and therefore must be disposed of properly. (See Section 53.5, Well Placement).
5. Water samples shall be analyzed by a State-certified lab. Frequency and type of analysis shall be as determined by the HMMP on a site specific basis.
6. Sampling protocol must receive prior approval by HMMP.
7. At sites where contamination exists, the stability of water sampled through time, must be checked by measuring the temperature, pH, and conductivity before and after sampling.

Section 58.0 WELL DESTRUCTIONS

When a well is no longer to be used, it must be destroyed to eliminate a possible conduit for contaminants that can effect groundwater quality.

Before a well is destroyed it must be surveyed to determine the method of construction and current condition.

Section 58.1 Destruction of Monitoring Well

1. Well must be inspected before destruction to determine if there are any obstructions that will impede filling or sealing.
2. Well casing must be perforated or punctured to allow sealing material to fill all voids or well must be destroyed by removing all material within the original borehole, including casing, screen, filter pack and annular seal.
3. Placement of the sealing material must be performed under pressure. (See Section 53.4 Allowable Grout Types).

Any deviation from the above requirements must be approved by KCEHD prior to issuance of the destruction permit.

Section 58.2 Destruction of Cathodic Protection Wells

1. Wells located in unconsolidated sediment and that penetrate one aquifer must be sealed, with an approved grout type, as follows:
   a. Where there is known contamination or pollution source at or near well site, seal must be to a depth of 100 feet from the surface
   b. In urban areas seal must be to a depth of 50 feet from the surface.
   c. Cathodic protection wells that are located in non-urban areas, where there is no known contamination or pollution source nearby, must be sealed to a depth of 20 feet from the surface or as directed by the permitting authority.

2. Wells that penetrate more than one aquifer, where water quality varies from one aquifer to another, must be sealed in such a way to ensure that water from poor quality zones, does not penetrate zones of good quality water.

Section 59.0 REPORTING AND MONITORING RECORDS

If an unauthorized release is detected by an alarm, laboratory analysis or visually, the operator must stop using the tank, and notify the Permitting Authority with in 24 hours of detection.

A written response plan that addresses what steps must be taken should a release occur must be kept on site. A copy of the response plan and routine monitoring procedures must be submitted to Kern County Environmental Health Department.

All monitoring records shall be available to the Permitting Authority for review (when requested) and shall be kept at the facility for a minimum of 3 years.

Section 60.0 PERSONNEL QUALIFICATIONS

The Hydrogeologist, Geologist or Engineer who performs the hydrogeological assessment must be registered in the State of California and have at least 2 years experience in this field.

Cathodic Protection Wells must be designed be a Corrosion Engineer who has been certified by the NACE (or equivalent), and who is registered in the State of California as a professional engineer.

The well driller must have a current C-57 Contractor's License.

The owner/operator or his representative is responsible for the operation and maintenance of the monitoring system.

APPENDIX

WELL DRILLERS REGISTRATION FORM

1. Name of individual, partnership, company or corporation currently legally licensed to perform the drilling, digging, driving or boring of domestic water wells in Kern County.

   _____

2. Business Address:_____

   _____

3. Business phone number: ( )_____

4. If individual owner or partnership give home address(s) and home phone(s) where owner(s) can be reached after normal work hours.

   _____

   ( )_____

5. If company or corporation give home address and phone number of company or corporation representative that has the primary management responsibility.

   _____

   ( )_____

6. **Current California State Well Drilling contractor's License Number.** _____

7. Number of drilling rigs:_____ Type: _____

8. Trucks used for moving rigs:

Make of Truck	Year	Lic #

OWNERSHIP IDENTIFICATION:

Lettering that gives name, address and phone number and assigned registration number of business is to be on both sides of truck cab that hauls or tows drilling equipment.

MONITORING WELL APPLICATION

ENVIRONMENTAL HEALTH SERVICES DEPARTMENT
HAZARDOUS MATERIALS MANAGEMENT PROGRAM
2700 "M" STREET, SUITE 300
BAKERSFIELD, CA 93301

Application Date
No. of Wells
PTO No.
MW No.(s)

Circle One:

CONSTRUCT MODIFY DESTROY

For Office Use Only

A. FACILITY INFORMATION

Project Contact:	Phone:	T/R/Sec:
Facility Name:	Facility Phone:	Cross Street:
Address:	City:	Zip:
Owner:		Phone:
Address:	City:	Zip:

B. CONTRACTOR INFORMATION

Environmental Contractor:		Phone:
Address:	City:	Zip:
License No. and Type:		W.C. No.:
Drilling Contractor:		Phone:
Address:	City:	Zip:
License No. and Type:		W.C. No.:

C. ENVIRONMENTAL INFORMATION

Depth to Groundwater:	Verified By:
Lithology Log Reviewed By:	Registration No.:

D. PROJECT INFORMATION

Proposed Start Date:	Proposed Completion Date:	
Drilling Method:		
Type of Well (Circle One): Groundwater	Vadose Zone	Test Hole

Signature:_____ Title:_____ Date:_____

CONSTRUCTION INFORMATION

DRILLING METHOD_____

	WELL 1	WELL 2	WELL 3	WELL 4
WELL DEPTH				
GROUND ELEVATION (IF KNOWN)				
BOREHOLE DIAMETER				
CASING-INSIDE DIAMETER				
CASING MATERIAL & GAUGE				
SCREEN MATERIAL & GAUGE				
TYPE OF BENTONITE PLUG & DEPTH				
ANNULAS SEALANT MATERIAL & DEPTH				
FILTER PACK MATERIAL & SIZE				
SCREEN SLOT SIZE & LENGTH				
SEALANT PLACEMENT METHOD				
LOCKING WELL CAP				

FACILITY PLOT PLAN — Provide a description of the facility to be monitored, including: location of tanks, proposed monitoring and placement, nearest street or intersection, location of any water wells or surface water within 500' radius of facility. Please attach.

WELL DIMENSIONS — Provide a detailed drawing of well(s). Include: depth of well, casing length, screen/filter pack length, annular sealants, and well cap. Note any irregularities. Please attach.

ZONE OF INFLUENCE VADOSE ZONE WELLS — Information on zone of influence, such as mathematical calculations or field test data, may be required upon review of the application.

NOTE: If application is not complete it may be returned.

DESCRIPTION OF ASTM STANDARDS

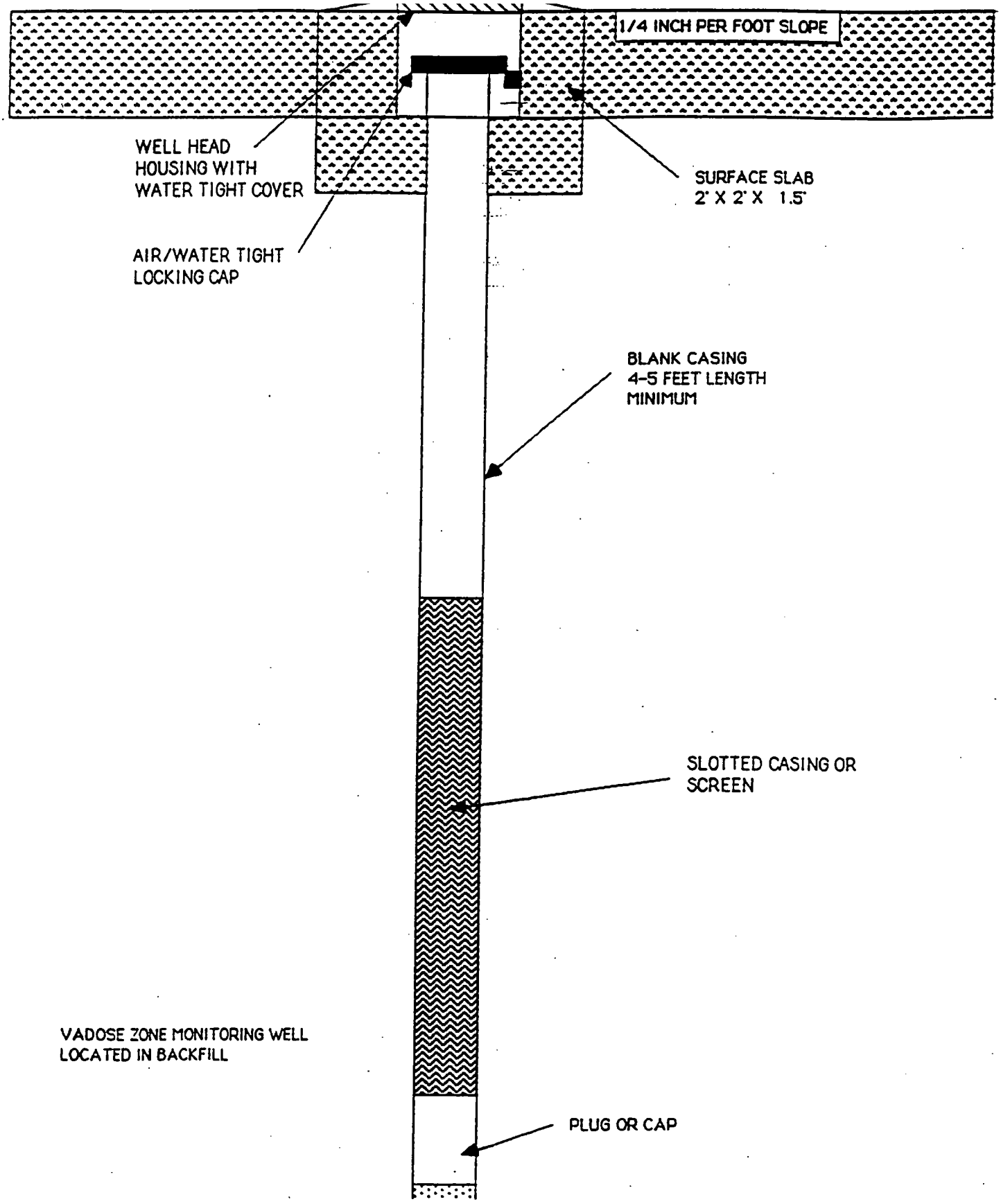
1. CAST IRON - ASTM A211 - "Standard Specification for Spiral-Welded Steel or Iron Pipe."

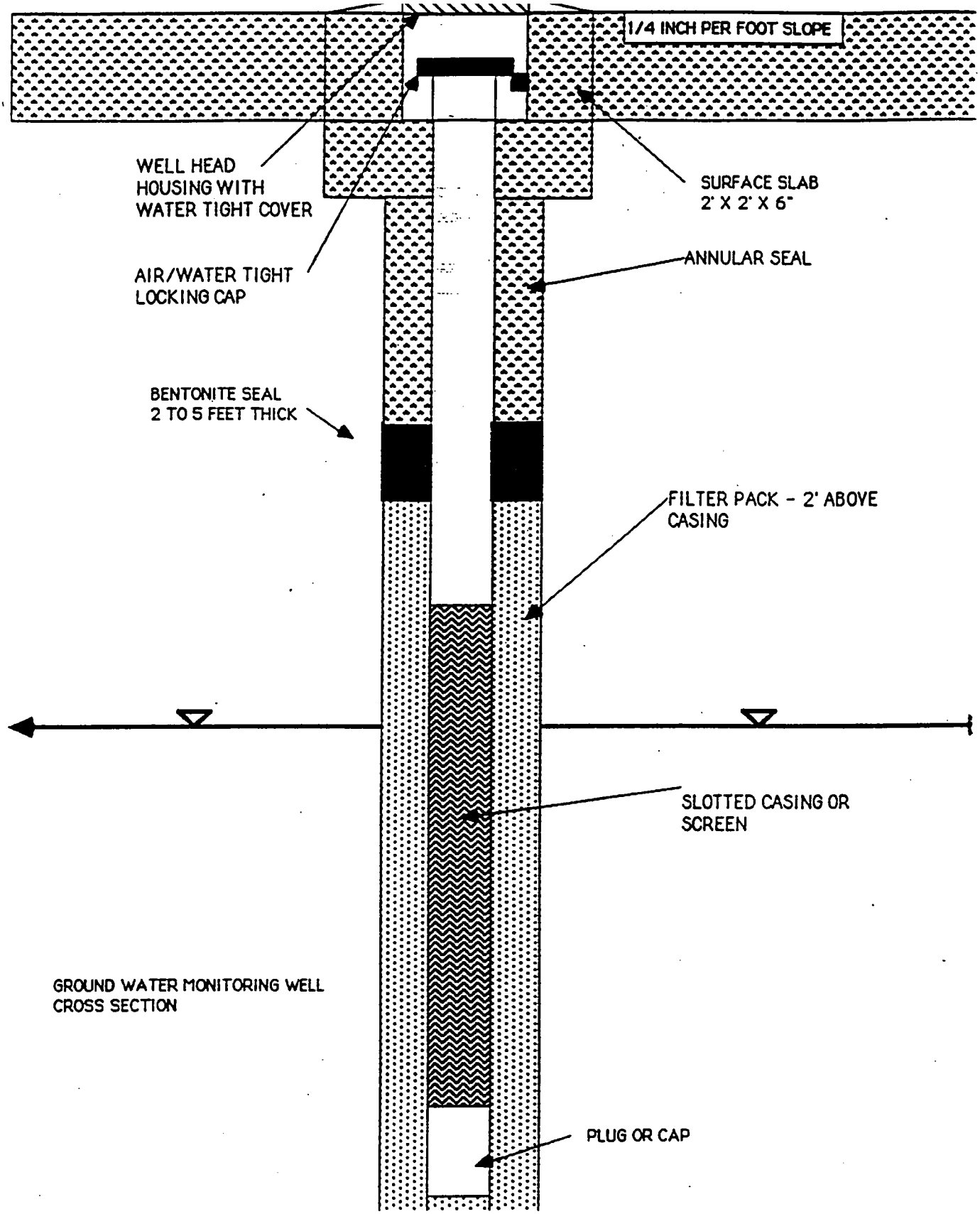
2. GALVANIZED STEEL - ASTM A120 - "Standard Specification for Pipe, Steel, Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses."

3. THERMOPLASTICS
   a. PVC, POLYETHYLENE, POLYPROPALENE - ASTM F480 - "Standard Specification for Thermoplastic Waterwell Casing, Pipe and Couplings Made in Standard Dimension Ratios (SDR)."
   b. FLUOROCARBON RESINS
      i. ASTM D3295 - "Standard Specification for PTFE (polytetrafluoroethylene) Tubing."
      ii. ASTM D3296 - "Standard Specification of FEP (fluorinated ethylene propylene) Fluorocarbon Tube."

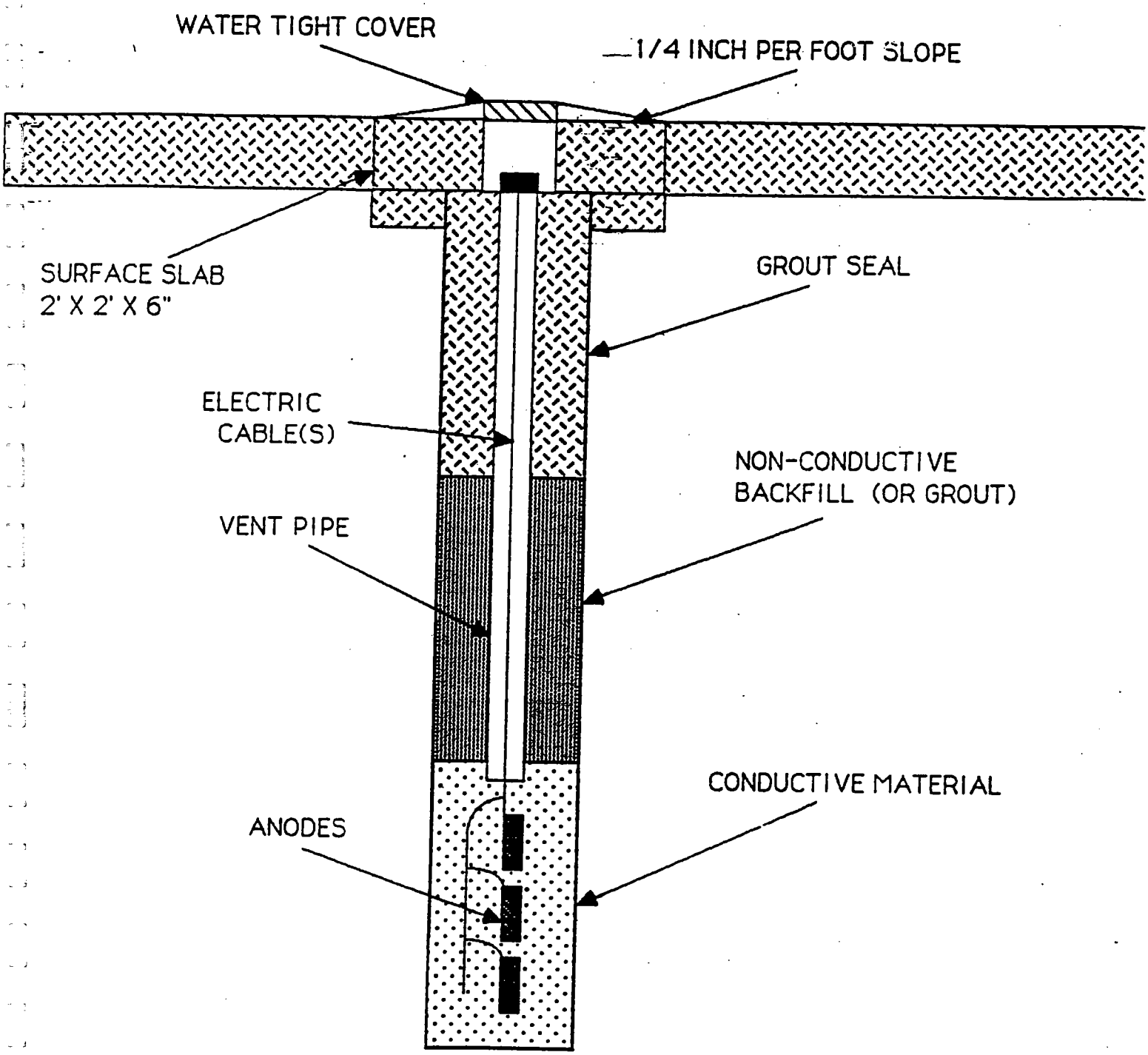
4. STAINLESS STEEL - ASTM A312 - "Standard Specification for Seamless and Welded Austenitic Stainless Pipe."

BH:ch
houghton\ut-50.002


1/4 INCH PER FOOT SLOPE
WELL HEAD
HOUSING WITH
WATER TIGHT COVER
SURFACE SLAB
2' X 2' X 1.5'
AIR/WATER TIGHT
LOCKING CAP
BLANK CASING
4-5 FEET LENGTH
MINIMUM
SLOTTED CASING OR
SCREEN
VADOSE ZONE MONITORING WELL
LOCATED IN BACKFILL
PLUG OR CAP



GROUND WATER MONITORING WELL CROSS SECTION



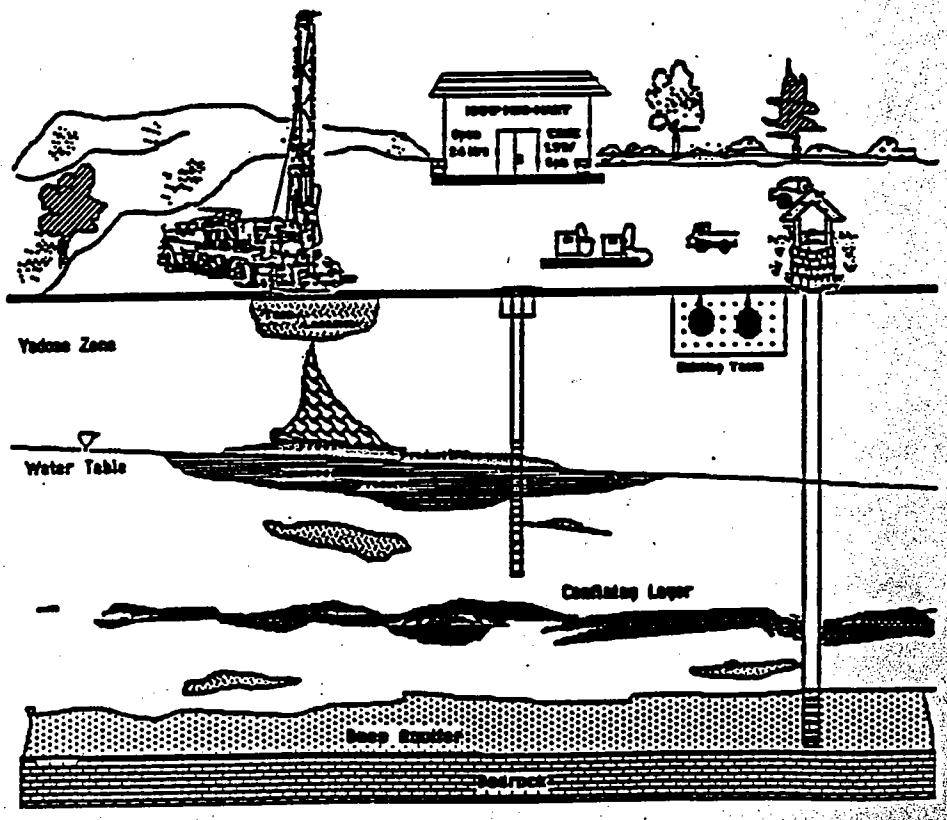
CATHODIC PROTECTION WELL

CROSS SECTION

Attachment "A"
UT-35

SITE CHARACTERIZATION

AND REMEDIATION



COUNTY OF KERN
Department of Environmental Health Services
Hazardous Materials Management Program
2700 "M" Street, Suite 300, Bakersfield, CA 93301
(805) 861-3636

rev. 10/94

TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
DEFINITION OF TERMS & GLOSSARY	2
ENVIRONMENTAL CONTRACTOR SELECTION	5
NOTIFICATION AND REPORT SUBMITTALS	7
Responsible Party Notification	7
Reports Required & Schedule for Submittals	7
General Requirements for all Plans/Reports	8
SITE CHARACTERIZATION WORKPLANS/REPORTS	9
Site Characterization Workplan	9
Site Characterization Report	12
REMEDIAL ACTION WORKPLANS/REPORTS	15
Remedial Action Plan	15
Progress Report	16
Remedial Action Report	16
Remedial Action Alternatives	16
RISK ASSESSMENT FOR CONTAMINATED SITES	21
PERMIT REQUIREMENTS	24
APPENDIX	
A Sample Drawings	25
B General Risk Appraisal	27
C Sampling & Analysis Guidelines	29
D Common Questions & Answers	34

INTRODUCTION

This handbook has been prepared to assist Responsible Party(ies) comply with the regulations and laws that address contamination from releases of hazardous substances. The Kern County Environmental Health Services Department (KCEHSD), Hazardous Materials Management Program (HMMP) has prepared this document in an effort to describe methods to assess the real or potential damage that contamination presents to the environment, public health, and safety. By better understanding these principles, the responsible parties may cost-effectively reduce their risk and liability.

This document consists of the following parts:

Definition of Terms and Glossary -- an explanation of terms commonly used in environmental assessments/remediation.

Contractor Selection -- provides guidelines for the underground storage tank owner and/or operator, land owner or other responsible party to choose the appropriate type of contractor for each specific task, such as preliminary assessment, site characterization, or complex groundwater investigation. Each task requires specific expertise before work will be approved by state and local agencies.

Notification & Report Submittals -- describes the notification process and schedule for submittal of all required reports.

Site Characterization Workplan/Reports -- provides in an outline the information that needs to be included for determination of the extent of contamination.

Remedial Action Workplan/Report -- provides in an outline the information that needs to be included to evaluate the most appropriate corrective action to be taken, its implementation and operation, and verification of site remediation. An explanation of currently available remedial technologies is also included.

Risk Assessment -- provides in an outline the information that needs to be presented in order to evaluate the possibility of leaving significant contamination in place or to justify a proposed cleanup level.

Permit Requirements -- describes the permits that are required by the HMMP during an investigation. Other permits that various agencies may require are also listed.

Appendix -- provides sample drawings to illustrate the information required to perform a proper subsurface investigation as well as some common questions asked and their answers. Guidelines on field sampling and laboratory analysis as well as quality control/quality assurance (QA/QC) guidelines are also provided.

DEFINITION OF TERMS & GLOSSARY

Aquifer: An underground formation composed of materials such as sand, or gravel that can store and produce water to wells or springs in a usable quantity.

Aeration: A remediation method that may be acceptable to treat gasoline contaminated soil. The requirements for this method are detailed in the Kern County Environmental Health Services Department's Policy on Aeration and Rule 4651 of the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD).

Air Sparging: A groundwater remediation method that involves the introduction of air into the saturated zone under controlled conditions to enhance volatilization and aerobic degradation of volatile organic contaminants.

Bioremediation: A remediation method that involves the process of biodegradation to remove or reduce the toxic characteristics or components of chemicals from soil and groundwater with the controlled use of scientific and engineering principles.

BTX & E: Benzene, Toluene, Xylene, and Ethylbenzene; chemicals commonly found in gasoline that are used as indicators of gasoline contamination in soil or water.

C-57 Contractors License: License issued by the State Contractor's Board which authorizes a person to drill, construct, and destroy water wells, monitoring wells or cathodic protection wells.

Chain of Custody: Method of tracking the possession of a sample from the time it is retrieved in the field until it is analyzed in a lab; it assures the accountability and integrity of the sample.

Contaminant Plume: A three-dimensional underground zone containing contaminants in various concentrations.

Contamination: The presence of hazardous substances in an amount that is greater than that which occurs naturally in soil, air, or water and may degrade the environment or have a possible adverse impact on human health.

Environmental Contractor: A person who meets the qualifications identified in the Environmental Contractor section of this handbook (page 5).

Environmentally Sensitive: An area within the county meeting any of the following criteria: 1) highest historic groundwater is within 50-100 feet of ground surface, or 2) nearest surface water in unlined conveyance is within 75 feet of tank(s), or 3) nearest agricultural or domestic well within 75 feet of tank(s), or 4) facility is located in a designated aquifer recharge area, or 5) Permitting Authority determines possible adverse environmental impact due to facility proximity to unique wildlife habitat areas.

Extremely Environmentally Sensitive: Area where the highest historic groundwater is within 50 feet of ground surface.

Groundwater: Underground water that fills pores between particles of soil, sand and gravel or openings in rocks, to the point of saturation. Where groundwater occurs in significant quantity, it can be used as a source of water supply.

Groundwater Gradient: The slope of the water table, generally coinciding with the direction of groundwater flow.

Hazardous Substances: Liquid, solid and gaseous substances that can adversely affect human health or the environment and are defined in either Federal, State or local regulations.

Hydrogeology: The branch of geology that deals with occurrence, distribution and movement of surface and groundwater.

Monitoring Wells: Special wells drilled at specific locations on a site for sampling of groundwater or vapors at selected depths and determining information such as direction of groundwater flow, types and concentration of contaminants, etc. The construction or destruction of a monitoring well is prohibited without first obtaining a Permit from the KCEHSD Hazardous Materials Management Program. Other monitoring well requirements are found in KCEHSD Handbook UT-50.

Non-Environmentally Sensitive: Area where the highest historic groundwater is greater than 100 feet of the ground surface.

Perched Groundwater: Water that is collected above a layer of impermeable material and is isolated from the underlying main groundwater body.

Preliminary Assessment (Tank Removal): The initial site investigation involving retrieval of soil samples to determine whether contaminants are present and further studies are needed in accordance with a "Site Characterization Workplan." Minimum specifications for preliminary assessments are provided in KCEHSD Handbook UT-30.

Quality Assurance/Quality Control (QA/QC): Assures that samples and test results are of optimum quality by following standards for laboratory handling and analyzing as specified in US EPA publication entitled "Test Methods for Evaluating Solid Waste" commonly known as SW-846.

Remedial Action Options: Options for corrective action which assure that public health and the environment are protected from the effects of contamination.

Remedial Action Plan: A plan for implementing the selected corrective action which is required to minimize, mitigate, or clean-up the effects of contamination.

Risk Assessment: An evaluation of the potential for the contaminant to adversely impact public health and the environment.

Sampling: The process of obtaining a representative segment of soil, air, or water to be analyzed for contaminants; must be performed in accordance with SW-846.

SW-846: EPA publication entitled "Test Methods for Evaluating Solid Waste" that was designed as a source of information to achieve uniform sampling and analysis of wastes. It includes a description of sampling container selection, chain of custody requirements, quality assurance/quality control, and methods for obtaining representative samples, etc.

Site Characterization: A study or investigation of a site to fully assess the lateral and vertical extent of contamination and threat to groundwater resources, the environment, and public health and safety.

Test Hole: A hole excavated or drilled in the ground for gathering data such as groundwater depth and quality, soil type and properties.

TPH: Total Petroleum Hydrocarbon

UT-30: Handbook developed by the Kern County Environmental Health Services Department, Hazardous Materials Management Program specifying requirements for permanent closure of underground hazardous substance storage tanks.

UT-50: Handbook developed by the Kern County Environmental Health Services Department, Hazardous Materials Management Program specifying requirements for construction and destruction of all monitoring wells.

Unified Soil Classification System: A system for classifying soils in accordance with ASTM standards.

Vadose Zone: The zone that overlies the water table; includes the soil zone, the intermediate zone and the capillary fringe.

Vapor Extraction: A remediation method engineered to remove volatile contaminants from the soil through the use of one or more vacuum wells. Contaminated vapors that are extracted are treated before they are released into the atmosphere.

Well Log: A systematic and sequential record of geologic data obtained from a well during drilling. A well log may be in narrative, tabular, graphic and symbolic form. It generally includes information on the thickness and lithologic composition of the rocks in the order in which they were penetrated, as well as the presence of water, unusual odor, or other subsurface peculiarity.

ENVIRONMENTAL CONTRACTOR SELECTION

The work associated with the investigation of hazardous chemicals releases requires a professional level of expertise. Specifically, preliminary assessments must be performed by contractors knowledgeable in proper sampling procedures. More complex investigations, such as site characterizations, require the knowledge of contaminant transport mechanisms, and laws associated with hazardous waste management including regulations and ordinances. Other aspects associated with subsurface investigation such as the application of specific permit conditions, risk assessments, and implementation of different remedial action alternatives must be acquired.

FOR PRELIMINARY ASSESSMENTS (TANK REMOVAL)

All contractors retrieving samples for preliminary assessment after removal of underground tanks must submit to KCEHSD for approval written sampling procedures which address the following:

1. Types of sample containers and their preservation.
2. Sample preservation methods.
3. Equipment used and method of sample retrieval.
4. Health and safety considerations.
5. Familiarity with sampling specifications provided in KCEHSD UT-30 and EPA SW 846.

FOR SITE CHARACTERIZATION AND REMEDIATION

1. **In Soil Only:**

   a. Workplans and reports must be prepared by or under the supervision of an appropriately registered professional in the state of California with at least 3 years full time experience in performing environmental assessments associated with hazardous chemical releases into the environment.

   b. Boring logs must be prepared by or under the direct supervision of a California registered geologist (RG), certified engineering geologist (CEG), registered civil engineer (RCE) or registered geotechnical engineer (RGE). The report that contains the boring logs and/or other geologic interpretations must be signed by one of the above registered professionals.

2. **Involving Groundwater:**

   a. Workplans and reports must be signed by an appropriately registered professional in the state of California with at least 5 years full time experience in hydrogeology and in performing environmental assessments associated with hazardous chemical releases into the environment.

   b. Wells must be designed and installed by or under the direct supervision of a California RG, CEG, RCE or RGE. Report of the well logs and/or other geologic interpretations must be signed by one of these registered professionals.

3. **Remediation System Design**

   The remediation treatment system for contaminated soil and/or groundwater must be designed by or under the direct supervision of an appropriately registered professional in the State of California with at least 3 years experience in the proposed remediation system. All calculations, specifications and/or assumptions must be verified by the registered professional.

4. **Other Reports**

   Risk Assessment: Must be prepared by a professional, knowledgeable in contaminant transport mechanisms and risk assessment evaluations (qualitative/ quantitative) using federal, state and local guidelines.

   Health & Safety Plan: Must be prepared by a professional familiar with health and safety requirements on hazardous materials/wastes and/or industrial operations.

NOTES:

1. **The contractor must provide to KCEHSD a resume of the individual who will be preparing and/or signing workplans and reports. KCEHSD reserves the right to reject workplans or reports not meeting the minimum requirements.**

2. **KCEHSD recommends that multiple bids be obtained before selecting a contractor.**

NOTIFICATION AND REPORT SUBMITTALS

After removal of underground storage tanks(s) and review of preliminary analytical data, a determination is made whether further investigation is necessary, or closure is appropriate.

RESPONSIBLE PARTY NOTIFICATION

A responsible party (RP) as defined in Title 23, CCR, Section 2720 is notified by mail of an unauthorized release from underground storage tank(s). The RP for sites that are classified as non-environmentally sensitive (NES) by this Department have 10 days to determine whether local agency oversight costs will be paid directly to the County (Local Option) or through the State/Federal Fund (State Option). If the local option is chosen, an initial deposit of $1000 is required for oversight costs. Contracts for the local option may be renewed when the initial or subsequent deposits are exhausted.

Sites classified as environmentally sensitive (ES) or extremely environmentally sensitive (EES) are automatically enrolled by the Department into the State Option.

REPORTS REQUIRED & SCHEDULE FOR SUBMITTALS

1. **Site Characterization Workplan**

   a. Workplan: Within 30 days from the date of notification by KCEHSD that a site characterization is required at the facility.

   b. Field Investigation: Within 30 days after approval of workplan by KCEHSD.

2. **Site Characterization Final Report:** Within 60 days of completion of field investigation.

3. **Remedial Action Plan:** Within 60 days of KCEHSD approval of remediation method.

4. **Progress Report:** Within 1 month after actual remediation is started and quarterly thereafter.

5. **Remedial Action Report:** Within 30 days of completion of the remediation.

NOTE: Failure to abide by the above time schedule may result in legal actions being initiated.

GENERAL REQUIREMENTS FOR PLANS/REPORTS

1. All workplans and reports must include the facility name, location, contact person (representing owner), address, telephone number, and facility permit number.

2. All workplans and reports must be signed, stamped and dated by the qualified personnel as described in the "Environmental Contractor Selection" section. Registered professionals must provide the expiration date of their registration.

3. All workplans and reports must be properly bound. Except for cover letters loose sheets are not acceptable.

4. For groundwater cases a copy of all workplans and reports must also be submitted to:

   Central Valley Regional Water Quality Control Board
   3614 E. Ashlan Avenue
   Fresno, CA 93726
   ATTN:

   OR

   Lahontan Regional Water Quality Control Board
   15428 Civic Drive, Suite 100
   Victorville, CA 92392-2383
   ATTN:

SITE CHARACTERIZATION WORKPLANS/REPORTS

SITE CHARACTERIZATION WORKPLAN

A. SITE CHARACTERIZATION WORKPLAN INVOLVING SOIL ONLY

A site characterization workplan must be approved by KCEHSD prior to beginning work. The Workplan must include the following information:

1. Site Background

a. History of site and tank use.

b. Historical information regarding discrepancies or reportable variations on inventory monitoring, results of tank tests, repairs to tanks or piping.

c. Estimates of liquid quantity and composition leaked into the environment and how quantified.

d. Information on local topography, geology, sumps, dry wells, nearby waterways, and groundwater depth and its current designated beneficial use including references.

2. Area and Site Specific Maps/Plot Plans

a. Area map showing site location relative to nearby landmarks such as water courses, highways, urban or industrial areas, etc. (see sample illustrations).

b. Scale drawing of the site showing nearby cross streets (include street names), buildings, septic tanks and leachfields, water wells, underground and overhead utility lines, canopies and any other obstacles which may present a hazard during drilling (see sample illustrations).

c. A diagram of all removed and/or existing tanks and piping systems on the property. Each tank must be labeled with corresponding past and present contents and volumes.

d. A north arrow pointing towards the top of the paper shall be included on all maps/plot plans.

3. **Preliminary Site Assessment Results**

   a. Analytical results of the preliminary site assessment.

   b. Summary of all other environmental site work performed on sumps, dry wells or underground tank closures.

4. **Soil Sampling Plan**

   a. Proposed sampling locations and depths including rationale for their selection. To define the vertical extent of contamination, the soil boring shall be advanced until field observations and instrumentation readings are "none detected" for a minimum of two consecutive (10 feet) soil samples.

   b. The number of samples to be sent to the lab for analysis must be adequate to obtain a representative profile of the contamination.

   c. Proposed methodology for completion and destruction of all borings.

   d. Plan for management of drilling spoils.

   e. Contaminants to be analyzed, the name of the laboratory that will perform the analyses, analytical methods, field investigation procedures, and Quality Assurance and Quality Control (QA/QC) plans.

   f. Equipment and procedures for sample retrieval.

5. **Health and Safety Considerations**

   a. Hazard identification and abatement.

   b. Personnel training.

   c. Chemicals of concern including exposure limits.

   d. On site monitoring and required safety equipment.

   e. Emergency information.

   f. Personnel protective equipment.

B. SITE CHARACTERIZATION INVOLVING GROUNDWATER

In addition to all of the requirements for a site characterization workplan involving soil only, the following information must also be submitted to KCEHSD for review and approval for sites where groundwater is threatened or affected:

1. Site Background

a. Proximity of private, municipal, domestic and irrigation wells on site or within 500 feet of the contamination.

b. Tables summarizing preliminary soil and groundwater data.

c. Information on ground water quality including the present designated beneficial use.

2. Sampling Plan

a. Site map showing location and depth of all proposed groundwater monitoring wells.

b. Details of proposed monitoring well construction.

c. Proposed groundwater sampling methodology to include purging, testing for stability, frequency of sampling, number of samples, and equipment for obtaining groundwater samples and floating product.

d. Rationale for monitoring well locations, construction, and sampling frequency.

e. Name of the laboratory that will perform the analyses, contaminants to be analyzed, analytical methods and QA/QC.

3. Determination of Aquifer Characteristics

a. Method of determining groundwater gradient and direction.

b. Proposed method and rationale for determining other hydrogeologic characteristics such as hydraulic conductivity, transmissivity, storage capacity, and aquifer thickness.

SITE CHARACTERIZATION REPORT

A. SITE CHARACTERIZATION REPORT INVOLVING SOIL ONLY

If the site characterization study indicates that only soil is contaminated and no threat to groundwater exists, a site characterization report with a minimum of three remedial action options must be submitted to KCEHSD for review and approval. The report shall include but not be limited to the following:

1. **Brief discussion of the problem and findings from the preliminary site assessment or other studies.**

2. **Site Characterization findings shall include:**

   a. The vertical and lateral extent of the contamination plume accurately delineated on overview and cross section diagrams drawn to scale. Cross sections must include soil stratigraphy based on boreholes, trenches, monitoring wells, or any other supporting information (see sample illustrations).

   b. Results and interpretations of all data collected.

   c. Tables summarizing analytical data, and discussion of methodologies used to collect and analyze the samples.

   d. All borings shall be described using Uniform Soil Classification System and logged by a professional geologist, civil engineer or engineering geologist who is registered in the State of California and experienced in the Unified Soil Classification System. A technician trained and experienced in the use of the Unified Soil Classification system working under the direct supervision of one of the aforementioned professionals shall be deemed qualified to log borings provided the aforementioned professional reviews the logs and assumes responsibility for the accuracy and completeness of the logs. All reports, plans, or other analysis must be signed by the above aforementioned registered professionals.

   e. Estimated volume of substance released.

3. **Remedial Action Options (appropriate for the site)** shall include:

   a. Evaluation of at least three remediation alternatives including the "no action" alternative. The justification for "no action" must be supported by either passing the general risk appraisal contained in Appendix B or providing a more detailed risk assessment. In the event that the site fails the general risk appraisal contained in Appendix B, the permittee may submit a more detailed risk

assessment as outlined in **pages 21 - 23** if "no action" is still desired as the final remediation activity.

b. A brief description, feasibility study, and cost analysis of each alternative.

c. Risks associated with the implementation of each alternative such as compromising the integrity of a building, exposing biological receptors, etc.

d. The alternatives may be presented in a form that ranks these alternatives based on the above criteria. The contractor must recommend one option that is best suited for the site.

e. Expected ranges of concentrations of contaminants that each remediation alternative is capable of treating.

f. An evaluation of the need for any monitoring wells and analysis during or after remediation.

NOTES:

1. **Hazardous Materials Management Program Staff are available for consultations during this selection period.**

2. **Appendix B may be copied and used as worksheet for the general risk appraisal.**

B. SITE CHARACTERIZATION REPORT INVOLVING GROUNDWATER.

In addition to the items required for the site characterization report involving soils only, the groundwater site characterization must also include at a minimum the following for review and approval by this Department.

1. Groundwater Investigation Results shall include:

a. Details of monitoring well installation such as number, depth, location and construction. Any changes or deviations from the workplan must be indicated.

b. Well development data such as volume purged, conductivity, pH, and temperature readings of the water.

c. Vertical and horizontal extent of groundwater contamination.

d. Depth and extent of floating product.

e. Contaminated aquifer gradient and regional gradient based upon the most recent data on depth to groundwater.

f. Extent of vapor plume.

g. Interpretation of groundwater analysis results and analytical data summarized in a table.

h. Estimates of liquid leaked and how it was determined.

i. All other aquifer data used to evaluate groundwater remedial actions.

j. The results obtained from the site characterization must be presented in figures and tables when appropriate.

2. Remedial Action Alternatives shall include:

a. Evaluation of feasible remediation options. These options may also be presented in a matrix highlighting the cost, time frames for completion, advantages and disadvantages specific to the site.

b. Field laboratory or pilot studies on the remediation process.

c. Past experience with the selected remediation method on sites with similar conditions if available.

REMEDIAL ACTION WORKPLANS/REPORTS

REMEDIAL ACTION PLAN

A remedial action plan shall be proposed based upon the site characterization results. In addition, there may be added requirements or reviews for a specific project by other agencies such as:

1. Regional Water Quality Control Board, if the contamination threatens or affects groundwater.

2. California Environmental Protection Agency, Department of Toxic Substances Control, if treatment, storage, disposal or transportation of a hazardous waste is required.

3. Kern County Air Pollution Control District or San Joaquin Valley Unified Air Pollution Control District if the plan involves any chemical emissions into the atmosphere.

The remedial action plan shall include the following:

1. Results of field and/or laboratory studies or proposed pilot study.

2. A detailed description of the approved remediation method including schematics and calculations for the entire remediation system.

3. Remedial activity details such as number, placement and construction design of recovery wells, pumping rate, soil to be excavated, layout of vent wells, biodegradation rates, etc...

4. Expected concentrations of contaminants after remediation.

5. Sampling and analysis plan to monitor performance of the remediation system and to verify remediation effectiveness.

6. Disposition of treated soil and/or water.

7. Health and Safety plan during remediation activities.

8. Discussion of implementation schedule including phases if appropriate.

9. The primary contractor and any subcontractors who will be involved in the remediation.

PROGRESS REPORT

A Progress Report must be submitted for remediation projects continuing over three months. The report shall include the following:

1. Changes or deviations from the approved remedial action plan and justification for any changes.

2. Data gathered during remediation activities.

3. Estimated time and concentrations remaining to be remediated, and basis for the estimations.

4. Problems encountered and corrective measures taken.

REMEDIAL ACTION REPORT

The remedial action report is prepared when it has been determined that the site has been remediated. This report shall include the following:

1. Brief summary of the project.

2. All data collected to verify that the site has been remediated.

3. A discussion and interpretation of the verification data, and the rationale for determining that the site has been remediated.

REMEDIAL ACTION ALTERNATIVES

The following is a list of currently available technologies that are used in remediating petroleum contaminated soil and groundwater. By providing the recommended information described below, KCEHSD's review time frame will be minimized and enhance the transfer of information.

A. NO ACTION

The "NO ACTION" may be proposed if the contamination found at the site is not significant. At sites where the levels are significant, the feasibility of leaving the contamination in place may be evaluated by first performing a general risk appraisal as shown in Appendix B of this handbook, then a detailed risk assessment, if necessary. The risk assessment shall address at a minimum, the potential migration routes, and the short and long term effects to public health and the environment.

B. CONTAINMENT

The containment of contamination in place will be approved after being determined through a risk assessment that migration of existing contamination will not be significant.

The site shall be graded and a base of Class II aggregate with a cap of asphalt concrete shall be applied. The cap shall extend well beyond the area of contamination, and sloped to prevent pooling of water or liquids on the surface. The cap shall also be adequately sealed after application and the integrity maintained. All potholes or cracks must be repaired immediately.

A qualified paving contractor must grade and apply the cap. It is recommended that a 4-inch asphalt concrete and an 8-inch aggregate base for heavy duty truck use be applied.

C. EXCAVATION

Excavation may be approved if demonstrated that removal of impacted soil is the most appropriate method to remediate the contamination based on economic and risk analysis results. The proposal must include the following information but not be limited to:

1. Excavation procedures including equipment to be used.
2. Area to be excavated and quantity of soil to be excavated.
3. Confirmatory sampling and analysis procedures.
4. Disposition of excavated soil such as:

Off-site Disposal/Treatment: Provide name and address of the disposal site or treatment company, type of treatment, name and address of the transporter and record of shipment (manifests).

Aeration: Refer to KCEHSD's Aeration Policy of Petroleum Contaminated Soil and Rule 4651 of the SJVUAPCD.

Enhanced Bioremediation (Landfarming Method): Provide location where soil will be landfarmed and the details of the bioremediation system (refer to page 18 for bioremediation reporting requirements).

D. VAPOR EXTRACTION

Vapor extraction may be approved if it can be demonstrated that subsurface soil conditions and contaminant properties are conducive to the method. The information that must be provided in the proposal shall include, but not be limited to:

1. Pilot study results or proposal to determine pertinent parameters such as radius of influence, hydraulic conductivity, pressure at well heads, etc.

2. Number of wells, their location, and construction design.

3. Detailed description and specifications of extraction and vapor treatment system.

4. Estimated time of cleanup and method of determination.

5. Method and frequency of monitoring the performance of the entire system.

E. ENHANCED BIOREMEDIATION

Enhanced bioremediation through landfarming or above ground application may be approved if it is determined by risk and cost analysis that this alternative is the most appropriate remediation technique for the site. The information that must be provided shall include, but not be limited to:

1. Site specific feasibility study results that demonstrate the applicability and efficiency of this method by either using indigenous or commercially available biocultures.

2. Information on commercial biocultures such as chemical additives, case histories, and manufacturer's brochures.

3. Details of the bioremediation system operation to include construction design, method of introducing biocultures or nutrients, method of aeration, mixing/tilling, and frequency of these activities.

4. Monitoring and verification sampling and analysis procedures.

NOTE: **In situ bioremediation will be considered only at sites where extensive data on the hydrogeology, physical, chemical properties of the contaminants, and any additives (nutrients, etc) that will be introduced have been determined. This method is not encouraged for mitigation of groundwater contamination applications because of several factors such as uncontrolled migration of contaminants, possible chemical transformations and hydrogeologic complexities which may result in further deterioration of groundwater quality.**

F. PUMP & TREAT

Pump & treat involves the pumping of contaminated water to the surface for treatment. The treated water may be discharged back to the aquifer or to the sewer after obtaining the appropriate discharge permits. When designing the groundwater pumping and discharge system, the extent of contamination, the hydrogeological, and chemical and biological characteristics of the area must be adequately assessed. The information that must be provided in the proposal shall include, but not be limited to:

1. Site specific data such as hydraulic conductivity, transmissivity, specific yield, porosity, aquifer thickness, and expected pumping rates. A pump test must be performed to determine relevant aquifer characteristics.

2. Details of the groundwater extraction system need to include pump specifications and performance data.

3. Details of the groundwater treatment method that will be used e.g., air stripping, bioremediation (reactors), carbon adsorption, etc.

4. Radius of influence, flow line arrival times, drawdown in extraction well, number of pore volumes to be flushed, and estimated cleanup time. Mathematical calculations performed manually or by computer models must be provided.

5. Disposition of the treated water.

6. Sampling plan to monitor compliance with discharge requirements and to evaluate the performance of the remediation system.

G. AIR SPARGING

In situ air sparging is a technique for remediating sites where groundwater is contaminated with volatile organic compounds. Air is injected into the saturated zone to enhance volatilization and aerobic biodegradation of the contaminants. It is usually used in conjunction with soil vapor extraction to capture the vapors and prevent off site migration.

When designing the in situ air sparging system, the extent of contamination, hydrogeologic, chemical and biological characteristics of the area must be adequately assessed. The following information that must be included in the proposal shall include, but not limited to:

1. Details of the air sparging system to include the number of wells, pump specifications, and air source.

2. Well locations, construction design, and casing materials.

3. Air flow rates including an estimation of the radius of influence.

4. Monitoring plan including an estimated cleanup time.

5. Remediation plan for the vadose zone that will be implemented in conjunction with air sparging such as soil vapor extraction or excavation.

Prior to initiating air sparging, groundwater needs to be tested for pH, total dissolved solids, and dissolved constituents such as iron, manganese, calcium, magnesium, and oxygen.

RISK ASSESSMENT GUIDELINES FOR CONTAMINATED SITES

This section was developed to help responsible parties (**RP**) and consultants comply with the Kern County Environmental Health Services Department's (**KCEHSD**) requirements for risk assessment (**RA**) at contaminated sites. It is intended to provide guidance in preparation of an acceptable risk assessment for determination of risks to human health (carcinogenic and non-carcinogenic risks) and the environment.

In order to provide a uniform format for the KCEHSD's review of the environmental fate, transport and risks, the following information must be provided in a risk assessment.

GENERAL REQUIREMENTS

1. The name and location of the site, the name, address and phone number of the company or individual preparing the RA must be included in the document.

2. The RA must be dated and bound.

3. The reason for performing a risk assessment.

4. The site characterization must be completed before preparing a RA.

5. If certain site specific parameters such as permeability, organic and moisture content, etc have not been determined, worst case or conservative values may be assumed. References and rationale for all assumptions must be provided.

6. All assumptions, sample calculations and final computer printouts must be submitted. Computer printouts must be limited to the input and output data for the initial and final year or "time interval". Computer printouts must be bound.

IDENTIFICATION AND EVALUATION OF RISK

1. **Site Assessment Results**

   a. Analytical results tabulated and illustrated in plan and cross-sectional views.

   b. Contaminants of concern.

   c. Average and highest concentration of contaminants.

   d. Soil and/or groundwater properties determined during assessment that are necessary for the environmental fate, transport and risk calculations such as hydraulic conductivity, porosity, organic and moisture content, etc.

2. **Contamination Migration Routes and Receptors**

   a. Identification and description of receptors, areas and environmental media (groundwater, atmosphere, surface water) that may be impacted.

   b. Description of potential migration routes or mechanisms including natural and man-made factors that may influence contaminant transport.

   c. Potential interaction of contaminants.

   d. Identification of exposure pathways (inhalation, ingestion, etc.) if a receptor may be involved.

3. **Estimation of Risks**

   a. Estimation of transport time of contaminants to a receptor and/or to the environment as determined by computer modeling or manual calculations.

   b. Concentration of contaminants that may potentially reach a receptor and/or the environment.

   c. Estimation or quantification of risk or exposure levels (noncancer and carcinogenic risk).

   d. Regulatory standards or guidelines on acceptable exposure levels, potency/slope factors (include references).

   e. Evaluation of the quantified risks (comparison between acceptable levels and calculated levels).

4. **Assumptions and Calculations**

   a. Description of the transport mechanism (diffusion, advection, etc.) and discussion of its applicability. Formulas used in manual or computer calculations must be included.

   b. Chemical properties of contaminants such as Henry's Law constant, diffusivity coefficients, molecular weight, vapor pressures, and water solubility.

   c. Atmospheric conditions such as temperature, and wind velocity.

   d. Soil parameters such as porosity, organic, and moisture content.

   e. Groundwater parameters such as hydraulic conductivity, permeability, depth, and gradient.

f. All parameters and scenarios that are utilized in the modeling or manual calculations must be summarized in drawings, figures or tables as appropriate. Rationale for all assumptions must also be presented.

g. For proprietary solutions or codes, sufficient information must be provided in order that the results may be reproduced using similar solutions. Uncommon abbreviations used in the computer program must be defined.

5. **Conclusion and Recommendation**

a. Discussion of the risk assessment results.

b. Discussion of the strengths and limitations of the risk assessment.

c. Conclusions and recommendations.

NOTE: **Performing a risk assessment does not assure the approval of the "NO ACTION" alternative or any proposed cleanup level. KCEHSD recommends that all applicable factors such as cost of each alternative be considered before selecting a remedial method.**

PERMIT REQUIREMENTS

PERMITS REQUIRED BY THE HAZARDOUS MATERIALS MANAGEMENT PROGRAM

A permit is required for:

1. groundwater monitoring wells
2. borings (test holes) that are drilled to groundwater

The number of wells and/or test holes, locations, and construction design associated with site assessment and remediation must be approved by HMMP-Enforcement prior to submitting the permit application. Permit applications can be obtained from KCEHSD and must be submitted at least 10 working days before the scheduled drilling date.

PERMITS REQUIRED BY OTHER AGENCIES

Other agencies that may require permits or authorizations (especially in the remediation phase) include, but are not limited to:

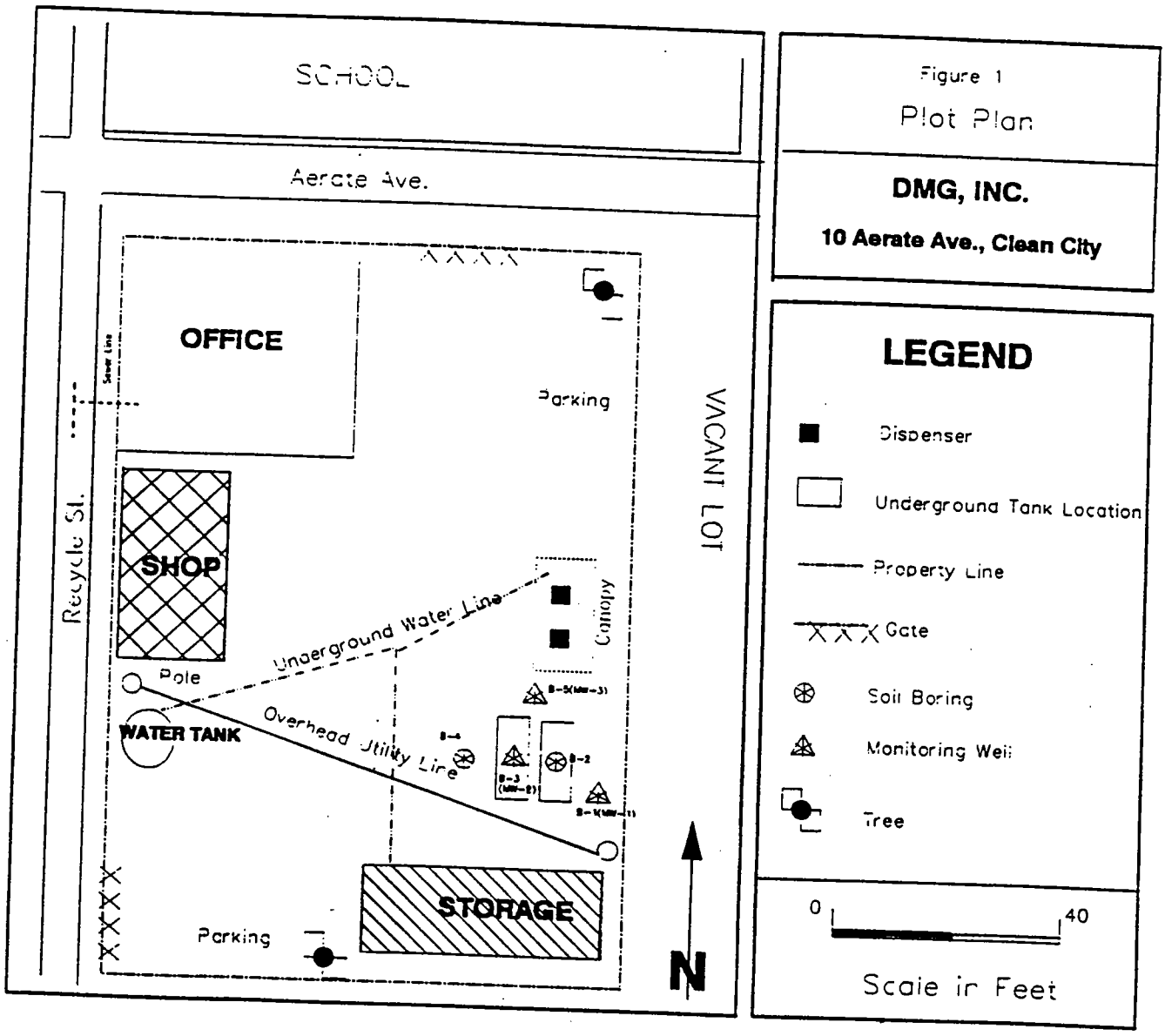
1. Cal-EPA Dept. of Toxic Substances Control for treatment of a hazardous waste.
2. Regional Water Quality Control Board for discharge of water or waste.
3. Air Pollution Control District for releases of chemicals into the atmosphere.
4. Public Works or Planning for grading permits, right-of-way, etc.

It is the responsibility of the responsible party and/or his contractor to obtain all necessary permits prior to beginning work.

APPENDIX A - SAMPLE DRAWINGS

SITE PLOT PLAN

The site plot plan must be drawn to scale and include all items listed in the Site Characterization Workplan requirements on page 9. Below is an example of a plot plan drawing.



"PLAN" AND "VERTICAL CROSS-SECTION" VIEWS OF THE CONTAMINATION PLUME

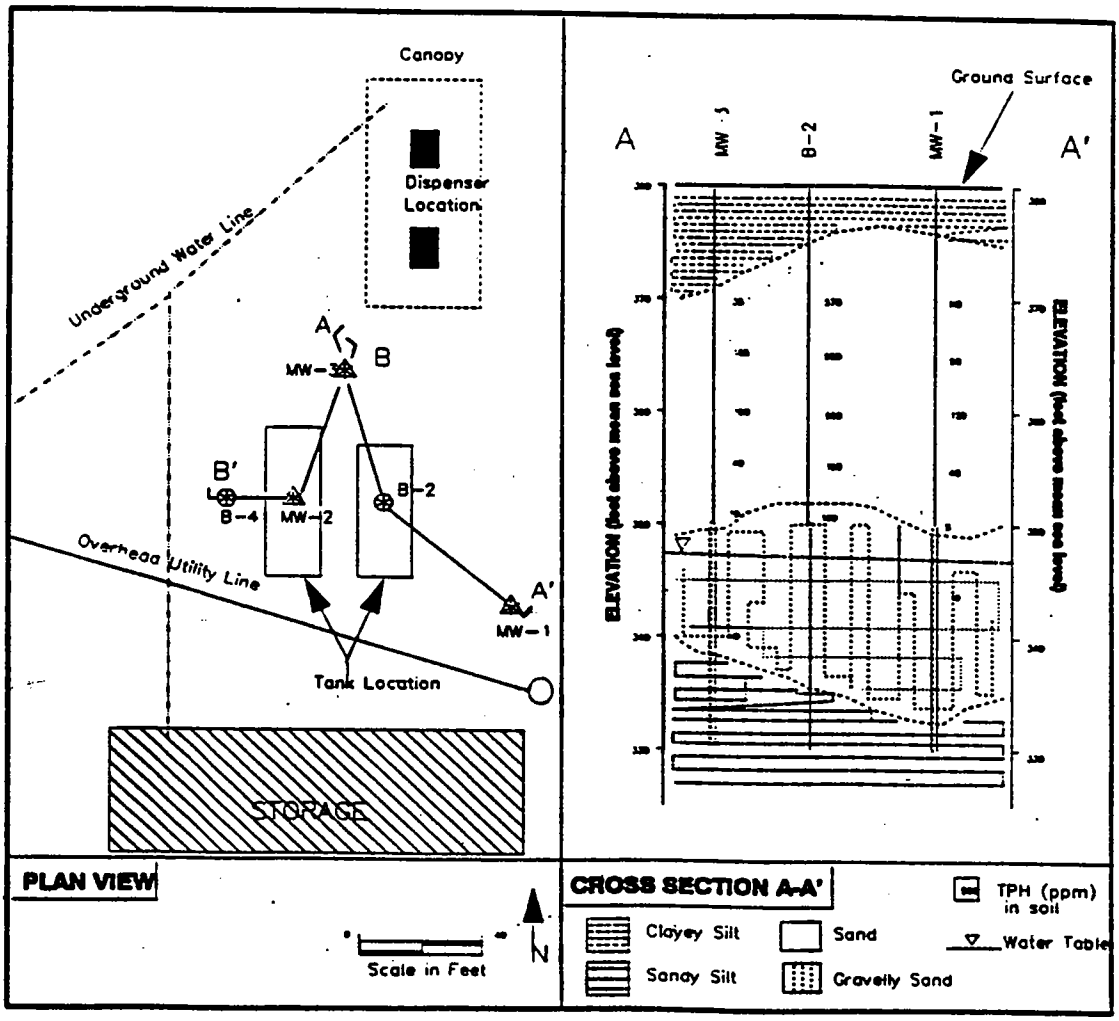
A "plan view" of the contamination plume is an overhead view of the lateral extent of the contamination plume.

A "vertical cross-sectional" view of the contamination plume is the cutaway view of the vertical and lateral extent of the contamination plume through the soil.

Both views must include all of the following:

- scale, north arrow, legend
- tank, piping, and dispenser location, buildings and structures
- lateral and vertical (on x-sectional view) extent of plume
- sample locations and contaminant concentrations shown
- significant soil changes with depth, groundwater depth

Below are simplified, basic examples of "plan" and "vertical cross-sectional" views of contaminant plume.



APPENDIX B - GENERAL RISK APPRAISAL

A. VAPOR MIGRATION TO THE SURFACE

Table 1

VAPOR MIGRATION TO THE SURFACE

	YES	NO
1. Is part or the entire contamination plume beneath or near (15 feet from edge of plume) a building?		
2. Is the contamination plume within 20 feet to ground surface?		
3. Is the contamination plume near (15 feet from edge of plume) potential subsurface confined spaces such as basements, sewers etc.?		
4. Are there subsurface conduits that will increase vapor migration to the surface?		
5. If "YES" to any of the above, are the concentrations (in soil) of: TPH(g) = or > 100 ppm TPH(d) = or > 1000 ppm BENZENE = or > 3 ppm TOLUENE, XYLENES or ETHYLBENZENE = or > 20 ppm	_____ _____ _____ _____	_____ _____ _____ _____

If "NO" to all of #5, proceed to Table 2 (Leaching Potential Analysis).

If "YES" to any of #5, the risks associated with possible vapor migration to the surface must be addressed. Both noncancer and cancer risks must be evaluated. If BENZENE was not detected, the excess cancer risk is not needed.

Regardless of whether #5 is "YES" or "NO", Table 2 (Leaching Potential Analysis) needs to be completed.

B. LEACHING POTENTIAL ANALYSIS (Table 2-1 from LUFT manual)

Table 2

SITE FEATURE		SCORE	SCORE 10 PTS IF CONDITION IS MET IS	SCORE	SCORE 9 PTS IF CONDITION IS MET	SCORE	SCORE 5 PTS IF CONDITION IS MET
Minimum Depth to Ground Water from the Soil Sample (feet)			>100		51-100		25-50\1
Fractures in subsurface (applies to foothills or mountain areas)			None		Unknown		Present
Average Annual Precipitation (inches)			<10		10-25		26-40\2
Man-made conduits which increase vertical migration of leachate			None		Unknown		Present
Unique site features: Recharge area, coarse soil, nearby wells, etc.			None		At least one		More than one
COLUMN TOTALS-TOTAL PTS			+		+		=
RANGE OF TOTAL POINTS		49 pts or more		41 - 48 pts		40 pts or less	
MAXIMUM ALLOWABLE B/T/X/E LEVELS (PPM)		1/50/50/50		.3/.3/1/1		NA/3	
MAXIMUM ALLOWABLE TPH LEVELS (PPM)	GASOLINE	1000		100		10	
	DIESEL	10000		1000		100	

\1 If depth is greater than 5 ft. and less than 25 ft., score 0 points. If depth is 5 ft. or less, this table should not be used.
\2 If precipitation is over 40 inches, score 0 points.
\3 Levels for BTX&E are not applicable at a TPH concentration of 10 ppm (gasol or 100 ppm (diesel)(For explanation see step 6, page 27.)

Source: October 1989 Version of Leaking Underground Fuel Tank Field Manual

If the BTXE & TPH levels are exceeded, the potential threat to groundwater may be further evaluated by performing a risk assessment.

NOTE: Guidelines on a detailed risk assessment are outlined in pages 21-23.

APPENDIX C - SAMPLING AND ANALYSIS GUIDELINES

In addition to sampling and analysis protocols describe in the EPA SW-846 and other approved publications, the following describes acceptable procedures for the type of investigation described in this booklet:

SOIL SAMPLING

A. CORE SAMPLES:

1. Collect undisturbed soil samples by using a split-barrel core sampler (California split spoon sampler) with stainless steel or brass tubes/cylinders.

2. There must be no headspace in the tubes. Cover with an acceptable material such as Teflon, then cap with the plastic lid.

3. The samples must be labeled and placed into a cooler immediately for delivery to the laboratory. A temperature of 4° C. (37° F.) must be maintained in the cooler at all times until delivery to the lab.

4. Follow the proper chain-of-custody procedures.

5. All sampling equipment must be properly decontaminated between samples.

6. Precautions should be taken to prevent cross contamination of equipment by site personnel.

B. SAMPLING SOIL PILES/EXCAVATION:

1. The collection of samples by inserting the sampling tube or glass jar into the soil pile should be performed to minimize the disturbance of the soil. Hand augers that can be fitted with sampling tubes may also be used.

2. There must be no headspace in the sampling containers.

3. Follow items #3 to 6 as described above in the core sampling.

4. The number of confirmatory samples to be retrieved from an excavation is determined based on site specific conditions. For soil stockpiles, one composite sample per 50 cubic yards is recommended.

GROUNDWATER SAMPLING

1. Wells must be developed/purged prior to sampling. The purging process must ensure that all stagnant water is replaced by fresh formation water.

   For low yield wells (yield less than 3 casing volumes): After evacuation of water to dryness, retrieval of a water sample should be based on the recovery rate.

   For high yield wells (yield over 3 casing volumes): Evacuate at least 3 casing volumes of water prior to sampling. The water stability must also be determined by measuring the pH, conductivity and temperature.

   For domestic wells: Site specific sampling requirements will be determined when required.

2. Groundwater samples must be retrieved within 24 hours after development.

3. The use of dedicated sampler for each well is preferred.

4. Acceptable protocols for field sampling such as labeling, preservation, and chain-of-custody procedures must be followed.

LABORATORY ANALYSIS

The following table summarizes the methods of analysis, preservation, etc that may be used as a reference in the investigation.

Table 3

METHODS FOR CHEMICAL ANALYSIS

CHEMICAL(CONTAMINANT)		MATRIX	METHOD	HOLDING TIME
GASOLINE/ DIESEL	BTX & E	Soil	8020. 8240. 8260	14 days until analysis
		Aqueous	602. 604	7 days – no pres.
		Drinking Water	503.1	7 days – no pres.
	TPH	Soil	8015M	14 days until analysis
		Aqueous	8015M	14 days until analysis
	ORGANIC OR TOTAL LEAD	Soil	DHS–LUFT	14 days until analysis
		Aqueous	DHS–LUFT	14 days until analysis
WASTE OIL	TRPH	Soil	418.1	14 days until extraction
		Aqueous	418.1	14 days until extraction
	TOX	Soil	9020	no specified time
		Aqueous	9020	7 days
	ORGANIC OR TOTAL LEAD	Soil	DHS–LUFT	14 days until analysis
		Aqueous	DHS–LUFT	14 days until analysis
SOLVENTS ETC	PURGEABLE HALOCARBONS	Soil	8010	14 days until analysis
		Aqueous	601	14 days
		Drinking Water	502.1	7 days
	VOLATILE ORGANICS	Soil	8240, 8260	14 days until analysis
		Aqueous	624	7 days – no pres.
		Drinking Water	503.1	7 days – no pres.
	SEMI–VOLATILE ORGANICS	Soil	8270	14 days until extraction
		Aqueous	625	7 days until extraction
	PCBs	Soil	8080	14 days until extraction
		Aqueous	608	7 days until extraction

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

All sampling activities must have a quality assurance program to verify data credibility. This program must be for field and laboratory work.

FIELD QA/QC

For QA/QC purposes, blank samples are prepared and analyzed to check for cross-contamination during sample collection, shipment, and in the laboratory. Blank samples are usually prepared for liquid samples and recommended for soil samples if cross-contamination is suspected. The following types of blanks may be used depending on the situation:

1. **Equipment Blank:** This sample is used to assess the caliber of field contamination procedures.

2. **Field Blank:** This sample is prepared when there is no need to decontaminate sampling equipment or use a sample collection vessel. This sample provides information on possible contamination of chemical preservatives, or contamination introduced during shipment or in the laboratory.

3. **Trip Blank:** This sample is used to detect any contamination that may have occurred during sampling and/or transportation. This sample is prepared only when no other type of blanks are available.

The following samples are also utilized for field quality control:

1. **Replicate Sample:** This sample determines the consistency of sampling procedures and analytical methods. One (1) replicate sample is usually obtained out of every ten (10) sampling points. At sites where there are fewer than ten (10) sampling points, at least one (1) replicate sample must be taken. The laboratory must not know the identity of the replicate sample.

2. **Split Sample:** This sample is obtained by dividing a sample and placing them into two containers for analysis by separate laboratories.

3. **Background Sample:** If necessary, a background sample is collected in an area not affected by site activities to establish background concentration levels. This sample is retrieved, sealed, labeled, packaged, and transported to the laboratory in the same manner as all the field samples.

A record of all sample identification numbers and chain of custody shall be maintained in the field notebook/log. All significant events, site conditions, and revisions during the field investigation shall also be recorded. All field procedures must be conducted by properly trained individuals.

LABORATORY QA/QC

All analyses must be performed by state certified laboratories. The laboratory quality control program shall include, but not limited to:

1. Daily checkout of the instrument.
2. Daily verification of instrument operational parameters.
3. Preparation of standard calibration curves.
4. Analysis of reagent blanks.
5. Analysis of duplicates and verification of repeatability of duplicate analysis.
6. Spiked sample recovery.
7. Preparation of control charts for determining warming and control units.

All analytical results must specify reporting units, detection levels, sample matrix, solids or moisture content (if applicable) and basis of analysis (wet-dry). In addition, all data validation must be submitted with the analytical results.

APPENDIX D - COMMON QUESTIONS AND ANSWERS

1. How much will all this work cost?

   There are many factors that influence the cost of this type of investigation. These factors include whether contamination threatens or has reached groundwater, public health and environmental risk at the site, appropriate remedial action options approved by regulatory agencies, and the scope of work required, i.e. number of reports/samples and type of equipment necessary.

2. Am I going to be required to remove all of the contamination?

   Not necessarily. There are several other remedial action options that are available depending on site conditions. All options for remediation must be submitted to Kern County Environmental Health Services Department following the guidelines described in this handbook.

3. Does the Environmental Health Services Department maintain a pre-approved list of environmental contractors?

   No. Since it is prohibitively burdensome to keep a current list, it would be unfair to new companies doing business in this area not to be included. For this reason, we suggest you call the state licensing boards for registered professionals and/or consult advertising sources such as the telephone book, newspaper, or trade publications for contractor contacts. Environmental Health Services does review the qualificatio of the contractor you select when proposals, reports, or studies are provided f review.

4. What is the Environmental Health Services Department's cleanup level in soil and groundwater?

   The cleanup levels are site specific. These levels are determined through the incorporation of federal, state and local agency standards. If the proposed cleanup levels are higher than regulatory standards, a risk assessment must be performed using expected and worst case assumptions.