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MOFFETT FIELD
SSIC NO. 5090.3

STATE OF CALIFORNIA — GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
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February 24, 1989
File No. 2189.8009 (LWT)

Mr. Alex E. Dong
Head, Environmental Restoration Section
Western Division, Naval
Facilities Engineering Command
P.O. Box 727
San Bruno, CA 94066-0720

Subject: Comments on "Removal Action Plan for Tanks 2, 14, 43, 53, 67, 68, and Sump 66" for Naval Air Station Moffett Field dated August 1988.

Dear Mr. Dong:

In general, the concept of the recommendation in the above plan for removal of the six tanks and one sump is acceptable. We understand that the scope of this action is limited to the removal of the tanks and sump and that investigation and final remediation of the soil and groundwater contamination caused by leaks from these units will be addressed as part of the overall RI/FS process. However, we have comments on the above plan that should be addressed before you proceed with the removal action. These comments are listed below.

1. The Removal Action Plan does not describe methods and procedures for sample collection, handling, preservation, and analysis, sample container and sampling equipment cleaning, and quality assurance. The methods and procedures to be used should be those specified in the approved Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) dated March 1988. The Removal Action Plan should reference the appropriate sections of the SAP and QAPP.

2. Section 3.3

   The Removal Action Plan references the Regional Board's "Guideline for Addressing Fuel Leaks" of September 1985. You should be aware that this document has been updated by "Regional Board Staff Recommendations for Initial Evaluation and Investigation of Underground Tanks" dated June 2, 1988. A copy of this document is enclosed for your use. The sections of the 1985 document not updated by the 1988 document (e.g. analytical procedures) are still valid. Both these documents are directly applicable only to motor vehicle fuel/oil contamination. They are not directly applicable to Tanks 2, 43, 67, 68 and Sump 66.

   The Removal Action Plan states that "... soil boring/monitoring well must be installed, or excavation should continue until levels below 100 ppm are met." This statement is not totally accurate. The necessity of soil/groundwater investigation is not dependent upon the amount of soil removed. According to the 1988 document, soil/groundwater investigation is required if any of the following conditions exists:

   - obvious tank system failure (i.e. hole or obvious leak),

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- there is $\geq$ 100 ppm TPH or O&G in the initial soil samples,
- detectable petroleum hydrocarbons in soils below the seasonal high groundwater level, or
- detectable petroleum hydrocarbons in the water in the excavation.

Regarding the 1000 ppm TPH, this concentration was set for reasons other than water quality protection. The 1988 document makes no mention of 1000 ppm for this reason. In most cases, the Regional Board's position has been to encourage soil excavation to nondetectable concentrations.

3. Section 4.1.2

In addition to the parameters listed, waste samples from the tanks or sump should be analyzed for Specific Conductivity and Ions as specified in the March 1988 SAP.

Please clarify the last paragraph of this section. Does "disposed of in accordance with Title 22 of the California Administrative Code" mean disposed of as a hazardous waste?

4. Section 4.1.5

All piping should be removed when possible.

5. Section 4.1.6

The photoionization detector to be used should be selected to ensure that it is capable of measuring the contaminants which will be present at each site. If a HNu is used, a 11.7 eV lamp should be used at Tanks 2, 43, 67, 68 and Sump 66 to allow detection of halogenated aliphatics.

Pursuant to the "Regional Board Staff Recommendations ..." June 2, 1988 document, the sidewall soil samples at Tanks 14 and 53 should be collected at the soil/groundwater interface at the sites where there is groundwater in the excavation. Additionally, soil samples should be collected every 20 lineal feet of pipe.

The analytical parameter for soils from around Tanks 2, 14, 43, and 53 should include PCB pursuant to the March 1988 SAP.

6. Section 4.1.8

Regarding disposal and analysis of groundwater within the excavation, see comment number 3, above.

7. Section 4.1.9

The method for compositing samples to get the "composite soil sample" from the excavated soil piles should be specified.

We do not recommend use of excavated soils containing less than 100 ppm TPH as backfill. The assumption here is that the excavated soils will be just slightly below 100 ppm TPH. This practice may be acceptable only at Tanks 14 and 53, and only if the insitu soils are at an equivalent TPH concentration. For the other tanks and sump 66, TPH will not represent fully the level of contamination of the excavated soils. We strongly encourage use of clean soils as backfill.

8. Section 4.1.10

   The equipment decontamination procedure specified in the Removal Action Plan is not equivalent to that specified in the March 1988 SAP. The procedures specified in the SAP should be used.

9. Section 4.2.2, see comment 3; Section 4.2.5, see comment 4; Section 4.2.7, see comment 5; Section 4.2.8, see comment 6; Section 4.2.9, see comment 7; and Section 4.2.10, see comment 8.

If you have any questions, please call Lila Tang at (415)464-0884.

Sincerely,

Steve Morse
Division Chief
South Bay Toxics Cleanup

Enclosure: "Regional Board Staff Recommendations for Initial Evaluation and Investigation of Underground Tanks," June 2, 1988

cc(w/o enclosure):
Michael Cain, Naval Air Station Moffett Field
Lewis Mitani, EPA
Don Cox, DHS
Russ Frazer, City of Mountain View
Charles Nicholson, Santa Clara County Health Dept.
Gil Torres, SWRCB
Tom Iwamura, Santa Clara Valley Water District
Jay Maille, City of Sunnyvale

REGIONAL BOARD STAFF RECOMMENDATIONS FOR INITIAL EVALUATION AND INVESTIGATION OF UNDERGROUND TANKS

2 JUNE 1988

Prepared by Staff of

North Coast Regional Water Quality Control Board
San Francisco Bay Regional Water Quality Control Board
Central Valley Regional Water Quality Control Board

REGIONAL BOARD STAFF RECOMMENDATIONS FOR INITIAL EVALUATION AND INVESTIGATION OF UNDERGROUND TANKS 2 JUNE 1988

INTRODUCTION

Chapter 6.7, Division 20 of the Health and Safety Code and the California Underground Storage Tank Regulations (Subchapter 16 of Title 23 of the California Code of Regulations), established a program for regulation of underground storage tanks which requires local implementing agencies to permit, inspect and oversee monitoring programs to detect leakage of hazardous materials from underground storage tanks. Cleanup of contaminated soil and ground water resulting from a leak or unauthorized discharge from an underground storage tank or appurtenant piping may be directed by the local implementing agency -- with or without a contract with the State Water Resources Control Board (SWRCB) -- or by the Regional Water Quality Control Board (Regional Board). In either case, the various agencies will coordinate to ensure that requirements from each agency are consistent.

This document contains recommendations for investigating underground tanks developed by staff from three Regional Boards which share common boundaries (North Coast, Region 1; San Francisco Bay Area, Region 2; and Central Valley, Region 5). Several technical documents have been prepared independently by local implementing agencies, Regional Boards, and SWRCB for evaluating and investigating underground tank leaks. The Leaking Underground Fuel Tank (LUFT) manual was recently developed as a state and local interagency guidance document limited primarily to motor vehicle fuel contamination of soils. This present staff recommendation document is intended to expand on and clarify, and, in some cases, present alternatives to several areas addressed in LUFT.

These recommendations are for the initial investigation of underground tank leak incidents and routine tank removals. They describe a systematic approach for determining which actions are required, including soil cleanup only or a more comprehensive soil/ground water investigation. Staff of Regions 1, 2, and 5 may consider other approaches which have demonstrated validity, but strongly encourage the use of the following guidelines during the preliminary site investigation in these Regions. The primary objective of this document is to provide uniform procedures for performing the investigation.

LEAD AGENCY

In cases where the results indicate that only the soil has been impacted, the appropriate local implementing agency may be the lead agency with the Regional Board in an advisory capacity as needed. If the ground water has been impacted then the lead agency will be either the Regional Board or local implementing agency. If non-fuel constituents are detected in the soil or ground water, the Regional Board will be the lead agency unless special arrangements are made. In all cases the local implementing agency and the Regional Board will coordinate as necessary to provide consistency and concurrence in the appropriate investigative and remedial actions proposed. [SUPPLEMENTS SECTION I.D OF LUFT]

REPORT REQUIREMENTS

ALL WORK AND REPORTS WHICH REQUIRE GEOLOGIC OR ENGINEERING EVALUATIONS AND/OR JUDGEMENTS MUST BE PERFORMED UNDER THE DIRECTION OF AN APPROPRIATELY REGISTERED OR CERTIFIED PROFESSIONAL. (See sections 6735, 7835, and 7835.1 of the Business and Professions Code). Also Rule 415 of the Professional and Vocational Regulations is to be followed which states:

> "A professional engineer...registered or licensed under this Code shall practice and perform engineering ...work only in the field or fields in which he is by education and/or experience fully competent and proficient."

A statement of qualifications for each lead professional should be included in all reports. Initial tank removal and soil sampling does not require such expertise; however, borehole and monitoring well installation and logging, and impact assessments do require such a professional. [SUPPLEMENTS SECTION II D.4.a.1 OF LUFT]

UNDERGROUND TANK INVESTIGATION PROCESS

Figure #1 titled "Underground Tank Investigation Process" shows the procedures to be followed to detect underground tank leaks and to conduct subsequent soil/ground water investigations. The following sections of this document explain these procedures and the rationale upon which they are based. The sections are organized to follow the progression of Figure #1. [SUPPLEMENTS SECTION II B.2.a OF LUFT]

For soil and ground water sampling procedures see Section II titled, "Routine Tank Removal Investigation", and Table #1 titled, "Sampling for Routine Tank Removals". For monitoring well construction details consult the LUFT manual or other appropriate references.

Underground tank leaks generally are detected by one of the following conditions:

1. Nuisance conditions,
2. Inventory reconciliation,
3. Confirmed failed tank system tests, or
4. During routine tank removal.

I. Fuel Leak Indicators

I.1. Nuisance Conditions

The Porter-Cologne Water Quality Control Act defines "nuisance" as anything which:

> "(1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, and (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal, and (3) occurs during or as a result of the treatment or disposal of wastes".

In the context of fuel leaks the term "nuisance conditions" refers to the discovery of fuel or fuel vapors which may be related to nearby spills or leaking underground storage tanks. Nuisance conditions can exist with either known or unknown sources. This document provides guidance for investigating the source of nuisance conditions. [SUPPLEMENTS SECTION II B.4.a OF LUFT]

When the source is not known, the initial step in the investigation is to identify the responsible party (or parties). Examples of nuisance conditions include discovery of vapors or free product in utility vaults, buildings, storm drains or sewers. A preliminary survey of the sites in the immediate vicinity may result in the identification of adjacent facilities that appear likely to have contributed to the observed nuisance

condition. In such instances it may be appropriate to limit the radius of search for other potential sources until the local facilities have been eliminated by more thorough investigation. [ADDS TO LUFT]

Note: The search procedures contained in Chapter III of the National Fire Prevention Association Manual 329, 1987 edition, are to be followed in attempting to locate the source(s).

Where no local source is immediately located, the next response by the local implementing agency should be to locate all fuel tanks within a 2000 foot radius. As the fuel tanks are located, the responsible party for each tank, or tank cluster, is to be notified to review inventory records for the previous six months for each tank, as well as the history of tank/piping repairs or previous fuel leak cleanups. The results of the inventory review are to be summarized and submitted to the local implementing agency along with the history of leaks or repairs. Those facilities whose inventories reveal losses, and those with inadequate inventory records, will be required to perform Precision Tests of tanks and piping (See NFPA 329, Chapter 4). [ADDS TO LUFT]

If the inventory review does not locate potential sources of the nuisance conditions, then all facilities will be required to conduct a Precision Test unless this test was performed within six months prior to leak discovery. (To simplify this investigation phase, it is suggested that the local implementing agency work in concentric radii from the source point by having those nearest the nuisance area conduct the work.) [ADDS TO LUFT]

Based on the results of the inventory reconciliation, repair leak history and precision tests, two basic responses by the local implementing agency are possible:

A. Some facilities will show no inventory loss, pass the precision test and will have an acceptable history of repairs or leaks. For these facilities additional investigation is not necessary unless all facilities within 2000 feet meet these conditions. In this case those facilities closest to the nuisance conditions will be required to conduct an initial soil/ground water investigation. [ADDS TO LUFT]

B. All facilities which have a confirmed inventory loss or tank system test failure per Subchapter 16, Section 2644 will be required to conduct an initial soil/ground water

investigation. Those facilities with a history of repair(s) and/or leak(s) may also be required to perform an initial soil/ground water investigation. At those sites where an initial investigation is necessary, the responsible party is to follow the procedures outlined in Section III below. [ADDS TO LUFT]

I.2. Inventory Losses

Subchapter 16 designates inventory reconciliation as a component of several monitoring alternatives. Section 2644 of Subchapter 16 describes inventory reconciliation procedures and tank system failure criteria. If an inventory loss is confirmed per Section 2644 then the responsible party must immediately abate the leak. At this point the responsible party has two options:

A. In some circumstances Subchapter 16 and local fire regulations may allow the tank system to be repaired and operation to continue. However, a soil/ground water investigation must be conducted (See Section III). [ADDS TO LUFT]

B. The tank can be removed per local agency or Subchapter 16 requirements and the routine tank removal investigation procedures outlined in Section II are to be followed. [ADDS TO LUFT]

I.3. Confirmed failed tank system test

Subchapter 16 delineates monitoring alternatives for underground storage tanks. Underground storage tank precision testing is included in several of these alternatives. Section 2643 of Subchapter 16 outlines the specific criteria for evaluating failure of underground storage tank systems. If a leak has been confirmed per Section 2643, then the responsible party must immediately abate the leak (All tank test results are to be reported to the local agency). At this point the responsible party has two options:

A. In some circumstances Subchapter 16 and local fire regulations may allow the tank system to be repaired and operation to continue. However, a soil/ground water investigation must be conducted (See Section III). [ADDS TO LUFT]

B. The tank can be removed per local agency or Subchapter 16 requirements and the routine tank removal investigation

procedures outlined in Section II are to be followed. [ADDS TO LUFT]

II. Routine Tank Removal Investigation

When any underground storage tank is removed, whether for permanent site closure or tank replacement, the responsible party is to demonstrate that no unauthorized release from the tank has occurred. At a minimum a visual inspection of the tank system, and soil samples (and ground water samples when appropriate) are required. Laboratory analyses of samples are necessary to comply with the provisions of Subchapter 16. Field vapor detection methods are neither reproducible nor quantifiable. **Laboratory analyses are required for closure decisions.** However, the field vapor methods can provide some additional confidence for tank pit closure. [SUPPLEMENTS SECTION II C.1 OF LUFT]

A visual inspection of the tank and excavation must be conducted upon tank removal. All external tank surfaces and fittings are to be inspected for evidence of holes or leakage. The results of such inspection are to be documented in writing, with photographs where appropriate.

II.1. Obvious Tank System Failure

If a tank system failure is evident, a soil/ground water investigation is necessary. Holes in tanks or piping and stained soil beneath loose fittings are examples of evidence for tank system failures. (See Section III).

II.2. No Obvious Tank System Failure

Soil and/or ground water verification samples from the tank excavation are to be analyzed IN A STATE CERTIFIED LABORATORY. The number of soil samples and required Minimum Verification Analyses, are delineated in Tables 1 & 2 respectively.

These results are used in conjunction with other factors such as permeability of the soil, and residual soil contamination, to determine whether further action is required. Each case will fall into 1 of 3 groupings:

CASE #1: soil/ground water investigation required;
CASE #2: no further action required;
CASE #3: site specific analysis required.

[CASES 1 & 2 ARE DIFFERENT FROM LUFT REQUIREMENTS IN SECTION II D.1.a OF LUFT, WHILE CASE 3 IS NOT ADDRESSED BY LUFT]

CASE #1
Soil/Ground water Investigation Required

A soil/ground water investigation, as described in Section II.2, is required if ANY of the following conditions are found:

A. The concentration of either total petroleum hydrocarbon and/or total oil and grease is greater than 100 ppm in soil samples within the first two feet of native soil beneath the tank.

Local Implementing Agency and Regional Board experience has shown generally that large discharges are likely to have occurred when levels of contamination exceed 100 ppm in the soil.

NOTE: THE 100 PPM LEVEL IS NOT A CLEAN-UP LEVEL. THE ORIGIN OF THE 100 PPM LEVEL WAS TO DEVELOP A METHOD TO PRIORITIZE THE CASE LOAD AND INDICATE WHETHER A SIGNIFICANT VOLUME OF FUEL HAD BEEN RELEASED OR DISCHARGED. THE LEVEL OF CLEAN-UP IS TO BE DETERMINED BY ASSESSING THE POTENTIAL IMPACT OF RESIDUAL SOIL CONTAMINATION ON THE GROUND WATER. IN MANY INSTANCES IT MAY NOT BE APPROPRIATE TO LEAVE SOIL IN-PLACE WHICH IS CONTAMINATED WITH TOTAL PETROLEUM HYDROCARBONS OR OTHER COMPOUNDS AT ANY CONCENTRATION.

B. Detectable concentrations of any petroleum hydrocarbons are verified in the soil at or below the seasonal high ground water level. Sidewall samples, in addition to samples from the base of the excavation may be taken to verify that *no* lateral migration of the pollutants has occurred. If detectable petroleum hydrocarbons are found in these sidewall samples, then a soil/ground water investigation is required.

Ground water levels may fluctuate significantly from the wet to the dry season. The presence of contaminated soil at or below the seasonal high ground water level indicates the possibility that the ground water has or will have come into contact with this soil and thus become contaminated. Therefore, a soil/ground water investigation is appropriate.

Note: In the event the seasonal high ground water level is located in the backfill, this condition may not be

applicable if the soil samples from two feet below the backfill and from the side walls show no contamination. (i.e. the contamination was restricted to backfill material only).

The following may be acceptable sources of the depth to ground water data:

- Borehole logs or monitoring well data from the site.
- Existing reports on adjacent sites which provide representative data.
- Site specific data on depth to ground water from local departments of public works, or county water studies (not California Department of Water Resources regional water table data or general U.S. Geological Survey data, etc.).

Note: Data must include information concerning the depth to first ground water during the wet season. Regional maps and other non-site specific materials may not be appropriate.

C. Detectable levels of any petroleum hydrocarbons are found in the soil sample(s) beneath the tank, within the first two feet of native soil and the soil contains layers of sand, gravel, and/or other high permeability material.

Pollutants are known to migrate rapidly through soil containing layers of sand, gravel and/or other highly permeable material (such as fractured bedrock). Therefore, Regional Board staff concur that any detectable level of petroleum hydrocarbons in soil containing high permeability layers may indicate a ground water problem and, further investigation is warranted (Section III).

D. The ground water has potentially been impacted as evidenced by detectable levels of petroleum hydrocarbons in the water sample(s) from the tank excavation.

Water samples and analyses are required when there is ground water in the tank excavation (Section III). Detectable levels of petroleum hydrocarbons in the water in the excavation are an indication that the ground water has been impacted. Therefore, a soil/ground water investigation is required.

CASE #2
No Further Action Required

A ground water investigation is not required when all of the following conditions are met:

A. The total petroleum hydrocarbon and/or total oil and grease levels are less than 100 ppm in the soil samples beneath the tank, within the first two feet of native soil.

NOTE AGAIN THAT THE 100 PPM LEVEL IS NOT A CLEAN-UP LEVEL. THE ORIGIN OF THE 100 PPM LEVEL WAS TO DEVELOP A METHOD TO PRIORITIZE THE CASE LOAD AND INDICATE WHETHER A SIGNIFICANT VOLUME OF FUEL HAD BEEN RELEASED OR DISCHARGED. THE LEVEL OF CLEAN-UP IS TO BE DETERMINED BY ASSESSING THE POTENTIAL IMPACT OF RESIDUAL SOIL CONTAMINATION ON THE GROUND WATER. IN MANY INSTANCES IT MAY NOT BE APPROPRIATE TO LEAVE SOIL IN-PLACE WHICH IS CONTAMINATED WITH TOTAL PETROLEUM HYDROCARBONS OR OTHER COMPOUNDS AT ANY CONCENTRATION.

B. No detectable residues for petroleum hydrocarbons are found in the soil at/below the seasonal high ground water level.

NOTE: In the event the seasonal high ground water level is located in the backfill, this condition may not apply. At the discretion of the local agency, in addition to the samples from the base of the excavation, sidewall samples from the excavation may be taken to verify that no lateral migration of pollutants has occurred.

C. The soil has low permeability; predominantly silt and clay with no sand and/or gravel layers.

D. The ground water has not been impacted as evidenced by non-detectable levels of petroleum hydrocarbons in the water sample(s) from the tank excavation.

Regional Board staff concur that if the above conditions are satisfied the site should not pose a significant water quality threat. However, conditions may exist, i.e. an extremely sensitive site, where additional investigation is appropriate.

CASE #3
Site Specific Analysis Required

Whenever solvents or non-fuel contaminants are detected in the soil or ground water, further work will be required on a site specific basis. Generally, a soil/ground water investigation will be required.

III. Soil/Ground Water Investigation

As indicated in Figure #1, a soil or ground water investigation is required in any of the following instances:

- Source identified through nuisance conditions
- Inventory loss confirmed per Subchapter 16 (without tank removal)
- Confirmed failed tank system test (without tank removal)
- Leak confirmed during routine tank removal inspection procedures.

These investigations are divided into the following two categories, based on the general depth to ground water from ground surface:

Category #1: **Seasonal high ground water less than 50 feet (Shallow Ground Water).**

Category #2: **Seasonal high ground water greater than 50 feet (Deep Ground Water).**

[CATEGORY #1 AND CATEGORY #2 CLASSIFICATIONS ARE DIFFERENT FROM THE LUFT LEACHING POTENTIAL ANALYSIS]

The intent of these divisions is to insure the protection of the shallow ground water zones while allowing flexibility in situations where the ground water zone is deep and less likely to be impacted by leaks from underground storage tanks. The bottoms of large underground storage tanks are usually located 10-15 feet below the surface. Therefore "deep" ground water has a minimum 35-40 foot buffer zone from the tank bottom to the ground water. Regional Board staff believe that this zone may, in specific instances, adequately prevent pollutant migration into the ground water. Therefore, in cases where the depth to ground water is greater than 50 feet, a site specific approach is warranted. [LUFT REQUIRES REGIONAL BOARD CONCURRENCE]

III.1. Seasonal High ground water less than 50 feet

In cases where a soil/ground water investigation has been required and the depth to the seasonal high ground water is less than 50 feet, the responsible party must complete the following work (See Section III, and the LUFT manual for details concerning soil sampling and monitoring well construction):

III.1.a. Soil samples to determine the extent of the soil contamination

Soil samples are to be taken to determine the extent of soil contamination. During the construction of all monitoring wells and boreholes, soil samples are to be taken at a minimum of every five feet in the unsaturated zone and at any changes in lithology. For construction of the monitoring well (See III.1.b) within 10 feet of the contaminant source, all samples collected are to be analyzed in the laboratory for the appropriate constituents (Table #2). For soil samples from additional monitoring wells, field meters may be used as a screening device only. Confirming laboratory analyses must be performed.

Soil samples taken during monitoring well construction may not be adequate to define the extent of soil contamination. Additional boreholes, soil sampling, and analyses may be necessary.

III.1.b. Install one monitoring well within 10 feet of the tank in the verified downgradient direction.

If the verified downgradient direction has been previously determined at this site or at adjacent sites which provide representative data, then for this initial investigation, only one monitoring well within 10 feet of the tank, in the verified downgradient direction, will be required. The verified downgradient direction in these previous investigations must have been determined using data from a minimum of three monitoring wells, piezometers or other appropriate techniques. Monitoring wells and piezometers should be completed in the same water-bearing zone and constructed in the same manner. If verified downgradient direction data is not available, then a minimum of three monitoring wells will be required to determine the verified downgradient direction. [SUPPLEMENTS SECTION II D.6.a OF LUFT]

III.2. Seasonal high ground water greater than 50 feet

In cases where a soil/ground water investigation has been required and the depth to the seasonal high ground water is greater than 50 feet, the responsible party must complete the following work:

III.2.a. Determine the extent of the soil contamination.

Field meters are acceptable screening tools, but laboratory analysis of soil samples are required for verification of the extent of soil contamination. [SUPPLEMENTS LUFT SECTION II C.2]

III.2.b. Install monitoring well(s) per Regional Board guidance.

The Regional Board will assess the necessity of monitoring wells on a site-specific basis.

GROUND WATER MONITORING REQUIREMENTS

If ground water contamination is not discovered, some minimum ground water monitoring may still be required depending on the depth of the soil contamination. Ground water monitoring frequency and analyses will be established by the local agency with Regional Board concurrence.

If ground water contamination is discovered and/or floating product is found, a monitoring well sampling frequency must be established with Regional Board staff concurrence. Monitoring well sampling is to occur on a frequency based on the site and vicinity characteristics. It may be appropriate to begin with weekly sampling of the water level, free product and dissolved constituents, with the frequency reduced to a monthly or quarterly interval as sufficient information is collected. Quarterly monitoring is the maximum sampling interval typically allowed when ground water contamination is present unless other arrangements are made with Regional Board staff. [ADDS TO LUFT]

SOIL AND GROUND WATER SAMPLING AND ANALYSIS FOR ROUTINE TANK REMOVALS

Table #1, titled "Sampling For Routine Tank Removals", specifies the minimum number and location of soil and ground water samples

to be taken upon routine tank removal. The number of samples and the location of the samples varies depending on the tank size. The number of samples required was calculated in accordance with Subchapter 16, Section 2672d.1 specifications. The chart presents two cases: Case A (no water in excavation), only soil samples are required; and Case B (ground water in excavation), both soil and ground water samples are required. The following sections explain soil and ground water sampling procedures. [ADDITIONAL TO LUFT]

CASE A

Water is Not Present in the Tank Pit - Soil Samples Required

Soil samples are to be collected from beneath the tank pit a maximum of two feet into the native soil. The location and number of samples is specified in Table #1. If obviously stained or contaminated areas are detected in locations other than the specified locations, then additional soil samples are to be taken from the stained or contaminated areas.

Samples are to be taken using a driven-tube type sampler, capped and sealed with inert materials (see below), and extruded in the lab in order to reduce the loss of volatile materials. Formal signed chain-of-custody records are to be maintained for each sample and submitted with the analytical results to the regulating agency. [SUPPLEMENTS SECTION II D.1.a & b OF LUFT]

The following alternative sampling method may be used if samples cannot be safely collected from the excavation by the above method:

- Immediately upon removal of the tank, a backhoe bucket of native soil from each sample location is to be taken from the native soil/backfill interface. This soil is to be rapidly brought to the surface.

- Approximately three inches of soil is to be rapidly scraped away from the surface, then a clean brass tube (at least three inches long) is to be driven into the soil with a suitable instrument (e.g. a wood mallet or hammer). The ends of the tube are covered with aluminum foil, then plastic end caps, and finally wrapped with a suitable tape such as duct tape. Once properly capped, the samples are to be immediately placed on ice, or dry ice, for transport to a laboratory. Formal chain-of custody records must be maintained and submitted for each sample.

All piping must be removed and soil samples taken every 20 lineal feet. Soil samples from piping trenches are to be collected in tubes, capped, stored, and transported as described above.

Soil samples are to be analyzed for the appropriate Minimum Verification Analyses specified in Table #2.

CASE B

Water Present in the Tank Pit - Soil and Water Samples Required

If water is present in the tank pit, both soil AND water samples are required. The soil samples are to be taken by the methods outlined in Case A above, from the wall of the tank pit at the soil/ground water interface at the tank ends.

Water samples are to be taken as follows:

Prior to sampling the water from the tank pit for analysis, a visual observation is to be made for evidence of floating product. All observations are to be recorded.

The tank pit may be purged and allowed to refill before sampling. (The purged water may be stored in drums for disposal or discharged to the sanitary sewer if permission is granted. HOWEVER, IT IS NOT TO BE DISCHARGED TO A STORM DRAIN WITHOUT PRIOR PERMISSION OF THE REGIONAL BOARD.)

Water samples are to be taken which are representative of water in the tank pit. Generally, one water sample is adequate; however, more may be necessary to adequately characterize the water in the tank pit. Samples may be taken manually at the edge of the tank pit, both surface and about 12 to 18 inches below the water surface. However, the sample is to be taken with a device designed to reduce the loss of volatile components. A bailer with a sampling port is a suitable sampling device.

The water is to be transferred into a volatile organic analysis (VOA) vial with as little agitation as possible. A teflon (Registered trademark) septum is to be used to seal the vial. [ADDS TO LUFT]

Soil and water samples are to be analyzed for the appropriate Minimum Verification Analyses specified in Table #2.

TABLE #1

SAMPLING FOR ROUTINE TANK REMOVALS
2 JUNE 1988

CASE A: WATER NOT PRESENT IN TANK PIT

1) REMOVE A MAXIMUM OF TWO FEET OF NATIVE SOIL BEFORE SAMPLING.

2) IF AREAS OF OBVIOUS CONTAMINATION ARE OBSERVED, THEY ARE TO BE SAMPLED.

TANK SIZE	MINIMUM NUMBER OF SOIL SAMPLES	LOCATION OF SOIL SAMPLES
LESS THAN 1000 GAL.	ONE PER TANK	FILL OR PUMP END OF TANK
1000-10,000 GAL.	TWO PER TANK	ONE AT EACH END OF TANK
GREATER THAN 10,000 GAL.	THREE OR MORE PER TANK	ENDS AND MIDDLE OR GENERALLY SPACED ALONG THE LENGTH OF THE TANK
PIPING	ONE	EVERY 20 LINEAL FEET

CASE B: WATER PRESENT IN TANK PIT

1) THE TANK PIT MAY BE PURGED AND ALLOWED TO REFILL BEFORE SAMPLING. THE PURGED WATER IS TO BE HANDLED CORRECTLY.

2) THE WATER SAMPLE IS TO BE REPRESENTATIVE OF WATER IN THE TANK PIT.

TANK SIZE	MINIMUM NUMBER OF SOIL SAMPLES	LOCATION OF SOIL SAMPLES	MINIMUM NUMBER OF WATER SAMPLES
10,000 GAL. OR LESS (SINGLE TANK)	TWO	FROM WALL NEXT TO TANK ENDS AT SOIL/GROUND WATER INTERFACE	ONE
GREATER THAN 10,000 GAL. OR TANK CLUSTER	FOUR	FROM WALL NEXT TO TANK ENDS AT SOIL/GROUND WATER INTERFACE	ONE

TABLE #2
REVISED 6 OCTOBER 1988

RECOMMENDED MINIMUM VERIFICATION ANALYSES FOR UNDERGROUND TANK LEAKS

HYDROCARBON LEAK	SOIL ANALYSIS		WATER ANALYSIS	
Unknown Fuel	TPH G	GCFID(5030)	TPH G	GCFID(5030)
	TPH D	GCFID(3550)	TPH D	GCFID(3510)
	BTX&E	8020 or 8240	BTX&E	602 or 624
Leaded Gas	TPH G	GCFID(5030)	TPH G	GCFID(5030)
	BTX&E	8020 or 8240	BTX&E	602 or 624
	---Optional---		TEL	DHS-LUFT
	TEL	DHS-LUFT	EDB	DHS-AB1803
	EDB	DHS-AB1803		
Unleaded Gas	TPH G	GCFID(5030)	TPH G	GCFID(5030)
	BTX&E	8020 or 8240	BTX&E	602 or 624
Diesel	TPH D	GCFID(3550)	TPH D	GCFID(3510)
	BTX&E	8020 or 8240	BTX&E	602 or 624
Jet Fuel	TPH D	GCFID(3550)	TPH D	GCFID(3510)
	BTX&E	8020 or 8240	BTX&E	602 or 624
Kerosene	TPH D	GCFID(3550)	TPH D	GCFID(3510)
	BTX&E	8020 or 8240	BTX&E	602 or 624
Fuel Oil	TPH D	GCFID (3550)	TPH D	GCFID(3510)
	BTX&E	8020 or 8240	BTX&E	602 or 624
Chlorinated Solvents	CL HC	8010 or 8240	CL HC	601 or 624
	BTX&E	8020 or 8240	BTX&E	602 or 624
Non Chlorinated Solvents	TPH D	GCFID(3550)	TPH D	GCFID(3510)
	BTX&E	8020 or 8240	BTX&E	602 or 624
Waste Oil or Unknown	TPH G	GCFID(5030)	TPH G	GCFID(5030)
	TPH D	GCFID(3550)	TPH D	GCFID(3510)
	O & G	503D&E	O & G	503A&E
	BTX&E	8020 or 8240	BTX&E	602 or 624
	CL HC	8010 or 8240	CL HC	601 or 624
	---If any of the above detected, include:---			
	ICAP or AA TO DETECT METALS: Cd, Cr, Pb, Zn			
	METHOD 8270 FOR SOIL OR WATER TO DETECT:			
	PCB		PCB	
	PCP		PCP	
	PNA		PNA	
	CREOSOTE		CREOSOTE	

EXPLANATION FOR TABLE #2: MINIMUM VERIFICATION ANALYSIS

1.TOTAL PETROLEUM HYDROCARBONS (TPH) as gasoline (G) and diesel (D) ranges (volatile and extractible, respectively) are to be analyzed and characterized by GC FID with a fused capillary column. They are to be prepared by EPA method 5030 for volatile hydrocarbons, or extracted from soil by sonication using 3550 methodology, or extracted from water by liquid-liquid extraction using methodology 3510 for extractible hydrocarbons.

2.TETRAETHYLLEAD (TEL) may be analyzed as total lead. However, a confirming analysis must be completed using a soil sample at the same soil depth in another borehole, or for water, from an upgradient well that is not contaminated with hydrocarbons.

3.CHLORINATED HYDROCARBONS (CL HC) are analyzed by EPA method 8010 or 601, and requires second column confirmation, or by method 8240 or 624, and requires identification of the ten highest peaks not on the routine list.

4.BENZENE, TOLUENE, XYLENE AND ETHYLBENZENE (BTX&E) are analyzed by EPA method 8020 or 602, and requires second column confirmation, or by method 8[illegible]) or 624.

5.OIL AND GREASE (O & G) may be used when heavy, straight chain hydrocarbons may be present. Infrared analysis by method 418.1 may also be acceptable for O & G if proper standards are used.

6.To avoid false positive detection of benzene, benzene-free solvents are to be used. Fused capillary columns are preferred to packed columns; a packed column may be used as a "first cut" with "dirty" samples or once the hydrocarbons have been characterized and proper QA/QC is followed.

7.For DRINKING WATER SOURCES, EPA recommends that the 500 series for volatile organics be used in preference to the 600 series because the detection limits are lower and the QA/QC is better.

8.For all analyses on Table #2, appropriate standards are to be used for the material stored in the tank. For instance, seasonally, there may be five different jet fuel mixtures to be considered.

9.Other methodologies are continually being developed (such as cryogenic focusing), and as they are accepted by EPA and DHS, they may also be used pending Regional Board prior approval.

FIGURE #1 — UNDERGROUND TANK INVESTIGATION PROCESS

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