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REPORT: PHASE 3 PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT LATHROP PROPERTY EMERYVILLE, CALIFORNIA

Prepared for

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2000 Powell Street, Suite 1660
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June 16, 1989

Prepared by

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EXECUTIVE SUMMARY

1.1 INTRODUCTION

Woodward-Clyde Consultants (WCC) was retained by Mr. Thomas N. Lathrop in January 1989 to perform a preliminary environmental site assessment of a parcel of land in Emeryville, California (referred to as the "Lathrop property" and "site" herein). The purpose of the project was to investigate the potential presence of toxic substances in preparation for refinancing a portion of the developments located on the Lathrop property.

Three phases of work have been completed. Phase 1, reported previously, was a historical review of site development, a literature search for nearby toxics cases and an evaluation of the potential for site contamination. Phase 2, also reported previously, was a limited subsurface investigation of soil and groundwater, including soil and groundwater sampling and chemical analysis. Phase 3, reported herein, included verification water sampling and chemical analysis, a hydrogeological investigation and an exposure assessment to investigate potential risk to persons using the site. After discussing the conclusions of Phase 3, the findings of each phase of work are summarized in this Executive Summary.

1.2 CONCLUSIONS FROM PHASE 3 INVESTIGATION

The exposure assessment task in Phase 3 was performed to evaluate the possibility of human exposure to hazardous substances. The conclusion is that there is no significant threat to persons at the site, either working in the office buildings or maintaining the property. Workers in excavations extending more than 3 feet below grade may be exposed and should follow project-specific health and safety plans.

The verification sampling and analysis study confirmed that at least 6 of the 22 chemical substances (or groups) detected in both January and May 1989 groundwater samples are present at concentrations exceeding both U.S. EPA or State Drinking Water Standards or San Francisco Bay Basin Plan Effluent Criteria. These substances are arsenic, benzene, lead, phenols polynuclear aromatic hydrocarbons (PNAs) and zinc. It should be noted that groundwater beneath the site is not likely to be considered drinking water by regulatory agencies, due to its naturally brackish nature and the presence of contaminants. The drinking water standards are, however, a commonly invoked water quality criteria when performing preliminary assessments such as this project is intended to be.

Several other substances exceeded drinking water or Basin Plan standards and criteria in one of the two sampling rounds. A general increase in concentration levels was observed in the second sampling. For many chemical substances detected, no federal or state comparison criteria have been established at this time, to our knowledge. The impact of these chemicals on the environment must be assessed based site-specific on toxicological, health risk and beneficial water use studies.

Leakage of site groundwater into the waters of San Francisco Bay is possible, based on results of permeability calculations performed as part of this project. Detection and confirmation of potential off-site movement of contaminated site groundwater has not been performed. If such movement is occurring, it most likely is either north or south from the site toward the bay. In order to investigate this possibility, a program of biological monitoring, along the north shore of the Lathrop property where it borders San Francisco Bay, may be desirable.

1.3 SUMMARY OF PHASE 1: HISTORICAL REVIEW

The purpose of the Phase 1 study was to gather information about the site history in relation to past site uses and the potential for hazardous substances in the subsurface. Because of the known site history such substances were suspected. Therefore an additional purpose was to develop a chemical analysis program appropriate to the nature of the suspected chemical contaminants and develop a soil and groundwater monitoring well construction program to gather the necessary samples. A general description of the Phase 1 findings follows.

A site reconnaissance did not reveal surface indications of possible contamination. The buildings, parking lots and landscaped areas appeared to be well maintained. No hazardous waste storage areas were seen.

Two double-walled underground fuel storage tanks currently in use were identified. Management reported that fuel inventory and tank test records showed the tanks and associated piping to be sound. Subsequent to submittal of the Phase 1 report, the property managers reported that the tanks had received valid operating licenses.

A preliminary asbestos inspection was performed on Tower I. Asbestos was suspected since construction took place in the early 1970's when asbestos was a common element of composite building materials. The inspection revealed possible asbestos-containing materials (ACM) in the air conditioning system and in the boiler and chiller rooms. These materials were observed to be in generally good condition (WCC 1989a). One exception was a return air duct, possibly having an ACM liner, which was reported to have a liner deterioration problem. Subsequent to submittal of the Phase 1 report, the property managers reported that the deterioration problem was being repaired.

According to the utility company (PG&E), transformers at the site were inspected and tested. Transformers which they identified as containing PCBs were replaced.

A "search area" having a 2000 foot radius centered on the property was used to screen toxic case sites in the vicinity. Two toxics cases were identified within the search area, both east of U.S. Interstate 880. These cases concern fuel leaks from underground storage tanks. Their potential impact on the site is low, given that they are over 1000 feet away and cross-gradient, assuming groundwater flows toward San Francisco Bay perpendicular to the shoreline. This means that leaking fuel, moving down-gradient with groundwater, is unlikely to reach the site before reaching the bay and becoming diluted by wave action in the bay.

The mass filling of the peninsula took place between the early 1940's and 1968. During this period the site was owned by Fibreboard Corporation. Impoundment dikes were constructed on bay tidelands to contain a mass fill composed of construction debris, foundry casting sands and slag, soil excavated elsewhere and industrial waste. Some of this material may be considered hazardous by today's criteria. The the dikes probably have a high permeability. If contaminating chemicals were present in the waste material used to fill the impoundments, then the contaminants could possibility be leached by groundwater into the bay. The impoundments are underlain by low permeability bay mud, limiting the possibility of downward groundwater migration.

In 1968, new owners began engineering work to prepare for commercial development. The impoundments were capped by an engineered fill, pavement and structural foundation slabs.

The Phase 1 report concluded that the above ground commercial development area does not show indications of hazardous substances other than possible ACM in buildings, but that such materials may have been placed in the subsurface fill. A subsurface sampling and testing program was developed to investigate this possibility.

1.4 SUMMARY OF PHASE 2: SUBSURFACE INVESTIGATION & CHEMICAL ANALYSIS

The Phase 2 subsurface investigation was performed to test soil and groundwater for hazardous substances. Five borings were drilled, soil samples taken and analyzed, and the borings converted to groundwater monitoring wells. The wells were developed and sampled. All soil samples and water samples were tested for a wide range of chemical constituents selected for testing on the basis of the types of materials that may have been used as fill material, as understood from the Phase 1 investigation.

Soil samples were found to contain a number of hazardous chemical constituents including petroleum hydrocarbons, PNAs and metals. Asbestos, though not analyzed for in soil samples, is also known to be present in the fill based on site history.

The Waste Extraction Test (WET) was performed on composite soil samples when appropriate, as specified in the California Administrative Code, Title 22. Lead, in two borings, exceeded the Soluble Threshold Limit Concentration (STLC) used to define a hazardous waste. No other metals in soil samples exceeded STLC. The asbestos, where present in bulk or mixed with fill materials at elevated fiber concentrations, would also constitute a solid hazardous waste.

The petroleum hydrocarbons benzene, toluene and xylene were present in soil samples from at least one boring each. Other petroleum hydrocarbons, including derivatives of gasoline, diesel fuels and asphalts (polynuclear aromatic hydrocarbons) were also present. No PCBs or organochlorine pesticides were detected in soil samples.

Groundwater samples generally contained lower concentrations of a similar suite of constituents to those detected in soil samples. Specifically, arsenic, lead, nickel, zinc and PNAs were present in excess of water quality goals for San Francisco Bay set forth in the "Basin Plan" (Regional Water Quality Control Board, 1986). Petroleum hydrocarbons were also present in water samples, including derivatives of petroleum fuels and asphalts. Asbestos was analyzed for, but not detected, in groundwater samples.

1.5 SUMMARY OF PHASE 3: VERIFICATION SAMPLING AND CHEMICAL ANALYSIS, HYDROGEOLOGY STUDY, AND EXPOSURE ASSESSMENT

Three issues were raised as a result of the first two phases of this project. These were: 1) Is there a potential for occupants of the site to be exposed to the chemical constituents detected in soil or groundwater? 2) Is there the potential for leakage of contaminated groundwater from the site to San Francisco Bay or aquifers? and 3) Would a second groundwater sampling and testing confirm the presence and concentration levels of chemical substances previously detected?

The first issue raised was the possibility of human exposure to hazardous substances. A "risk of exposure" assessment was conducted which used qualitative criteria to explore sources, routes of transmission and receptors. The general conclusion was that above ground there is no significant threat to humans, but that appropriate health and safety precautions, including observation of applicable regulations for handling and disposal of excavated hazardous materials, should be taken when excavating more than three feet below grade. Also, results of the hydrogeology study suggested there may be a potential for groundwater leakage from the site. Contaminants in site groundwater might accumulate in marine organisms (such as shellfish) adjacent to the site. This could indirectly affect human beings who might regularly ingest them. However, further studies, including monitoring programs designed to measure toxics bioaccumulation in shellfish, would be needed for an evaluation of this potential exposure route.

The next issue raised was the possibility of contaminated groundwater leakage into the bay. In order to examine this possibility a limited hydrogeological study was performed, using measurements of tidal response in groundwater monitoring wells, as a means of calculating an overall representative average permeability value for the heterogeneous fill and dike materials. The study revealed a permeability range of 10^{-2} cm/sec to 10^{-3} cm/sec. These values are analogous to the permeability associated with silty sand to sand sized sediments, suggesting that leakage of site groundwater into the waters of San Francisco Bay is a possibility.

The third issue raised was the question of chemical data reproducibility. A verification groundwater sampling program was performed to seek confirmation of previous chemical analysis results. A similar suite of constituents was detected in the two samplings, with some additional constituents newly detected and some constituents not confirmed in the second sampling. Refer to Section 1.2 for a discussion of these.

2.0
INTRODUCTION

2.1 PROJECT BACKGROUND

Woodward-Clyde Consultants was retained by Mr. Thomas N. Lathrop on behalf of Mr. F.P. Lathrop in January 1989 to perform a preliminary environmental site assessment of the Lathrop property in Emeryville, California. The purpose of this project was to investigate the potential presence of hazardous substances on the property that might require expenditures for scientific investigation or engineered mitigation measures in the future.

The initial work was divided into two phases: Historical Review (Phase 1) and Subsurface Sampling and Testing (Phase 2). Final reports for these two phases were submitted to Mr. F.P. Lathrop on January 24, 1989 and March 29, 1989, respectively. Laboratory results indicated the presence of a number of organic and inorganic chemicals (hereafter referred to as "constituents") in both soil and groundwater samples. Comparison of detected concentrations against a variety of soil and water quality criteria revealed that some of the compounds in soil and water exceeded one or more criteria. For other of the detected compounds, no generally applicable standards or criteria were found, although toxicological data may exist for those compounds. That data can be used in a health risk assessment to develop numerical values for allowable concentrations, in cooperation with regulatory agencies.

Based on the findings of Phases 1 and 2, Woodward-Clyde Consultants (WCC) recommended additional studies to investigate (1) potential for leakage of site groundwater to San Francisco Bay or aquifers, (2) potential human exposure to contaminants and (3) resampling of monitoring wells to confirm earlier findings. These recommendations were implemented and are described herein.

2.2 SERVICES PERFORMED

Task 1: Verification Water Sampling and Testing

WCC purged and resampled the five existing groundwater monitoring wells and analyzed the new water samples obtained. The purpose of performing this task was to analyze a second set of groundwater samples for chemical concentrations and other water quality parameters. In Section 3 of this report, the results are compared to results from the January 1989 sampling to verify the accuracy of previous results, observe discrepancies, and compare results against various water quality criteria.

Task 2: Preliminary Hydrogeological Characterization

The purpose of this task was to obtain data that would allow calculation of a preliminary estimate of site permeability. A preliminary order-of-magnitude estimate of overall average site permeability is desirable at this time in order to form an opinion about possible leakage of contaminated groundwater into the waters of San Francisco Bay. This information would also be useful when considering site classification in terms of potentially applicable federal and state regulations governing sites having soil or groundwater contamination. Results of this study are presented in Section 4 of this report.

The scope of work was limited to measurements on existing monitoring wells on the Lathrop property. It was not intended to develop a full hydrogeological characterization of the site such as might be required by regulatory agencies during the course of a remedial investigation.

Task 3: Exposure Assessment

The purpose of this task was to develop an opinion regarding the risk which might be posed by the presence of chemical substances in the soil and groundwater to persons working in buildings or elsewhere on the Lathrop property. Considering the construction of the site, health risk was initially thought to be minimal to persons on-site. The results of this study, discussed in Section 5, confirmed this hypothesis.

Task 4: Final Report

The results of the Phase 3 Environmental Assessment outlined in Tasks 1 through 3 are presented in this final report. Certain data and exhibits from the Phase 1 and Phase 2 reports are referenced, rather than duplicated, to minimize redundancy. The purpose of combining this data is to present a single document that summarizes our findings on environmental conditions at the Lathrop property.

2.3 LIMITATIONS

We have performed our services for this project in accordance with our Agreement and with current professional standards for environmental site assessment investigations. No guarantees are either expressed or implied. Our investigation was limited to the Lathrop property, described herein. Our data, conclusions and opinions apply only to the Lathrop property. They do not apply to other areas of the Emeryville peninsula, or other nearby areas. This document and the information contained herein have been prepared solely for the use of Mr. F.P. Lathrop. Any reliance on this report by third parties shall be at their sole risk.

The groundwater sampling and analysis was limited to a small number of sampling points placed at locations appropriate to the general purposes of a preliminary subsurface environmental investigation, rather than at locations selected for the purpose of performing a thorough hydrogeological investigation. Because of the limited number of groundwater monitoring wells sampled and the limited number of groundwater samples analyzed, and the high degree of subsurface inhomogeniety, it is possible that hazardous materials which were not detected may be present. Similarly, the exposure assessment performed was limited to a general consideration of sources, receptors and the influence of site conditions on potential routes of chemical exposure.

There is no investigation which is thorough enough to preclude the presence of materials which now, or in the future, may be considered hazardous at the site. Because regulatory evaluation criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation. Conversely, chemicals considered to be toxic at a certain concentration level today and thus require remediation may, in the future, be found less toxic at the same concentration and thus experience a relaxation of the regulated concentration level. Opinions and judgments expressed herein, based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions.

3.0
VERIFICATION WATER SAMPLING AND TESTING

3.1 SAMPLING

Verification groundwater samples were collected from the five existing monitoring wells on May 2 and 3, 1989. The sample collection procedure was as follows.

After uncapping each well, the water level in the well was measured and the groundwater surface was then checked for presence of floating product, using a clean, translucent Teflon bailer. The well was then purged by removing three to six casing volumes (9 to 15 gallons) of groundwater. During this purging, the specific conductance, salinity, temperature, pH and turbidity of the removed groundwater were monitored until relatively stable conditions were achieved.

When purging was complete, the water level in the well was allowed to recover for several minutes. Groundwater samples were then collected using the same bailer as was used to purge the well. Floating petroleum product clogged the bailer used to sample MW-1. That bailer was discarded and a new bailer was used to purge and sample the remaining four monitoring wells. It was decontaminated between wells by washing with Alconox detergent, then triple rinsed with water. The final rinse was performed using deionized water. As each sample was collected, it was poured into a clean, pre-labeled sample jar or bottle. These were provided by the analytical laboratory, and contained the appropriate preservative agents for the respective analyses.

When filled and capped, the sample bottles and jars were placed in a cool ice chest. A chain-of-custody form was prepared for each day of sampling. On this form, the sample testing schedule was specified. Samples were transported to the laboratory at the end of each day. The laboratory signed and retained copies of the chain-of-custody form, thereby acknowledging receipt of the samples and the schedule of requested analyses. Copies of the chain-of-custody forms are on file in our Oakland office.

In Monitoring Well No. MW-1, a viscous, black, oily asphaltic substance clogged the bailer on the first trip down the well. The asphalt was apparently floating on the groundwater. This could not be visually confirmed because the outer surface of the bailer was completely covered with asphalt. When droplets of the asphalt were placed in a bucket of water, some of the droplets floated and some sank to the bottom. The asphalt had a mild petroleum odor. It tended to harden with time when exposed to air. As was observed after purging this well prior to the January 1989 sampling, MW-1 exhibited very slow water level recovery. The well had a groundwater depth of 8.8 feet below top of casing prior to the start of purging on May 2. During purging the well was bailed nearly dry to its total depth of 25 feet. By the afternoon of May 3, when the well was sampled, the groundwater level had recovered to a depth of only about 15 feet. No new floating layer had developed between the purging on May 2 and the sampling on May 3.

Water quality parameters derived from the May 1989 field measurements during sampling are given in Tables 1 through 5 for monitoring wells MW-1 through MW-5, respectively. The pH of site groundwater was nearly neutral, ranging from 6.4 to 7.4. Salinity varied from 2.6 to 11.5 percent of sea water, while conductivity varied from 1,700 to 17,000 umhos/cm. Groundwater temperature varied from 17 to 21 degrees C. In this second round of sampling, turbidity was also measured. Due to the presence of particulates in some of the samples, the value obtained from the field meter varied with time as the heavier particulates settled in the sample vial. Thus, the values obtained should be regarded only as qualitative indicators of turbidity.

3.2 ANALYTICAL TESTING PROGRAM

The analytical testing schedule for the May 1989 round of groundwater samples was the same as for the initial January 1989 round, with two exception. Laboratory pH determinations, which were included in January but not in May, and analyses for asbestos, included in May but not in January. The pH of groundwater samples was measured in the field during the May sampling.

The groundwater samples from each monitoring well were tested for the following chemicals:

- Low and medium boiling point hydrocarbons by modified EPA Method 8015 (gasoline standard);
- Benzene, toluene, xylene, and ethylbenzene by EPA Method 8020;
- High boiling point hydrocarbons by modified EPA Method 8015 (diesel standard);
- Oil and grease by EPA Method 413.2;
- Purgeable priority pollutants by EPA Method 8240;
- Extractable priority pollutants by EPA Method 8270;
- Title 22 Metals (including Chromium VI); and
- Asbestos

The results of these tests for the current sampling round are given in Tables 1 through 5.

To provide quality control, one sample blank was submitted each sampling day. These blanks were analyzed for low/medium boiling point hydrocarbons. A duplicate sample of groundwater from MW-5 was collected on May 2 and submitted for a high boiling point hydrocarbon test.

Because of the presence of particulates in some of the groundwater samples, special attention was paid to sample preparation (filtration) in the analytical procedures. Some particles may have come from tar paper or asphaltic material, known to be present in the fill. These might dissolve during extraction, thereby yielding higher hydrocarbon or extractable pollutant concentrations than actually exist in the groundwater. No filtering was specified for test methods normally performed directly on the sample supernatent liquid without extraction, or for methods in which the purge and trap extraction technique is used. However, for the extractable priority pollutant and the high boiling point hydrocarbon tests, a solvent extraction of the entire liquid sample is required. For these tests the groundwater samples were pre-filtered, using the same size filter used in the subsequent filtration of the solvent extract.

Low concentrations of acetone and methylene chloride, detected in the January groundwater samples, were not detected in the May samples. For carbon disulfide the converse was true. These chemicals are solvents commonly used in the laboratory. It is believed that their detection in the January samples resulted from sample contamination in the laboratory. This is supported by their non-detection in the May samples (January sample for carbon disulfide). Therefore, these three compounds are not listed in the tables of detected constituents, Tables 2 through 5. They do appear in the laboratory data sheets reproduced in Appendix A.

The chemical compounds benzene, toluene, xylene and ethylbenzene (BXTE) were tested by two different analytical methods. They are included in the suite of analytes specified by EPA method 8240 as well as the test for petroleum hydrocarbons, EPA method 8015/8020. Because the detection limits of the latter method are lower, and therefore presumed to have better precision, those are the results emphasized in the text of this report.

3.3 ANALYTICAL RESULTS

In this section the two groundwater chemical data sets are compared against several selected water quality criteria commonly applied for protection of human health and marine resources. The human health criteria presented are the Federal Primary and Secondary Drinking Water Standards for the Protection of Human Health and the Action Levels specified by the California Department of Health Services. The marine criteria include the effluent limits for shallow water discharge shown in Table IV-1 of the San Francisco Bay Basin Plan. Also shown are the California Ocean Plan, 6-Month Median Criteria, and EPA Acute Toxicity Saltwater Criteria. Of the three marine criteria presented, the San Francisco Bay Basin Plan ("Basin Plan") criteria for effluent discharges to the bay may be particularly relevant to this case, in our opinion. In the following sections, the January and May data sets will be compared to the Basin Plan criteria and all three of the drinking water criteria.

Analytical results for the organic compounds including concentrations and detection limits are presented in Tables 1A through 5A. Water quality data, metals, asbestos and petroleum hydrocarbon concentrations, and corresponding detection limits, are presented in Tables 1B through 5B. The table number (e.g. Table 4) corresponds to the monitoring well number (e.g. MW-4).

Results for each well are presented and discussed in sequence below. First, lithology and soil testing results, presented originally in the

Phase 2 report (WCC 1989b), are reviewed. Then the groundwater sampling and analysis results are presented and compared with water quality criteria. In order to limit the length of discussion and data tables, only those compounds detected are noted. The full suite of tested chemicals are shown on the laboratory data sheets in Appendix A.

3.3.1 Monitoring Well No. 1 (MW-1)

3.3.1.1 Lithology and Previous Soil Test Results. The soil lithology of MW-1 is presented in the boring log for this well in Appendix A of the Phase 2 report; chemical analysis results for soil samples tested during Phase 2 are given in Appendix B to that report (WCC 1989b). The soil boring encountered two feet of clayey sand overlying silty clay fill which extended to approximately 17 feet. A 5-foot layer of tar paper was present between 5.5 and 10.5 feet. The fill is underlain by Bay Mud starting at 17 feet. A composite of the soil samples taken during the drilling of this well was tested and showed elevated levels of low and high boiling point hydrocarbons(1100 and 1500 ppm, respectively), oil and grease (9000 ppm), as well as low levels of BTXE and 30 ppm of total polynuclear aromatic hydrocarbons (referred to in technical literature an herein as either "PNAs" or "PAHs". Total concentrations of chromium, barium and lead were highest for this composite sample, compared with the respective concentrations obtained for the composite soil samples of the other four borings. Other metals were detected at lower concentrations.

3.3.1.2 Comparison of Groundwater Results (Tables 1A and 1B). As noted in Section 3.1, a black asphaltic material was found floating on groundwater in MW-1 during the May resampling. The groundwater level measurement taken in this well on May 2 indicates that the bottom 1.5 feet of the tar paper fill layer is below the groundwater table. It may be that the presence of this floating asphaltic material is related to the tar paper, or to the high concentrations of petroleum hydrocarbons and oil/grease detected in MW-1.

Water quality parameters are shown on Table 1B. The field pH of 7.0 measured during the May sampling is lower than the laboratory value of 7.5 obtained from laboratory pH measurements on the January groundwater sample. The specific conductances and salinity measurements made during the May sampling are about one third the value of those measured during the January sampling.

Several additional metals, including arsenic, molybdenum, nickel, thallium, vanadium and zinc, were detected in the May sample testing, presumably because of the lower detection limits used in May. The concentrations of barium and chromium III obtained for the May sampling are 35% to 160% lower than those obtained for the January sampling. The concentration of lead obtained from the May sampling dropped significantly to 0.098 mg/L, compared with 0.7 mg/L obtained in the January sample analysis. Asbestos was not analyzed in the January sample, and was analyzed but not detected in May.

Low, medium, and high boiling point hydrocarbons, BTXE, and oil and grease were detected in the May groundwater sample. The values obtained for these compounds from the May sample are generally two to ten times higher than were those from the January sample. The benzene concentration increased from 4.0 ug/L in the January sample to 47 μg/L in the May sample. High boiling point hydrocarbons concentrations increased from 290 ug/L in the January sample to to 11,000 ug/L in the May sample. Oil and grease increased from 1.4 mg/L in the January sample to 3,800 mg/L in the May sample.

With the exception of benzyl alcohol, all of the organics detected in the January groundwater sample were detected in the May sample. The concentrations obtained in the May analyses were generally two to three times greater than for the January analyses, except for petroleum hydrocarbons, BTXE and oil/grease, discussed above, where the May concentrations were generally two to ten times greater.

3.3.1.3 Comparison With Water Quality Criteria. For chemicals where such criteria have been established, the concentrations of four chemicals exceeded drinking water criteria in both the January and May sampling of this well. These are lead, benzene, toluene and (sum of) phenols. In the May sample, the concentration of total 1,2-dichloroethene, toluene, and total xylenes exceeded both the drinking water criteria and the State Action Level. As may be seen from the many blank cells in the water quality criteria columns in Tables 1A and 1B, Federal and State drinking water criteria have not yet been adopted for many of the detected chemicals. The effluent concentration limits of the Basin Plan are exceeded for lead in both the January and May sample analyses, and for nickel, zinc, the sum of phenols and the sum of PAHs in the May sample analyses.

3.3.2 Monitoring Well No. 2 (MW-2)

3.3.2.1 Lithology and Previous Soil Test Results. The boring log for this well (WCC 1989b) shows the lithology to consist of 3½ feet of silty sand overlying silty clay fill to 19 feet. Below 19 feet, Bay Mud was found. It is noted in the log that the fill contains concrete, roofing paper, asphalt and wood debris below a depth of about 8 feet.

The composite soil sample for this well was chemically analyzed (WCC 1986b) and was found to contain oil and grease at 40,000 ppm, both low/medium and high boiling point petroleum hydrocarbons (44 ppm and 170 ppm, respectively), relatively low concentrations of BTXEs, and no PAHs. The only other organic constituent detected was napthalene at 13 parts per million. The concentrations of barium and zinc in the composite soil sample of MW-2 of 160 ppm and 670 ppm, respectively, were relatively high compared with the composite samples of MW-3, MW-4 and MW-5, but similar to those found in MW-1. Other metals were detected at lower concentrations.

3.3.2.2 Comparison of Groundwater Results (Table 2A and 2B). The field pH measured in the May sampling of 7.0 was somewhat lower than the laboratory pH measured in the January sampling. The water quality parameters of specific conductances and salinity were found to be slightly higher in the May sampling than the January sampling.

The metals barium and lead, detected in the January analyses, were also detected in the May analyses, at lower concentrations. Several additional metals, including arsenic, chromium III, molybdenum, silver, thallium, and zinc were detected in the May sample analyses, possibly due to the lower detection limits achieved in these analyses. Asbestos was not analyzed in January, and was analyzed but undetected in May.

As in the January analyses, low/medium boiling point hydrocarbons, and BTXE were found in the May groundwater sample. For these compounds, the concentrations obtained were greater in the May analytical results than for those obtained in January. High boiling point hydrocarbons were detected in the May analyses at 430 μg/L, whereas they were not detected in January. Oil and grease were detected at 7.2 mg/L. These were also undetected in the January sample analyses.

The only volatile organics detected, other than those thought to be lab contaminants as discussed previously in Section 3.2, was benzene at 14 ppb. This value is identical to the value obtained by EPA Method 8020, performed on the same sample. In the January sample analyses, no extractable organic compounds were detected. In the May sample, a number of extractable organics were detected, including some PAHs.

3.3.2.3 Comparison with Water Quality Criteria. The concentrations of two chemicals, lead and benzene, exceeded drinking water criteria in both the January and May analyses. Barium also exceeded the federal primary drinking water standard for the January analysis. The effluent standard of the Basin Plan were exceeded for lead in both the January and May analyses, and for silver and zinc in the May analyses.

3.3.3 Monitoring Well No. 3 (MW-3)

3.3.3.1 Lithology and Previous Soil Test Result. The boring log of MW-3 shows the lithology of the well to be silty clay fill from the surface to approximately 10 feet. From to 10 to 15.5 feet, a layer of fibrous fill (asbestos or fiberglass) material was found. The fibrous fill rested on Bay Mud, which continued to the bottom of the boring at 21.5 feet.

In the composite soil sample for MW-3, no BTXE or low/medium boiling point hydrocarbons were detected. Twelve (12) ppm of high boiling point hydrocarbons and 12 ppm of oil and grease were found, and 2 ppm of total PNAs. The two highest metals concentrations in the soil samples of MW-3 were 82 ppb lead and 130 ppb zinc. Other metals were detected at lower concentrations.

3.3.3.2. Comparison of Groundwater Results (Tables 3A and 3B). The field measured pH value of 7.4 for the May sampling is less than the 8.1 value obtained in the laboratory for the January sample. The specific conductances and salinity field measurements for the May sampling are about one-third those of the January sampling.

In the January analyses, lead and zinc were the only metals detected. These metals were detected again in the May analyses, but at lower concentrations. Arsenic and barium were also detected in the May groundwater sample analyses at concentrations at or below the corresponding detection limits for these metals in the January tests. Chromium III and thallium were detected in the May analyses at concentrations above the detection limits of the January analyses. Asbestos was not analyzed in January and was analyzed but undetected in May.

In the January analyses, total xylenes and high boiling point hydrocarbons were detected. The concentrations obtained for these compounds for the May sample are lower. Additionally, in the May analyses, low/medium boiling point hydrocarbons and toluene were detected at or below detection limits of the January analyses for these substances. Benzene at 1.4 µg/L, and oil and grease at 6.1 mg/L were also detected in the May sample, but not in the January sample.

The only volatile organic detected in the May groundwater sample was 2.5 µg/L of benzene. This is higher than the value obtained by EPA Method 8020 as part of the petroleum hydrocarbons analyses. No extractable organics were detected in either the January or May samplings of this well.

3.3.3.3 Comparison with Water Quality Criteria. The only exceedances of drinking water criteria found in the MW-3 data sets are lead for both samplings, and benzene for the May sampling only. The Basin Plan criterion for zinc was also exceeded in the January sampling data set for MW-3.

3.3.4 Monitoring Well No.4 (MW-4)

3.3.4.1 Lithology and Previous Soil Test Results. The boring log of MW-4 shows the lithology to be sandy clay fill from the surface to 2 feet, underlain by silty clay and debris fill. Roofing shingle debris was noted at 8 feet. From 14 to 22 feet the fill consisted of linoleum and tar paper and included some asphalt, wood, and fiberglass shingle debris. Bay Mud was encountered from 22 feet to the bottom of the boring at 27 feet.

In the composite soil sample for MW-4, oil and grease were found at a concentration of 21,000 ppm. Lesser concentrations of low/medium and high boiling point hydrocarbons (3 ppm and 89 ppm, respectively), were detected. Low concentrations of BTXE were also found. No organics were detected by EPA Methods 8240 and 8270 for this composite sample. The metals concentrations found in the MW-4 composite soil sample were similar to those found for MW-3 and MW-5, with the exception of lead. Lead was present at a concentration of 350 ppm, second only to MW-1 in total concentration.

3.3.4.2 Comparisons of Groundwater Results (Tables 4A and 4B). During the May sampling, a lower value pH (6.4 vs. 8.2) was obtained compared with the January sampling. The specific conductance was also lower in May than January.

For the January sampling, barium, lead, nickel, and zinc were detected in the groundwater sample. Barium and nickel were detected in the May sampling at concentrations similar to those found in January. The concentrations of lead and zinc were higher in May. The concentration of lead was 0.22 mg/l (May) vs. 0.10 mg/l (January). Zinc was found at 0.95 mg/L (May), while 0.170 mg/L was found in the January sampling. In the May sampling, arsenic and cobalt were also detected, but at concentrations at or below the detection limit of the January tests for these metals. Chromium III, which was undetected in the January sampling, was detected at 0.036 mg/L in the May sampling. Asbestos, not analyzed in January, was undetected in May.

In both the January and May samplings, low/medium and high boiling point hydrocarbons, oil and grease, and BTXE were all detected, with similar concentrations between the two samplings. The only other new volatile organics detection in the May analysis was 2-butanone (i.e, methyl ethyl ketone).

Seven compounds were detected in the extractable organic analysis for the January groundwater sample. Five of the seven compounds were detected again in the May analyses and at similar concentrations, including two PAHs. Diethylphthalate and phenol were not detected in the May analyses. Benzoic acid and 4-methylphenol were newly detected in the May analyses.

3.3.4.3 Comparison with Water Quality Criteria. Exceedances of drinking water criteria were noted in both the January and May samplings for lead and benzene, and for phenol in January but not in May. Lead and zinc exceeded Basin Plan criteria in both samplings, and nickel in May only.

3.3.5 Monitoring Well No. 5 (MW-5)

3.3.5.1 Lithology and Previous Soil Test Results. The boring log of MW-5 shows the lithology to be silty clay from the surface to 4 feet underlain by clayey sand and sandy clay fill to 21 feet. The sample description for the 15-foot sample on the log notes that it was composed largely of tar paper and roofing scraps. From 21 to 25 feet, Bay Mud was encountered.

In the chemical analyses for the composite soil sample for MW-5, no BTXE or low boiling point petroleum hydrocarbons were found. High boiling point hydrocarbons and oil and grease were detected at 27 ppm and 11,000 ppm, respectively. No purgeable or extractable priority pollutants were detected in the composite sample for the well. The metals values obtained for the MW-5 composite sample are similar to those for the composite sample of MW-3 and MW-4, except that lead is lower, and nickel and vanadium are higher.

3.3.5.2 Comparison of Groundwater Results (Tables 5A and 5B). The field values of specific conductance and salinity taken during the January and May samplings are similar. The field pH measured during the May sampling is lower (6.6 vs. 7.8) than the lab value obtained for the January sample.

Five metals were detected in the MW-5 groundwater sample for the January sampling: arsenic, barium, lead, nickel, and zinc. For all of these metals but nickel, a similar concentration was found in the May analyses. No nickel was detected in the May analysis. Thallium and cobalt were detected in the May analyses at concentrations at or below the detection limits of the January tests. Chromium III was detected at

0.015 mg/L in the May analyses, but went undetected in January. Asbestos, not analyzed in January, was analyzed but undetected in May.

In the January sample analyses, toluene, xylene and high boiling point petroleum hydrocarbons were found in the groundwater. Similar values of xylenes and high boiling point hydrocarbon were found in the May sampling. Toluene was not found in the May groundwater sample by EPA Method 8020 but was found by EPA Method 8240. Low/medium boiling point petroleum hydrocarbons were also found in the May sample at a level below the detection limit of the initial sampling. Oil and grease were detected at 5 mg/L in the May groundwater sample. The only volatile organic detections noted for the MW-5 sample which are not suspected to be laboratory contamination are toluene and xylenes in the May sampling. The only detection by EPA Method 8270 was 45 mg/L of 2-methylphenol.

3.3.5.3 Comparison with Water Quality Criteria. The only constituent found to exceed drinking water criteria in well MW-5 in both the January and May samplings is lead . The measured concentrations of arsenic, lead, zinc, and PNAs exceed the Basin Plan effluent criteria for both the January and May samplings. Nickel also exceeds the Basin Plan criteria for the January sampling.

3.4 CONCLUSIONS

The purpose of performing this verification sampling and analysis task was to confirm the reliability of the results obtained from the January 1989 groundwater sampling. In particular, for those chemical constituents in groundwater that were present in January 1989 in excess of an established water quality criteria (such as state or U.S. EPA drinking water standards) the purpose was to confirm this fact. For many of the constituents present in groundwater lacking established criteria, the purpose was simply to confirm their presence.

These chemical constituents were detected in both the January and May 1989 groundwater samples:

- Arsenic
- Barium
- Chromium (+3)
- Nickel
- Lead
- Zinc
- 2-Butanone
- 2-Hexanone
- Benzoic Acid
- 2,4-Dimethylphenol
- 2-Methylphenol
- 4-Methylphenol
- Napthalene
- Phenol
- PNAs
- TPH (gasoline)
- TPH (diesel)
- Oil and Grease
- BTX&E (all)

Verification sampling was performed to confirm the presence of certain chemical compounds and identify those that exceed either drinking water or marine water quality criteria. The following chemical constituents of groundwater were found in both the January and May 1989 groundwater samples to be in excess of either drinking water or Basin Plan water quality criteria:

- Arsenic
- Benzene
- Lead
- PAHs
- Phenols
- Zinc

A few other chemicals were detected in the May 1989 sampling that were not previously detected, and vice versa. These are shown in Table 1 through 5.

4.0
CALCULATION OF PERMEABILITY BASED ON TIDAL FLUCTUATIONS

4.1 INTRODUCTION

A gross estimate of the permeability of fill material at the Lathrop Property of from 10^{-2} to 10^{-3} cm/sec was obtained by applying the stage-ratio method for determining the coefficient of transmissivity as described by Ferris (1963). In this method, the aquifer's response to cyclic variations in the tidal water levels was measured. The magnitude of the tidal fluctuations was compared to the corresponding magnitude of response in each well as a function of the distance of that well from the closest point on the bay. The methodology is described below.

4.2 METHODOLOGY AND RESULTS

Groundwater level changes in Monitoring Wells 1 through 5 (MW-1 through MW-5) and tidal water level changes in the San Francisco Bay at the end of the pier located next to Charley Brown's Restaurant (Figure 1) were measured at 10 minute intervals from noon on Thursday, May 11 through 1 pm on Monday, May 15, 1989. The changes in water level were measured using digital electronic data loggers and submerged pressure transducers. Digitized data was transferred to a computer spreadsheet for processing and plotting.

The water elevation vs. time data from each of the loggers was then plotted as shown in Figures 3 through 8. The peak-to-peak amplitudes representing fluctuations in tidal levels and the peak-to-peak amplitudes representing corresponding fluctuations in groundwater levels in the monitoring wells were compared. The ratio of groundwater fluctuation to change in tidal levels was computed for the rising and falling limb of each cycle. These ratios are listed in Table 6. The length of the period of tidal fluctuations, computed for both limbs of each cycle, was about half a day.

The data from Wells 1 and 5 were not used in this study. The small flat peaks on the MW-1 and MW-5 charts could not be related to the tidal fluctuations. Water levels in Well 1 rose slowly during the test. This may be due to unusually low permeability in the vicinity of the well, causing it to have a slow recovery of water level after water samples were taken several days before.

The averages of the ratios for rising and falling stages (Table 6) are plotted in Figure 9 against distance from each of the wells to the San Francisco Bay at the peninsula edge, next to the Bay. Where distance, Y, equals 0, the range of the water level response in the wells is equal to the range in the tide. Therefore, the range ratio on Figure 9 approaches unity as Y approaches zero. Thus a line was drawn from this point on the graph through each of the data points to obtain ΔY, or the distance over one log cycle used in the equation for transmissivity shown below.

4.2.1 Calculated Transmossivities and Permeabilities

As indicated in Figure 9, for one log cycle ΔY = 67 feet for Well 2, ΔY = 155 feet for Well 3, and ΔY = 133 feet for Well 4. Given the equation:

$$T = \left[\frac{4.4\ (\Delta Y)^2}{t_o}\right]S$$

where

T = transmissivity
ΔY = distance over one log cycle

S = specific storage

t_o = length of period of tidal fluctuations (approximately 1/2 day)

The transmissivities were calculated as shown in the Table of Values below. The thickness of the fill, B, is about 16 feet and permeability (K) is equal to transmissivity divided by B. The calculated permeabilities corresponding to the calculated transmissivities are also present in the Table of Values below.

Table of Values

	S	T (gallon/day/foot)	K (cm/sec)
MW-2	0.1	3,950	$1.3x10^{-2}$
	0.01	395	$1.3x10^{-3}$
MW-3	0.1	21,142	$7.1x10^{-2}$
	0.01	2,142	$7.1x10^{-3}$
MW-4	0.1	15,566	$5.2x10^{-2}$
	0.01	1,556	$5.2x10^{-3}$

4.3 CONCLUSIONS

The permeabilities derived from this method are in the range of magnitude of 10^{-2} to 10^{-3} cm/sec. This corresponds to sediments which fall into the range of permeabilities for sand to silty sand (Freeze and Cherry 1979). The varied response in each of the wells to the tidal fluctuations suggests that the underlying strata is heterogeneous, both laterally and vertically. However, the narrow range of permeability values calculated for three monitoring wells suggests that groundwater in these three wells is controlled by material having the permeability of sand or silty sand. This suggests the possiblity that site groundwater could migrate through the permeable dike material into the surrounding bay waters.

5.0
EXPOSURE ASSESSMENT

5.1 INTRODUCTION

This section presents the results of a qualitative assessment of health and environmental risks posed by the chemical substances identified in soil and groundwater samples from the five sampling stations on the Lathrop property. The assessment consisted of identifying and analyzing possible exposure pathways for humans and evaluating the physical, chemical, and toxicological properties of the substances. Exposure pathways are identified and evaluated in terms of the potential health risks presented by the substances.

The conclusion reached as a result of this exposure assessment is that there is no significant threat to persons working at the site, either in office buildings or outside maintenance. Workers in excavations deeper than 3 feet below grade could possibly be exposed to hazardous materials and should follow project specific health and safety plans.

As discussed in Section 3.0, a number of chemical contaminants were identified in soil and groundwater samples at the five soil borings and monitoring locations on the property. The presence of these chemicals at the site is apparently related to the history of fill placement which created the Watergate peninsula (WCC 1989a,b). Some of the chemicals are present at concentrations above those which are commonly applied by governmental regulatory agencies to define maximum allowable concentrations for protection of human health and water resources. For many other of the chemicals, no generally accepted standards have yet been developed or uniformly applied by the agencies.

In WCC's Phase 2 report and in Section 3.0 of this report, chemical concentrations detected in soil and groundwater samples from the site were compared with a range of potentially applicable hazardous waste and water quality criteria. In this section, a preliminary assessment is presented of the potential risks that the presence of these chemicals in the subsurface pose to occupants of the site. This assessment is presented in qualitative terms, that is, it is not intended to be a comprehensive Health Risk Assessment (e.g., USEPA 1987). Rather, it is intended to provide a preliminary evaluation of whether there may be significant chemical risks to human health at the site and, if so, to identify them as warranting future detailed examination and more comprehensive assessment. The methodology used consists of identifying and analyzing possible chemical exposure pathways to humans, presuming that exposure to the chemicals, either directly or indirectly, could be harmful to health.

5.2 ENVIRONMENTAL SETTING

Descriptions of historical tidelands reclamation activities and development of the Lathrop property are summarized below. They were presented in the Phase 1 and Phase 2 reports in greater detail (WCC 1989a,b).

The Lathrop property occupies 18 acres near the eastern margin of the Emeryville Peninsula, on reclaimed tidal land extending into San Francisco Bay. The peninsula was created beginning in the 1940s by constructing impoundments on tidal marshes. The impoundment dikes ("dikes") were reportedly built of foundry slag, concrete rubble and soil excavated elsewhere. The interior areas of the impoundments were filled by placing a mixture of soil, construction and fire debris (wood, broken concrete), and industrial rubble and waste materials (roofing paper, asphalt shingles, linoleum, asbestos, steel slag) onto the surface of Bay Mud exposed in the former bayshore tideland and below the shallow bay waters. WCC's Phase 1 and Phase 2 reports concluded that "there is reason to believe [hazardous] substances may have been dumped there, prior to development."

Beneath the Lathrop property, this heterogeneous fill material averages about 16 feet thick, as determined by the WCC Phase 2 soil borings, and previous WCC borings drilled during developmental construction on the property. The heterogeneous fill is overlain at ground surface by an engineered cap of clean, imported, silty/sandy clay fill material which averages about 3 feet thick and was placed during final developmental site grading.

Today, the Lathrop property is fully developed with three high-rise (12-16 story) office buildings, a two-level parking structure, paved parking facilities and driveways, and landscaped common areas. This development, together with the surface cap of engineered fill material throughout the 18-acre property, separates the site at ground surface from the underlying fill deposits. Over 95 percent of the Lathrop property is developed with structures on concrete slabs or parking areas paved with asphalt. The remaining portion of the Lathrop property is landscaped with grass, shrubs, and trees. The property east of the site is occupied by a hotel, gas station and an open field. West of the site is a condominium and retail development. The northern portion of the site borders on the water of San Francisco Bay and the southern boundary runs along Powell Street.

5.3 IDENTIFICATION OF POTENTIAL CONTAMINANTS

A variety of organic and inorganic chemical substances were identified in soil and groundwater samples collected from the 5 soil borings and groundwater monitoring wells at the site. Detailed chemical analysis results for soil samples (excluding asbestos, which was not analyzed) and comparisons of the detected concentrations with general criteria for soils were presented in WCC's Phase 2 report. The chemical analysis results for groundwater samples obtained during the Phase 2 study are compared to those obtained during the present study, in summary form herein on Tables 1 through 5.

For purposes of this preliminary assessment, and for future reference, descriptions of the physical, chemical, and toxicological properties of most of the chemicals detected in soil and groundwater samples from the site are presented in Appendix B, and several key toxicological parameters for the chemicals are summarized in Table 7.

Chemical substances identified in the soil and groundwater samples consisted of metal ions, single and multiple ringed aromatic hydrocarbons, ketones, organic acids, and organic alcohols. Asbestos was also reported to be present in the fill, in previous engineering studies.

5.4 EXPOSURE PATHWAYS AND PRELIMINARY ASSESSMENT

Because the ground surface at the Lathrop property is effectively sealed from the heterogeneous fill and groundwater below which contain these chemicals, the potential risk to humans which would be posed by direct contact with the chemicals above ground is virtually absent. However, human exposure to the chemicals could still occur, by several possible pathways which warrant examination:

- Inhalation of chemical vapors and/or contaminated airborne dust entering on-site buildings;

- Direct dermal contact with contaminated soil or groundwater, or vapor/dust inhalation, when excavating in soils deeper than about 3 feet;

- Use of the groundwater for drinking, or contact with the groundwater if pumped for other purposes, such as irrigation.

These possible pathways are discussed below. In addition to these, a fourth, less direct, possible pathway appears to warrant preliminary examination, and possibly a more detailed future assessment, based upon the hydrogeologic data collected during this phase of investigation and presented in Section 2 of this report. That is, based on this recent site-specific data, there appears to be hydraulic communication between the shallow groundwater below the site and the adjoining bay water. Thus the potential exists for migration of groundwater containing dissolved chemicals into the bay. Therefore, the possible impacts on aquatic life (fish/shellfish) adjacent to the site could conceivably represent an exposure pathway to humans.

5.4.1 Inhalation of Vapors and Dusts within Buildings

Several of the compounds found in the soil and groundwater have vapor pressures high enough to enable them to volatize readily from soil and water. Among them are benzene, xylene, toluene, ethylbenzene and napthalene. It is unlikely, however, that any of the volatile compounds could reach significant or detectable concentrations in indoor or outdoor air. The concrete floors of the buildings, paved driveways and parking lots and the engineered fill cap that covers over 95 percent of the site would retard upward vapor movement, keeping vapors from entering the surface air in appreciable concentrations. The three high-rise office buildings on the site are equipped with heating, ventilation and air conditions (HVAC) systems that maintain positive pressure in the office buildings. The pressure should prevent vapors or dust from entering the buildings. Intakes for the HVAC system are on the roofs of the buildings which range from 12 to 16 stories high. The site itself borders San Francisco Bay, directly in the path of the prevailing westerly winds entering the Golden Gate, which would quickly disperse airborne vapors. It is thus unlikely that vapors or contaminated dusts would enter the intakes at detectable concentrations before they were dispersed by the wind. It is WCC's opinion that this potential exposure pathway may be dismissed as insignificant and warrants no further consideration.

5.4.2 Direct Contact or Inhalation in Excavations

Workers could be directly exposed to chemicals or chemical vapors in excavations dug deep enough to reach the heterogeneous fill materials where contamination exists, or which reach groundwater. Exposure could be by direct dermal contact or by inhalation of vapors, where present. Where contamination with volatiles is present, the potential for a vapor hazard may be particularly significant because a deep excavation would constitute a confined space, where harmful vapors may tend to accumulate and concentrate. Similarly, it is possible that asbestos could be uncovered in deeper excavations, presenting risk via inhalation.

This potential exposure pathway is judged to be significant at the site and should be considered in any excavations deeper than 3 feet. Appropriate health and safety plans should be prepared and implemented for all deeper excavations. For any such excavation which covers a large area (e.g., new building construction, underground parking, etc.) or a substantial length (e.g., a deep pipeline), consideration should be given to performing a pre-construction soil boring and chemical analysis program to identify areas of significant contamination. Clearly, applicable regulations governing handling or disposal of contaminated soils or groundwater should be observed.

5.4.3 Shallow Groundwater

The shallow groundwater below the site and vicinity is naturally brackish and is non-potable per drinking water standards. Thus, it is highly unlikely that this groundwater would ever be used as a source of drinking water for humans or as a source of irrigation water for landscaping. The risk associated with ingestion of site groundwater is judged to be very low, and therefore does not warrant further study.

However, there is an associated site groundwater issue which warrants examination. During development of the Emeryville peninsula, a soils engineering technique for accelerating consolidation-related settlements of the Bay Mud deposit below the site was designed and used. This method utilized a grid of closely-spaced, drilled, gravel-filled boreholes, called "sand drains" to promote rapid settlement of the mud throughout much of the Emeryville peninsula, including the western portion of the Lathrop property. Because shallow groundwater below the site is now known to contain chemical contaminants, the question arises as to whether these sand drains could possibly be vertical conduits to permit transfer of the contaminants to deeper, possibly potable water-bearing zones.

That question was examined during this study by reviewing historical engineering documents and a technical paper (e.g., see WCC 1969, 1971; Margason, E. and Arango, I. 1972). It appears that all of the sand drains at the site were drilled to depths less than about 50 feet. Native soils in the upper 50 feet below the site are predominantly low-permeability clays, with no continuous sand or gravel strata. Furthermore, the sand drains were designed for the "single drainage" condition, which means that groundwater migrating toward the drains would tend to flow upward, and not downward, in the drains to the more permeable fill material above native soils. Observations of water flow from the drains after their installation verified this field condition. Therefore, the potential for the sand drains to act as conduits for downward contaminant migration is judged to be insignificant.

5.4.4 Potential Shellfish Impacts

As discussed above in this section and in Section 4, there appears to be potential for migration of site groundwater to the adjacent bay water. While it is expected that any substantial chemical concentrations in groundwater would be immediately diluted to very low or non-detectable concentrations upon reaching the open bay water, it is possible that even very low levels of some contaminants, particularly the heavy metals, could impact shellfish near the site.

According to a survey by Jones and Stokes (1977), the mudflats directly north of the Watergate Peninsula are inhabited by the softshell clam, <u>Mya arenaria</u>. Also, a large population of littleneck clams, <u>Tapes japonica</u>, exists all along the southern shore of the peninsula. Clams are filter feeders; they draw water into their siphons and retain nutrients through filtration. Clams can accumulate certain chemicals in their tissues so that persons consuming such shellfish might be exposed to elevated levels of contaminants.

No human clamming activities at the clam beds have been observed at the site. Clamming activity in San Francisco Bay is generally low. However, if clams were harvested adjacent to the site and repeatedly consumed by the same persons, and if the clams were actually adversely impacted by groundwater below the site, then it is conceivable that this could represent an exposure pathway to humans warranting further investigation and assessment.

← ?

Seems to disregard Bioaccumulation effect in clams

5.5 CONCLUSIONS

Health risks associated with several potential human exposure pathways to chemicals found in the soil and groundwater at the Lathrop property were evaluated. The identified pathways were inhalation of vapors and contaminated dusts in office buildings, ingestion of groundwater, direct contact with contaminated soil and inhalation of vapors and contaminated dusts during excavating operations, and possibly consumption of contaminated shell fish, if such are shown to exist in future studies.

Pathways for which risk was judged insignificant were inhalation of vapors and contaminated dusts in office buildings and ingestion of groundwater. Consumption of contaminated shellfish could represent an

?

exposure pathway to humans if the same individuals were to frequently consume clams harvested from the area. No clamming activities are known in the area, making this an unlikely exposure pathways.

In conclusion, an examination of risk of exposure to hazardous chemicals in the subsurface showed that no threat exists for persons working at the Lathrop property development. Significant risk could be expected in on-site excavating activities that expose soil below a depth of about three feet. Development of a project specific health and safety plan is recommended when excavation more than 3 feet below grade is planned.

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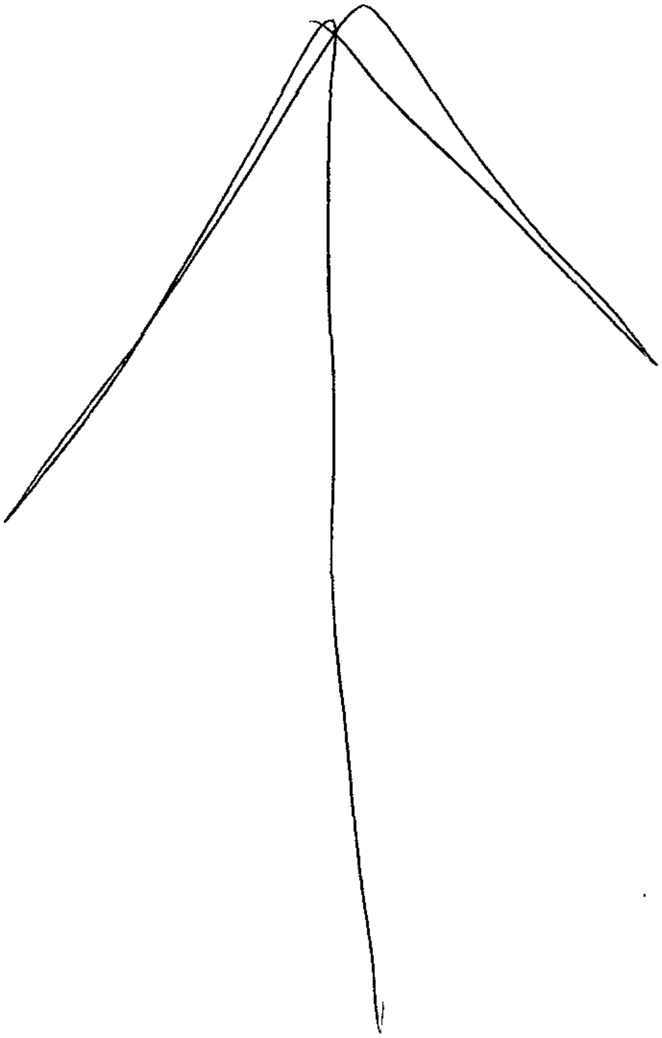

Table 1. SUMMARY OF TESTS RUN

Target Constituents (Test Method)	Soil	Water
Title 22 Metals + Chromium VI (ASS/ICP)	X	X
EPA 8080/608 (Organochlorine Pesticides)	X	X
EPA 8240/624 (Volatile Organics)	X	X
EPA 8270/625 (Semi-Volatile Organics)	X	X
EPA 8015/8020 (Low & Med. BP TPH with BTXE)	X	X
EPA 8015 (High BP TPH)	X	X
Total Recoverable Oil & Grease	X	X

BP - Boiling Point
TPH - Total Petroleum Hydrocarbons
EPA - Environmental Protection Agency
BTXE - Benzene, Toluene, Xylene and Ethylbenzene
AAS/ICP - Atomic Absorption Spectroscopy/Induction Coupled Plasma Detection

Table 2. SOIL ANALYSIS: FUEL AND LUBRICANT DERIVATIVES DETECTED [1,2]

Constituent (ppm)	MW-1	MW-2	MW-3	MW-4	MW-5	Test Description
Benzene	0.14	0.26	--	0.10	--	2
Toluene	7.00	0.48	--	0.72	--	2
Xylene	86.00	7.20	--	1.60	--	2
Ethylbenzene	6.60	0.50	--	0.14	--	2
TPH - Low BP	1,100	44	--	3	--	2
TPH - High BP	1,500	170	12	89	27	EPA 8015
Oil & Grease	9,000	40,000	12	21,000	11,000	Gravimetric

[1] All soil tests were run on composite samples prepared by combining all soil samples from each well into a single sample for analysis.

[2] BTEX tested by both EPA 8240/EPA and (8015/8020): higher result shown.

Blank cells (-) indicate constituent was not detected.

Table 3. SOIL ANALYSIS: OTHER ORGANIC CONSTITUENTS DETECTED[1,2]

Constituent (ppm)	MW-1	MW-2	MW-3	MW-4	MW-5	Test Description
Organics						
2-Methylnaphthalene	7.300	--	--	--	--	EPA 8270
Fluoranthene	8.000	--	0.160	--	--	EPA 8270
Naphthalene	76.000	13.000	--	--	--	EPA 8270
Polynuclear Aromatics (PNAs)						
Benzo(a)anthracene	--	--	0.130			
Benzo(a)pyrene	--	--	0.250	--	--	EPA 8270
Benzo(b)fluoranthene	--	--	0.400	--	--	EPA 8270
Benzo(g,h,i)perylene	--	--	0.300	--	--	EPA 8270
Chrysene	--	--	0.120	--	--	EPA 8270
Indeno(1,2,3-cd)pyrene	--	--	0.430	--	--	EPA 8270
Phenathrene	17.000	--	--	--	--	EPA 8270
Pyrene	13.000	--	0.380	--	--	EPA 8270
Total PNAs[3]	30.000	--	2.010	--	--	

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[1] Only constituents that were detected are shown. For a complete list of laboratory results see Appendices B and C, Laboratory Analysis Reports.

[2] Blank cells (-) indicate constituent was not detected.

[3] Criteria available for sum of PNAs

Table 4. SOIL ANALYSIS: INORGANIC CONSTITUENTS DETECTED[1]

Constituent (ppm)	MW-1	MW-2	MW-3	MW-4	MW-5
Arsenic	2.20	0.96	4.80	0.69	1.10
Barium	210.00	160.00	43.00	67.00	56.00
Beryllium	0.30	0.28	0.25	0.15	0.15
Cadmium	1.10	0.47	0.69	0.45	0.34
Chromium III	120.00	43.00	32.00	27.00	25.00
Cobalt	6.70	5.60	5.70	3.90	7.20
Copper	40.00	59.00	43.00	53.00	62.00
Lead	550.00	100.00	82.00	350.00	21.00
Mercury	0.33	0.14	0.13	0.16	0.13
Molybdenum	2.10	0.76	0.65	1.30	0.83
Nickel	30.00	36.00	22.00	25.00	42.00
Selenium	0.17	0.22	0.14	0.33	0.19
Silver	0.18	0.15	0.44	0.56	0.45
Vanadium	19.00	31.00	21.00	30.00	56.00
Zinc	550.00	670.00	130.00	79.00	130.00

---

[1] Only constituents that were detected are shown. For a complete list of laboratory results see Appendices B and C, Laboratory Analysis Reports. Test Method: AAS/ICP.

Table 5. SOIL ANALYSIS: WASTE EXTRACTION TEST RESULTS[1,2,3] - CONSTITUENTS DETECTED

Constituent (ppm)	MW-1	Rerun[4] MW-1	MW-2	MW-3	MW-4	MW-5
Barium	3.80	0.054	3.50	--	--	--
Cadmium	0.54	--	--	--	--	--
Copper	0.071	0.099	3.50	0.95	1.70	5.30
Lead	0.27	0.36	3.40	4.00	6.50	0.94
Mercury	0.0013	--	--	--	--	--
Nickel	1.30	0.053	0.63	0.81	0.57	0.96
Vanadium	--	--	0.64	--	0.68	0.56
Zinc	3.80	0.064	20.00	--	--	--

---

[1] Waste extraction test was run only on samples where the chemical concentration in soil was equal to or greater than ten times the STLC, a standard laboratory protocol.

[2] Only constituents that were detected are shown. For a complete list of laboratory results see Appendices B and C, Laboratory Analysis Reports.

[3] Blank cells (-) indicate constituent was not detected.

[4] The Waste Extraction Test was rerun on a fresh soil sample from MW-1 using deionized water.

Table 6. WATER ANALYSIS: FUEL AND LUBRICANT DERIVATIVES DETECTED[1,2,3]

Constituent (ppb)	MW-1	MW-2	MW-3	MW-4	MW-5	Test Description
Benzene	4.0	4.9	--	3.7	--	1
Toluene	430.0	0.6	--	9.6	1.1	1
Xylenes	170.0	0.9	0.6	9.6	2.3	1
Ethylbenzene	11.0	--	--	1.9	--	1
TPH - Low BP	2,500	67	--	120	--	EPA 8015
TPH - High BP	290	--	540	540	270	EPA 8015
Oil & Grease	1,400	--	--	3,500	--	Gravimetric

---

[1] Only constituents that were detected are shown. For a complete list of laboratory results see Appendices B and C, Laboratory Analysis Reports.

[2] BTXE tested by both EPA 8240 and EPA 8015/8020: highest result shown.

[3] Blank cells (-) indicate constituent was not detected.

Table 7. WATER ANALYSIS: OTHER ORGANIC CONSTITUENTS DETECTED[1,2]

Constituent (ppb)	MW-1	MW-2	MW-3	MW-4	MW-5	Test Description
Organics						
Acetone	280	20	--	24	28	EPA 8240
Benzoic Acid	510	--	--	--	--	EPA 8270
Benzyl Alcohol	6	--	--	--	--	EPA 8270
2-Butanone	55	--	--	--	--	EPA 8240
2-Hexanone	2,800	--	--	--	--	EPA 8240
Methylene Chloride	--	4	360	5	3	EPA 8240
Diethyl Phthalate	--	--	--	3	--	EPA 8270
Fluorene	--	--	--	3	--	EPA 8270
Phenol	78	--	--	4	--	EPA 8270
2,4-Dimethylphenol	76	--	--	--	--	EPA 8270
2-Methylphenol	32	--	--	--	--	EPA 8270
4-Methylphenol	110	--	--	--	--	EPA 8270
2-Methylnaphthalene	--	--	--	9	--	EPA 8270
Naphthalene	59	--	--	49	--	EPA 8270
Polynuclear Aromatics (PNAs)						
Acenaphthene	--	--	--	3	--	EPA 8270
Phenathrene	--	--	--	4	--	EPA 8270
Total PNAs	--	--	--	7	--	

---

[1] Only constituents that were detected are shown. For a complete list of laboratory results see Appendices B and C, Laboratory Analysis Reports.

[2] Blank cells (-) indicate constituent was not detected.

ble 8. WATER ANALYSIS: INORGANIC CONSTITUENTS DETECTED[1,2]

Constituent (ppb)	MW-1	MW-2	MW-3	MW-4	MW-5
Arsenic	--	--	--	--	37
Barium	310	1400	--	850	740
Chromium III	150	--	--	--	--
Lead	700	200	50	100	70
Nickel	--	--	--	64	78
Zinc	--	--	98	170	76

[1] Only constituents that were detected are shown. For a complete list of laboratory results, see Appendices B and C, Laboratory Analysis Reports.

[2] Blank cells (-) indicate constituent was not detected.

Table 9. LIST OF DETECTED CONSTITUENTS ALSO ON PROPOSITION 65 LIST (1)

Constituent	Monitoring Well(2)	Media	Category
Arsenic	1,2,3,4,5	soil	(3)
	5	water	(3)
Benzene	1,2,4	soil	(3)
	1,2,4	water	(3)
Benzo(a)pyrene	3	soil	(3)
Benzo(b)fluoranthene	3	soil	(3)
Beryllium	1,2,3,4,5	soil	(3)
Cadmium	1,2,3,4,5	soil	(3)
Indeno(1,2,3-cd)pyrene	3	soil	(3)
Lead	1,2,3,4,5	soil	(4)
	1,2,3,4,5	water	(4)
Methylene Chloride	2,3,4,5	water	(3)

---

(1) California Regulatory Notice Register, January 6, 1989.
(2) Monitoring well numbers shown; refer to Figure 2 for locations.
(3) "Chemicals Known to the State to Cause Cancer," Proposition 65 List.
(4) "Chemicals Known to the State to Cause Reproductive Toxicity," Proposition 65 List.

Table 10. COMPARISON OF DETECTED CONSTITUENT CONCENTRATIONS IN WATER FROM MW-1 AND MW-3

Constituent (ppb)	MW-1	MW-3	Detection Level
Benzene	4	--	0.5
Toluene	430	--	0.5
Xylene	140	640	0.5
Ethyl Benzene	9	--	5.0
TPH - Low BP	2,500	--	50.0
TPH - High BP	290	540	50.0

Constituent (ppb)	MW-1	MW-3	Detection Level
Acetone	280	20	50/10
Benzoic Acid	510	--	10/10
Benzyl Alcohol	6.0	--	2/12
2-Butanone	55	--	50/10
2,4-Dimethylphenol	76	--	2/2
2-Hexanone	2,800	--	50/10
Methylene Chloride	ND	4	10/2
2-Methylphenol	32	--	2/2
4-Methylphenol	110	--	2/2
Naphthalene	59	--	2/2
Phenol	78	--	2/2

Blank (--) indicates constituent not detected.

Table 11. SOIL ANALYSIS: COMPARISON AGAINST WASTE CRITERIA

Constituent	Location	Highest Concentration	STLC
Organic Chemicals (ppm)			
2-Methylnapthalene	MW-1	7.3	--
Fluoranthene	MW-1	8.0	--
Naphthalene	MW-1	76	--
Polynuclear Aromatics (ppb)			
Benzo(a)anthracene	MW-1	130	
Benzo(a)pyrene	MW-1	250	
Benzo(a)fluoranthene	MW-1	400	
Benzo(g,h,i)perylene	MW-1	300	
Chrysene	MW-1	120	
Indeno(1,2,3-cd)pyrene	MW-1	430	
Phenanthrene	MW-1	17,000	
Pyrene	MW-1	13,000	
	MW-1		
Total PNA's[3]		31,630	
Inorganics (ppm)		WET Test	
Arsenic		--	--
Barium	MW-1	3.8	100
Beryllium		--	--
Cadmium	MW-1	0.54	1
Chromium III		--	--
Cobalt		--	--
Copper	MW-1	5.3	25
Lead	MW-1	6.5	5
Mercury	MW-1	0.0013	0.2
Molybdenum		--	--
Nickel	MW-1	1.3	20
Selenium		--	--
Silver		--	--
Vanadium	MW-1	0.600	24
Zinc	MW-1	20	--

Blank (--) indicates constituent not detected.

Table 12. WATER ANALYSIS: COMPARISON AGAINST WATER QUALITY GOALS

Constituent	Highest Concentration	Location	California Ocean Plan[1]	S.F. Bay Basin Plan	EPA Acute Toxicity[2]
Fuel and Lubricant Derivaties (ppb)					
Benzene	4.9	MW-2	--	--	5,100
Toluene	430	MW-1	--	--	6,300
Xylene	170	MW-1	--	--	--
Ethyl benzene	11	MW-1	--	--	430
TPH-Low BP	2,500	MW-1	--	--	--
TPH-High BP	540	MW-3,4	--	--	--
Organic Chemicals (ppb)					
Acetone	280	MW-1	--	--	--
Benzoic Acid	510	MW-1	--	--	--
Benzyl Alcohol (ppb)	6	MW-1	--	--	--
2-Butanone	55	MW-1	--	--	--
2-Hexanone	2,800	MW-1	--	--	--
Methylene Chloride	360	MW-3	--	--	12,000
Diethyl Phthalate	3	MW-4	--	--	49,000
Fluorene	3	MW-1	--	--	300
Phenol	78	MW-1	30[3]	500[3]	5,800
2,4-Dimethylphenol	76	MW-1	30[3]	500[3]	--
2-Methylphenol	32	MW-1	30[3]	500[3]	--
4-Methylphenol	110	MW-1	30[3]	500[3]	--
2-Methylnaphthalene	9	MW-4	--	--	--
Napthalene	59	MW-1	--	--	23,500
Polynuclear Aromatics (PNAs)					
Acenapthene	3	MW-4	--	--	970
Phenanthrene	4	MW-4	--	--	300
	—			———	----
Total PNAs	7			15	
Inorganic Chemical (ppb)					
Arsenic	37	MW-5	8	20	2,319
Barium	1,400	MW-2	--	--	--
Chromium (III)	150	MW-1	--	--	10,300
Lead	700	MW-1	8	5.6	--
Nickel	780	MW-5	20	7.1	--
Zinc	170	MW-4	20	58	--

---

[1] 6 month median.

[2] EPA National ambient water quality criteria to protect saltwater aquatic life.

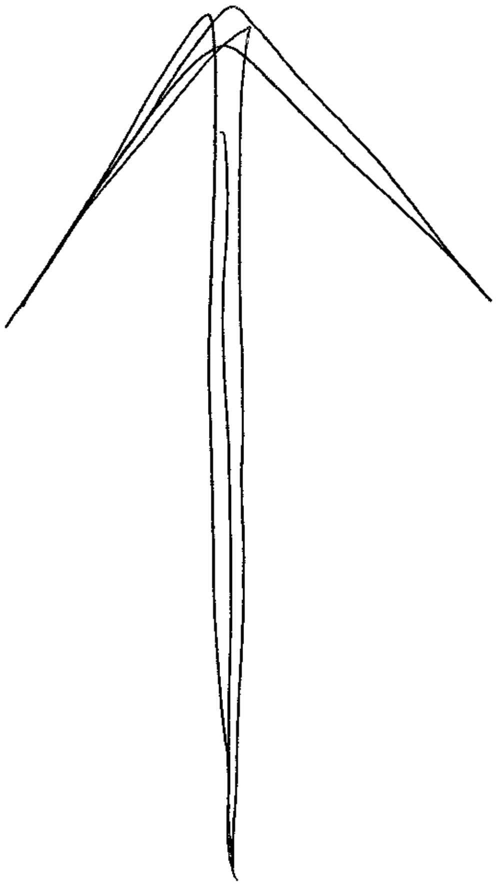
[3] For sum of phenols.

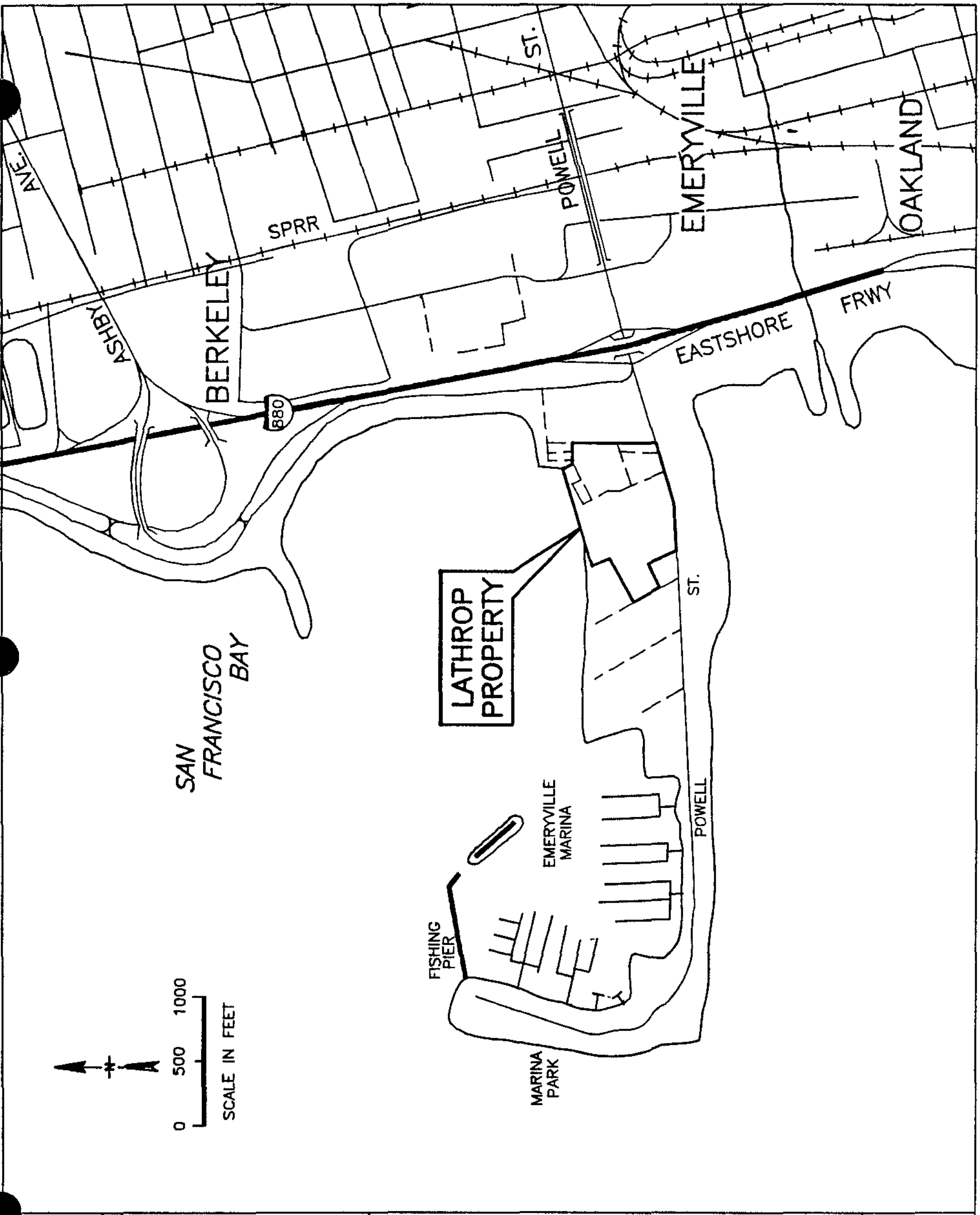
Table 13. WATER PARAMETERS DURING SAMPLING

Well No.	Water Level (feet below MP)	Pre-Sample Discharge (gallons)	Salinity (% seawater)	Temperature (°C)	Specific Conductance (μmho/cm)	pH	Color	Odor	Turbidity
MW-1	--	15	20	20	28,000	7.5	Brown	hydrocarbon	slight
MW-2	8.85	50	8	19	11,000	7.8	Lt. Brown	hydrocarbon	slight
MW-3	6.7	40	8	22	11,000	8.1	Brown	hydrocarbon	slight
MW-4	9.95	50	2	21	3,300	8.2	Lt. Brown	hydrocarbon	slight
MW-5	9.0	40	3	19	4,300	7.8	Lt. Brown	hydrocarbon	very slight

MP - measuring point

2





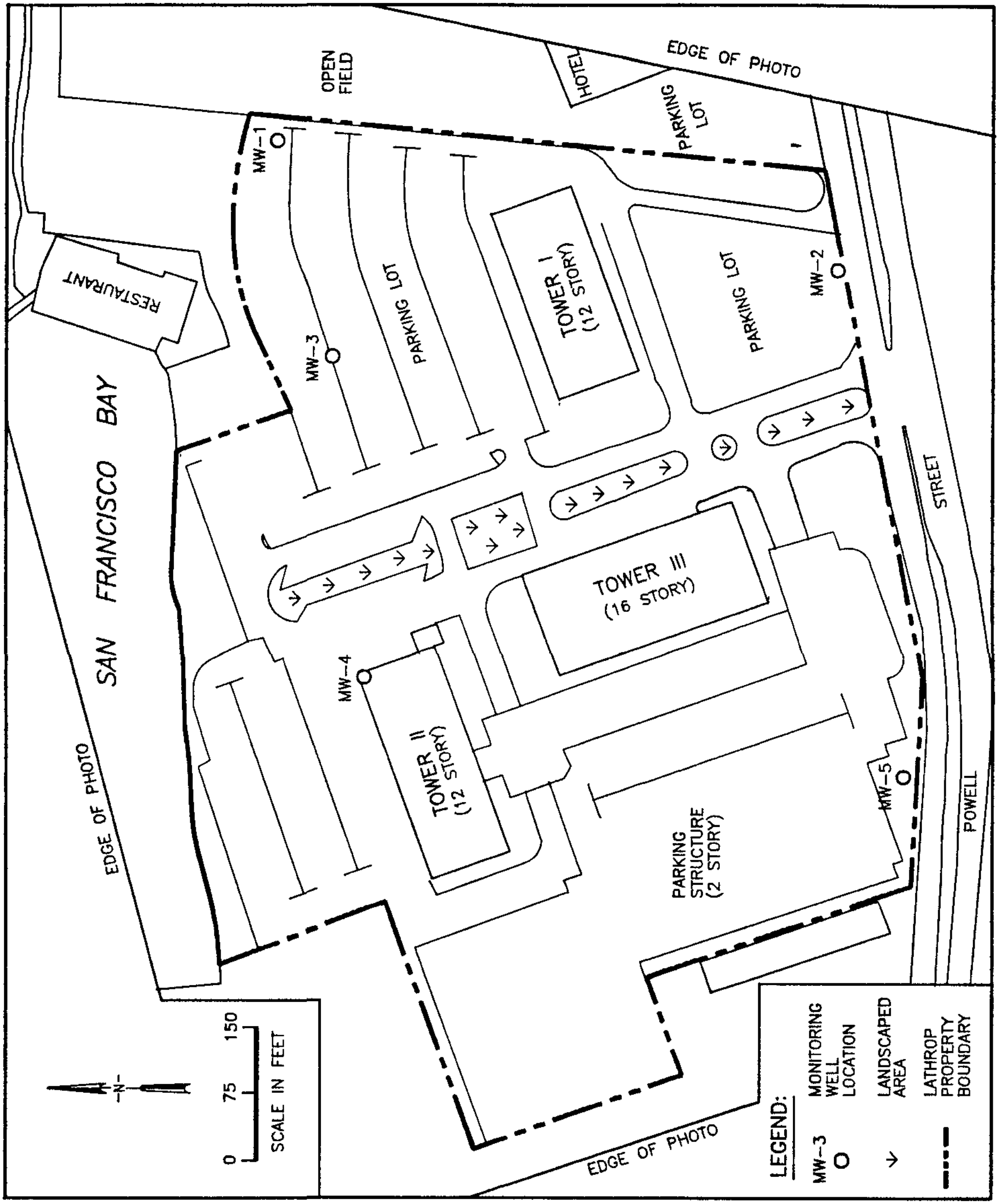
Project No.
8810235A

LATHROP PROPERTY
ENVIRONMENTAL ASSESSMENT

Woodward-Clyde Consultants

PROJECT SITE MAP

Figure
1



Project No.
8810235A

LATHROP PROPERTY
ENVIRONMENTAL ASSESSMENT

Woodward-Clyde Consultants

MONITORING WELL LOCATIONS
PHOTO DATE: 4-5-1985

Figure
2

Figure 3. LATHROP PROPERTY

Monitoring Well/Pier Water Level Data

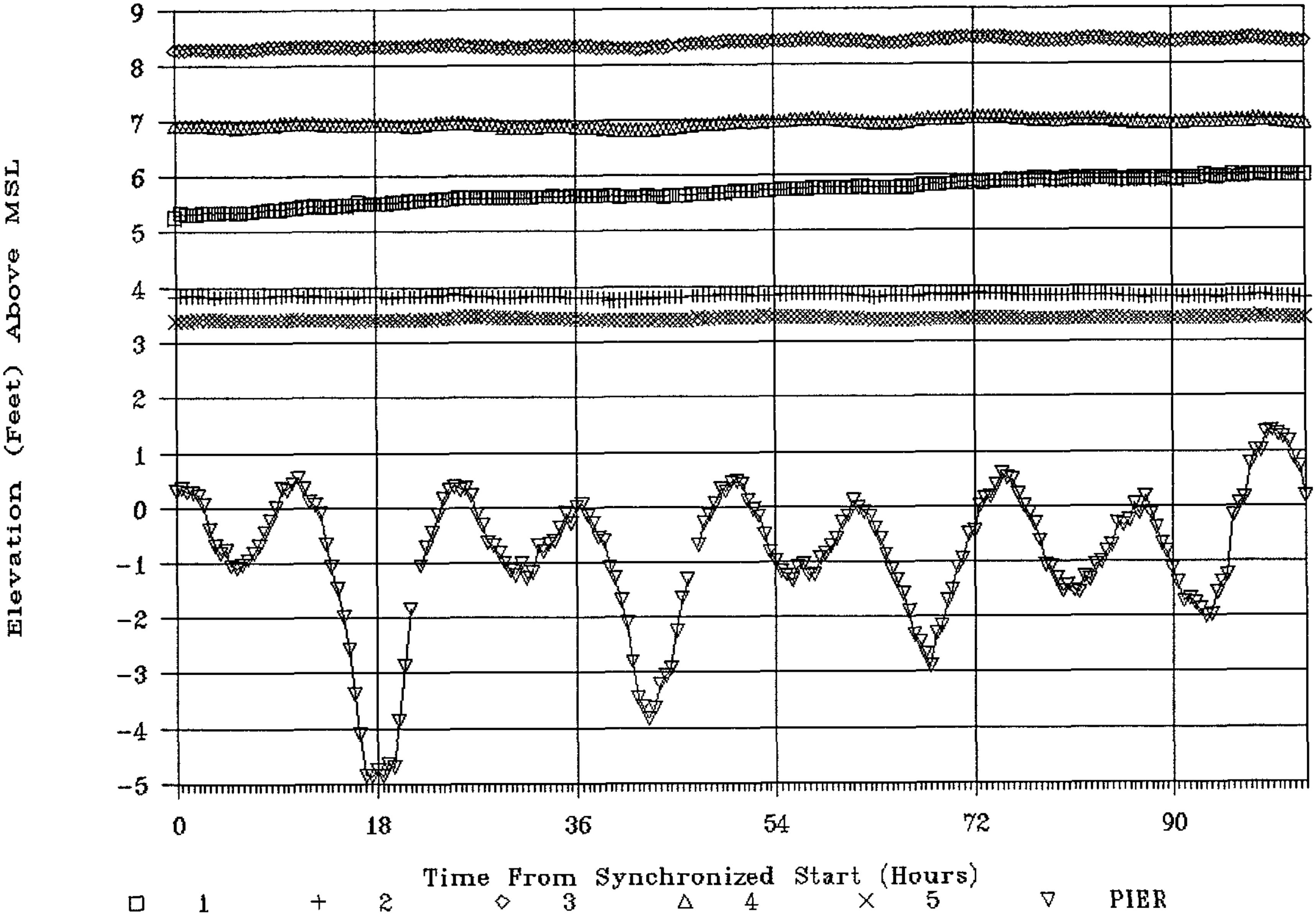


Figure 4. LATHROP PROPERTY

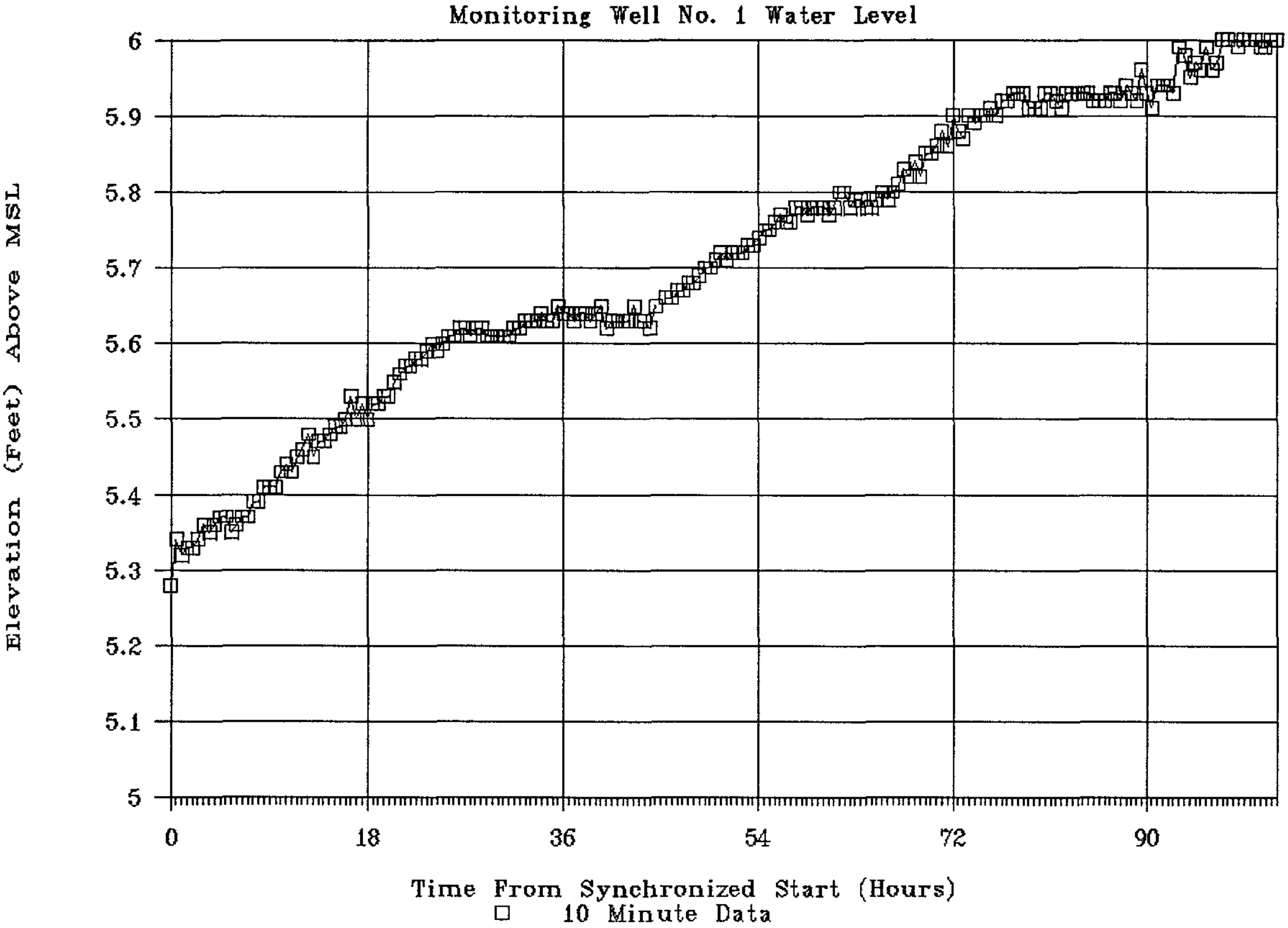


Figure 5. LATHROP PROPERTY

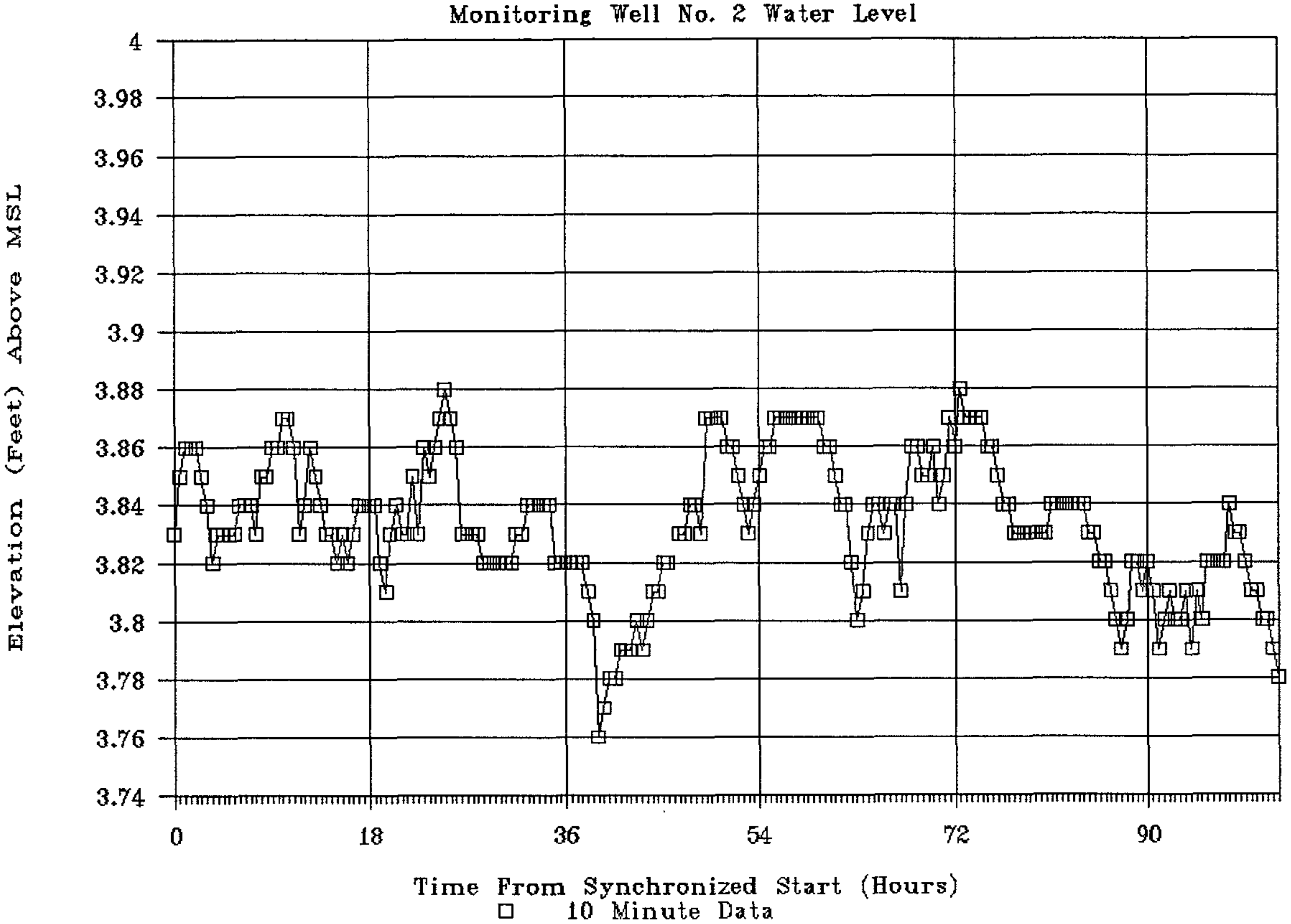
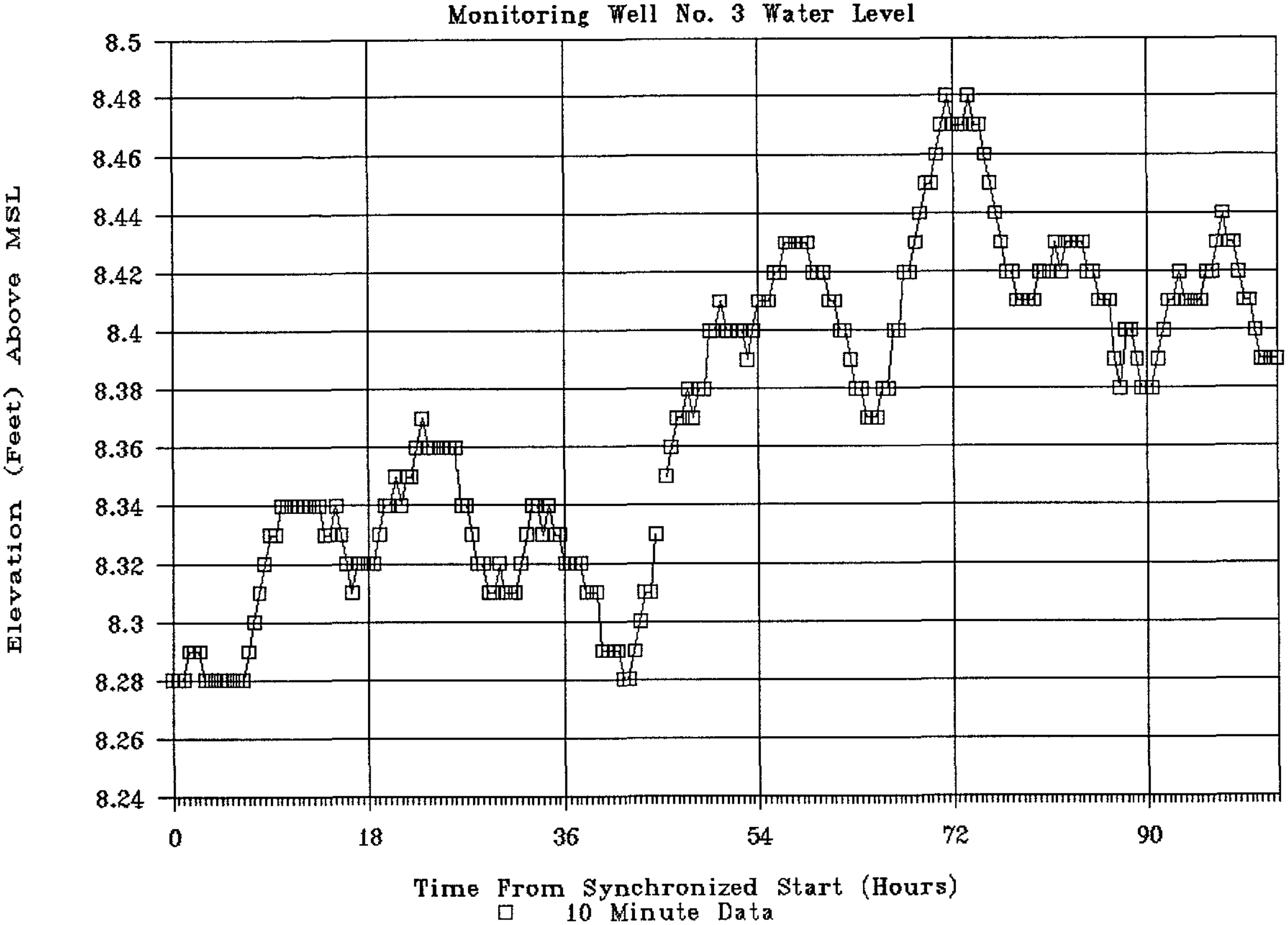


Figure 6. LATHROP PROPERTY



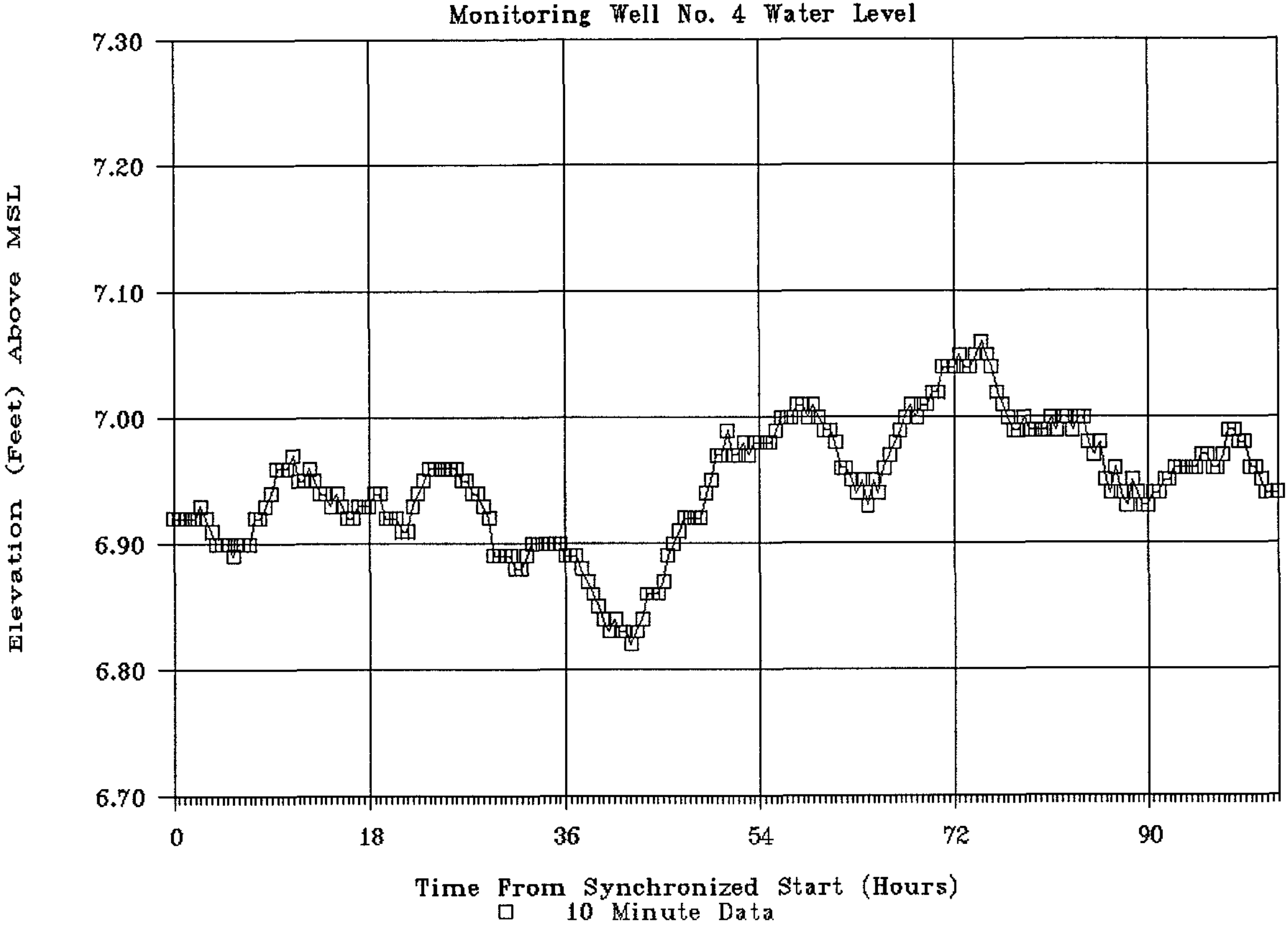
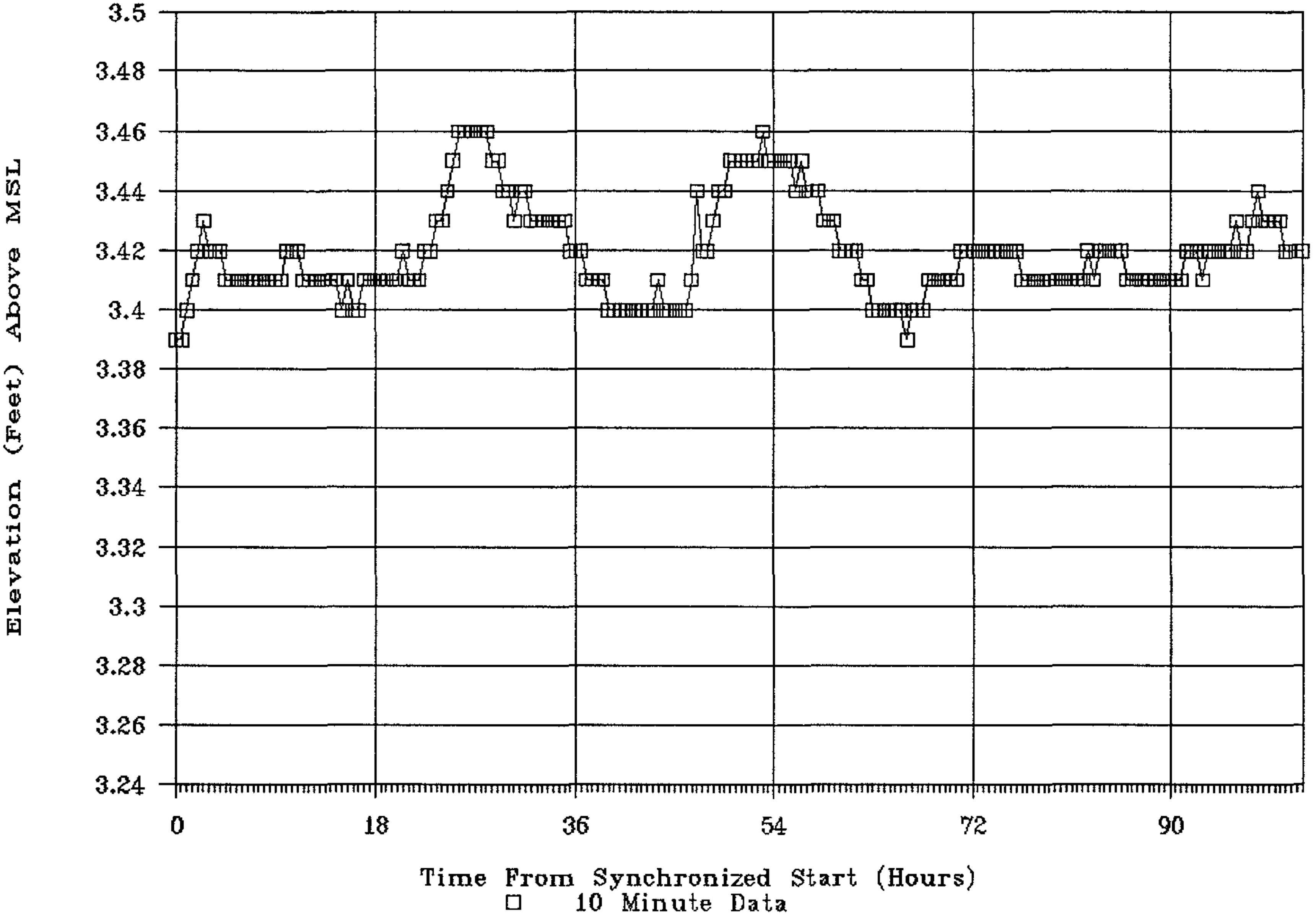
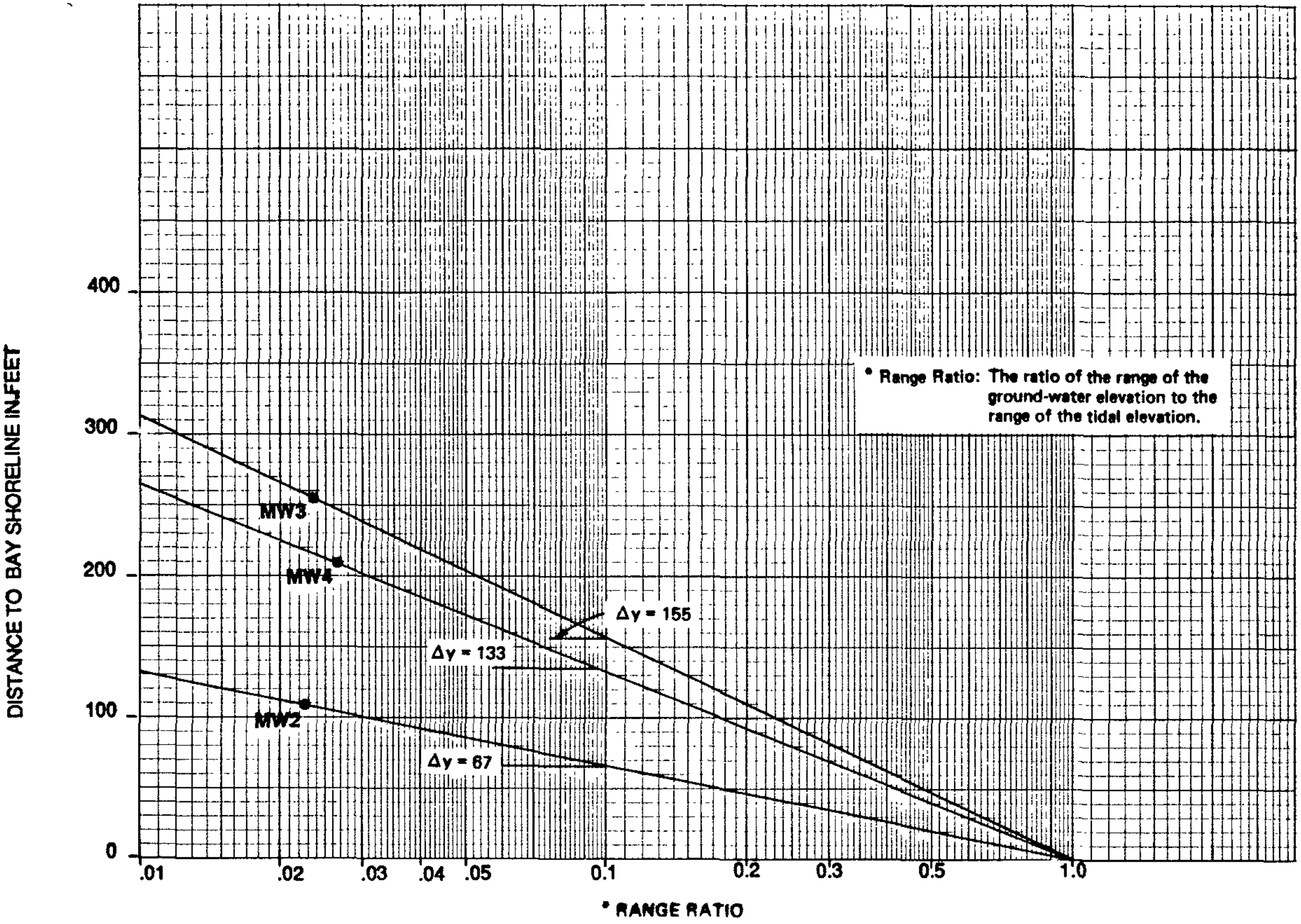


Figure 7. LATHROP PROPERTY

Figure 8. LATHROP PROPERTY

Monitoring Well No. 5 Water Level

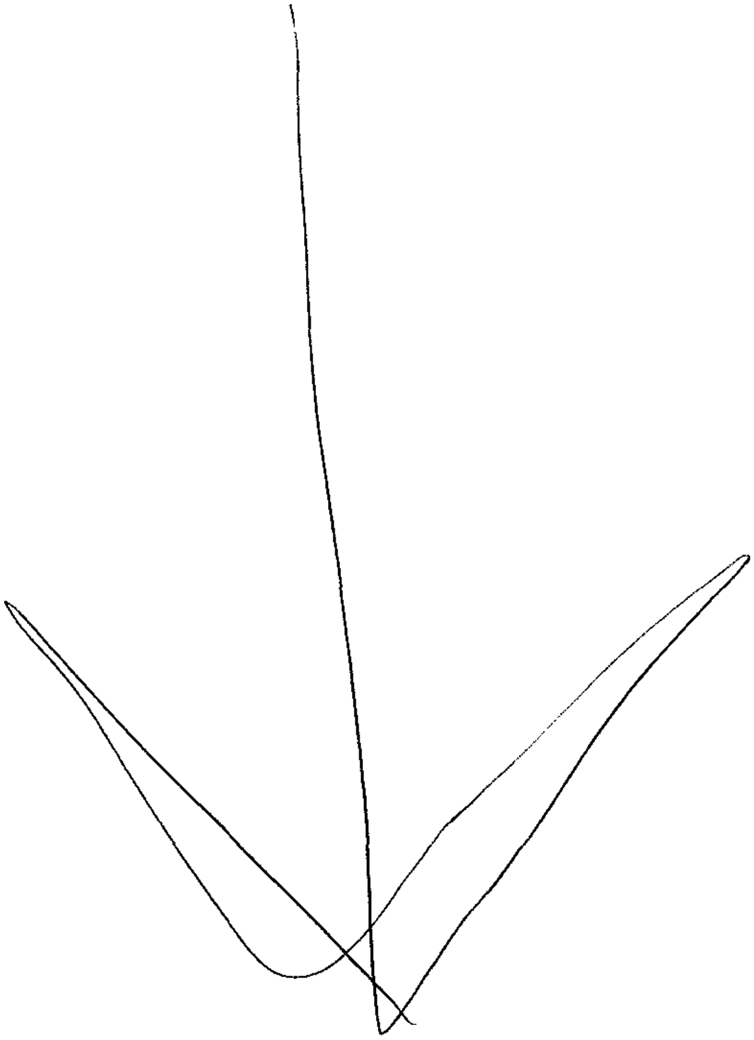




* Range Ratio: The ratio of the range of the ground-water elevation to the range of the tidal elevation.

Project No. 8810235A	LATHROP PROPERTY ENVIRONMENTAL ASSESSMENT	* RANGE RATIO VS. DISTANCE	Figure 9
Woodward-Clyde Consultants			

3



APPENDIX A

WATER SAMPLE CHEMICAL ANALYSIS REPORTS

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants 500 12th St., Suite 100 Oakland, CA 94607-4041 Attention: John McMillan	Client Project ID: #8820135A-4000 Matrix Descript: Water Analysis Method: EPA 5030/8015/8020 First Sample #: 905-0266 A-B	Sampled: Received: Analyzed: Reported:	May 3, 1989 May 4, 1989 May 10, 1989 May 15, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
905-0266	MW-1	7,700	47	680	35	550
905-0267	MW-3	30	1.4	0.52	N.D.	0.3
905-0268	MW-4	150	1.7	3.9	1.1	3.8
905-0269	MW-6D	N.D.	N.D.	N.D.	N.D.	N.D.

Detection Limits:	30.0	0.3	0.3	0.3	0.3

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Alan Lattaner

Client Project ID:	#8820135A-4000	Sampled:	May 2, 1989
Matrix Descript:	Water	Received:	May 3, 1989
Analysis Method:	EPA 5030/8015/8020	Analyzed:	May 9, 1989
First Sample #:	905-0090 A-B	Reported:	May 11, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons μg/L (ppb)	Benzene μg/L (ppb)	Toluene μg/L (ppb)	Ethyl Benzene μg/L (ppb)	Xylenes μg/L (ppb)
9050090 A-B	MW-2	130	14	0.84	N.D.	1.2
9050091 A-B	MW-5	34	N.D.	N.D.	N.D.	0.84
9050093 A-B	MW-6B	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**30.0**	**0.3**	**0.3**	**0.3**	**0.3**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID:	#8820135A-4000	Sampled:	May 3, 1989
Matrix Descript:	Water	Received:	May 4, 1989
Analysis Method:	EPA 3510/8015	Analyzed:	May 11, 1989
First Sample #:	905-0266 C	Reported:	May 15, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons µg/L (ppb)
905-0266	MW-1	11,000
905-0267	MW-3	420
905-0268	MW-4	500
Detection Limits:		50.0

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Laboratory Director

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(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants	Client Project ID: #8820135A-4000	Sampled:	May 2, 1989
500 12th St., Suite 100	Matrix Descript: Water	Received:	May 3, 1989
Oakland, CA 94607-4041	Analysis Method: EPA 3510/8015	Analyzed:	May 10, 1989
Attention: Alan Lattaner	First Sample #: 905-0090 C	Reported:	May 11, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons μg/L (ppb)
9050090 C	MW-2	430
9050091 C	MW-5	390
9050092 C	MW-6A	360

Detection Limits:	**50.0**

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Matrix Descript: Water
Analysis Method: EPA 413.2 (I.R.)
First Sample #: 905-0266 D

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 10, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

TOTAL RECOVERABLE OIL & GREASE

Sample Number	**Sample Description**	**Oil & Grease** mg/L (ppm)
905-0266	MW-1	3,800
905-0267	MW-3	6.1
905-0268	MW-4	7.2

Detection Limits:	**1.0**

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

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680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Alan Lattaner

Client Project ID: #8820135A-4000
Matrix Descript: Water
Analysis Method: EPA 413.2 (I.R.)
First Sample #: 905-0090 D

Sampled: May 2, 1989
Received: May 3, 1989
Extracted: May 10, 1989
Analyzed: May 10, 1989
Reported: May 11, 1989

TOTAL RECOVERABLE OIL & GREASE

Sample Number	Sample Description	Oil & Grease mg/L (ppm)
9050090 D	MW-2	7.2
9050091 D	MW-5	5.0

Detection Limits:	1.0

Analytes reported as N.D. were not present above the stated limit of detection.

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(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-1
Lab Number: 905-0266 E

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 7, 1989
Reported: May 15, 1989

INORGANIC PERSISTENT AND BIOACCUMULATIVE TOXIC SUBSTANCES

	Soluble Threshold Limit Concentration Waste Extraction Test			Total Threshold Limit Concentration		
Analyte	**STLC Max. Limit** (mg/L)	**Detection Limit** (mg/L)	**Analysis Result** (mg/L)	**TTLC Max. Limit** (mg/kg)	**Detection Limit** (mg/kg)	**Analysis Result** (mg/kg)
Antimony	15	0.1	-	500	0.1	N.D.
Arsenic	5	0.01	-	500	0.001	0.007
Barium	100	0.02	-	10,000	0.02	0.2
Beryllium	0.75	0.01	-	75	0.01	N.D.
Cadmium	1	0.01	-	100	0.01	N.D.
Chromium (VI)	5	0.005	-	500	0.005	N.D.
Chromium (III)	560	0.005	-	2,500	0.005	0.073
Cobalt	80	0.05	-	8,000	0.05	N.D.
Copper	25	0.01	-	2,500	0.01	N.D.
Lead	5	0.005	-	1,000	0.005	0.098
Mercury	0.2	0.001	-	20	0.001	N.D.
Molybdenum	350	0.05	-	3,500	0.05	0.084
Nickel	20	0.05	-	2,000	0.05	0.11
Selenium	1	0.005	-	100	0.01	N.D.
Silver	5	0.01	-	500	0.01	N.D.
Thallium	7	0.5	-	700	0.5	0.79
Vanadium	24	0.05	-	2,400	0.05	0.37
Zinc	250	0.01	-	5,000	0.01	0.095
Asbestos	-	10	-	10,000	100	N.D.
Fluoride	180	0.1	-	18,000	1.0	-

TTLC results are reported as mg/kg of wet weight. Asbestos results are reported as fibers/g.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Arthur G. Burton
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680 Chesapeake Drive • Redwood City, CA 94063
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Woodward-Clyde Consultants 500 12th St., Suite 100 Oakland, CA 94607-4041 Attention: Alan Lattaner	Client Project ID: #8820135A-4000 Sample Descript: Water, MW-2 Lab Number: 905-0090 E-I	Sampled: Received: Reported:	May 2, 1989 May 3, 1989 May 11, 1989

INORGANIC PERSISTENT AND BIOACCUMULATIVE TOXIC SUBSTANCES

	Soluble Threshold Limit Concentration Waste Extraction Test			Total Threshold Limit Concentration		
Analyte	STLC Max. Limit (mg/L)	Detection Limit (mg/L)	Analysis Result (mg/L)	TTLC Max. Limit (mg/kg)	Detection Limit (mg/L)	Analysis Result (mg/L)
Antimony	15	0.1	-	500	0.1	N.D.
Arsenic	**5**	**0.01**	**-**	**500**	**0.001**	**0.0098**
Barium	**100**	**0.02**	**-**	**10,000**	**0.02**	**0.68**
Beryllium	0.75	0.01	-	75	0.01	N.D.
Cadmium	1	0.01	-	100	0.01	N.D.
Chromium (VI)	5	0.005	-	500	0.05	N.D.
Chromium (III)	**560**	**0.005**	**-**	**2,500**	**0.005**	**0.005**
Cobalt	80	0.05	-	8,000	0.05	N.D.
Copper	25	0.01	-	2,500	0.01	N.D.
Lead	**5**	**0.005**	**-**	**1,000**	**0.005**	**0.18**
Mercury	0.2	0.001	-	20	0.001	N.D.
Molybdenum	**350**	**0.05**	**-**	**3,500**	**0.05**	**0.050**
Nickel	20	0.05	-	2,000	0.05	N.D.
Selenium	1	0.005	-	100	0.01	N.D.
Silver	**5**	**0.01**	**-**	**500**	**0.01**	**0.012**
Thallium	**7**	**0.5**	**-**	**700**	**0.5**	**0.11**
Vanadium	24	0.05	-	2,400	0.05	N.D.
Zinc	**250**	**0.01**	**-**	**5,000**	**0.01**	**0.18**
Asbestos	-	10	-	10,000	100	N.D.
Fluoride	180	0.1	-	18,000	1.0	-

TTLC results are reported as mg/kg of wet weight. Asbestos results are reported as fibers/g.
Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-3
Lab Number: 905-0267 E

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 7, 1989
Reported: May 15, 1989

INORGANIC PERSISTENT AND BIOACCUMULATIVE TOXIC SUBSTANCES

	Soluble Threshold Limit Concentration Waste Extraction Test			Total Threshold Limit Concentration		
Analyte	**STLC Max. Limit** (mg/L)	**Detection Limit** (mg/L)	**Analysis Result** (mg/L)	**TTLC Max. Limit** (mg/kg)	**Detection Limit** (mg/kg)	**Analysis Result** (mg/kg)
Antimony	15	0.1	-	500	0.1	N.D.
Arsenic	5	0.01	-	500	0.001	0.01
Barium	100	0.02	-	10,000	0.02	0.096
Beryllium	0.75	0.01	-	75	0.01	N.D.
Cadmium	1	0.01	-	100	0.01	N.D.
Chromium (VI)	5	0.005	-	500	0.005	N.D.
Chromium (III)	560	0.005	-	2,500	0.005	0.012
Cobalt	80	0.05	-	8,000	0.05	N.D.
Copper	25	0.01	-	2,500	0.01	N.D.
Lead	5	0.005	-	1,000	0.005	0.03
Mercury	0.2	0.001	-	20	0.001	N.D.
Molybdenum	350	0.05	-	3,500	0.05	N.D.
Nickel	20	0.05	-	2,000	0.05	N.D.
Selenium	1	0.005	-	100	0.01	N.D.
Silver	5	0.01	-	500	0.01	N.D.
Thallium	7	0.5	-	700	0.5	0.66
Vanadium	24	0.05	-	2,400	0.05	N.D.
Zinc	250	0.01	-	5,000	0.01	0.039
Asbestos	-	10	-	10,000	100	N.D.
Fluoride	180	0.1	-	18,000	1.0	-

TTLC results are reported as mg/kg of wet weight. Asbestos results are reported as fibers/g.
Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants 500 12th St., Suite 100 Oakland, CA 94607-4041 Attention: John McMillan	Client Project ID: 8820135A-4000 Sample Descript: Water, MW-4 Lab Number: 905-0268 E	Sampled: Received: Extracted: Reported:	May 3, 1989 May 4, 1989 May 7, 1989 May 15, 1989

INORGANIC PERSISTENT AND BIOACCUMULATIVE TOXIC SUBSTANCES

Analyte	Soluble Threshold Limit Concentration Waste Extraction Test			Total Threshold Limit Concentration		
	STLC Max. Limit (mg/L)	Detection Limit (mg/L)	Analysis Result (mg/L)	TTLC Max. Limit (mg/kg)	Detection Limit (mg/kg)	Analysis Result (mg/kg)
Antimony	15	0.1	-	500	0.1	N.D.
Arsenic	**5**	**0.01**	**-**	**500**	**0.001**	**0.003**
Barium	**100**	**0.02**	**-**	**10,000**	**0.02**	**0.84**
Beryllium	0.75	0.01	-	75	0.01	N.D.
Cadmium	1	0.01	-	100	0.01	N.D.
Chromium (VI)	5	0.005	-	500	0.005	N.D.
Chromium (III)	**560**	**0.005**	**-**	**2,500**	**0.005**	**0.036**
Cobalt	**80**	**0.05**	**-**	**8,000**	**0.05**	**0.05**
Copper	25	0.01	-	2,500	0.01	N.D.
Lead	**5**	**0.005**	**-**	**1,000**	**0.005**	**0.22**
Mercury	0.2	0.001	-	20	0.001	N.D.
Molybdenum	350	0.05	-	3,500	0.05	N.D.
Nickel	**20**	**0.05**	**-**	**2,000**	**0.05**	**0.072**
Selenium	1	0.005	-	100	0.01	N.D.
Silver	5	0.01	-	500	0.01	N.D.
Thallium	7	0.5	-	700	0.5	N.D.
Vanadium	24	0.05	-	2,400	0.05	N.D.
Zinc	**250**	**0.01**	**-**	**5,000**	**0.01**	**0.95**
Asbestos	-	10	-	10,000	100	N.D.
Fluoride	180	0.1	-	18,000	1.0	-

TTLC results are reported as mg/kg of wet weight. Asbestos results are reported as fibers/g.
Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Alan Lattaner

Client Project ID:	#8820135A-4000	Sampled:	May 2, 1989
Sample Descript:	Water, MW-5	Received:	May 3, 1989
Lab Number:	905-0091 E-I	Reported:	May 11, 1989

INORGANIC PERSISTENT AND BIOACCUMULATIVE TOXIC SUBSTANCES

	Soluble Threshold Limit Concentration Waste Extraction Test			Total Threshold Limit Concentration		
Analyte	STLC Max. Limit (mg/L)	Detection Limit (mg/L)	Analysis Result (mg/L)	TTLC Max. Limit (mg/kg)	Detection Limit (mg/L)	Analysis Result (mg/L)
Antimony	15	0.1	-	500	0.1	N.D.
Arsenic	5	0.01	-	500	0.001	0.027
Barium	100	0.02	-	10,000	0.02	0.65
Beryllium	0.75	0.01	-	75	0.01	N.D.
Cadmium	1	0.01	-	100	0.01	N.D.
Chromium (VI)	5	0.005	-	500	0.05	N.D.
Chromium (III)	560	0.005	-	2,500	0.005	0.015
Cobalt	80	0.05	-	8,000	0.05	0.050
Copper	25	0.01	-	2,500	0.01	N.D.
Lead	5	0.005	-	1,000	0.005	0.16
Mercury	0.2	0.001	-	20	0.001	N.D.
Molybdenum	350	0.05	-	3,500	0.05	N.D.
Nickel	20	0.05	-	2,000	0.05	N.D.
Selenium	1	0.005	-	100	0.01	N.D.
Silver	5	0.01	-	500	0.01	N.D.
Thallium	7	0.5	-	700	0.5	0.19
Vanadium	24	0.05	-	2,400	0.05	N.D.
Zinc	250	0.01	-	5,000	0.01	0.18
Asbestos	-	10	-	10,000	100	N.D.
Fluoride	180	0.1	-	18,000	1.0	-

TTLC results are reported as mg/kg of wet weight. Asbestos results are reported as fibers/g.
Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-1
Analysis Method: EPA 8240
Lab Number: 905-0266 F,G

Sampled: May 3, 1989
Received: May 4, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acetone	100.0	550
Benzene	20.0	60
Bromodichloromethane	20.0	N.D.
Bromoform	20.0	N.D.
Bromomethane	20.0	N.D.
2-Butanone	100.0	150
Carbon disulfide	20.0	N.D.
Carbon tetrachloride	20.0	N.D.
Chlorobenzene	20.0	N.D.
Chlorodibromomethane	20.0	N.D.
Chloroethane	20.0	N.D.
2-Chloroethyl vinyl ether	100.0	N.D.
Chloroform	20.0	N.D.
Chloromethane	20.0	N.D.
1,1-Dichloroethane	20.0	N.D.
1,2-Dichloroethane	20.0	N.D.
1,1-Dichloroethene	20.0	N.D.
Total 1,2-Dichloroethene	20.0	100
1,2-Dichloropropane	20.0	N.D.
cis 1,3-Dichloropropene	20.0	N.D.
trans 1,3-Dichloropropene	20.0	N.D.
Ethylbenzene	20.0	71
2-Hexanone	100.0	7,200
Methylene chloride	20.0	N.D.
4-Methyl-2-pentanone	100.0	N.D.
Styrene	20.0	N.D.
1,1,2,2-Tetrachloroethane	20.0	N.D.
Tetrachloroethene	20.0	N.D.
Toluene	20.0	170
1,1,1-Trichloroethane	20.0	N.D.
1,1,2-Trichloroethane	20.0	N.D.
Trichloroethene	20.0	N.D.
Trichlorofluoromethane	20.0	N.D.
Vinyl acetate	20.0	N.D.
Vinyl chloride	20.0	N.D.
Total Xylenes	20.0	1,200

Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

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Woodward-Clyde Consultants	Client Project ID: #8820135A-4000	Sampled:	May 2, 1989
500 12th St., Suite 100	Sample Descript: Water, MW-2	Received:	May 3, 1989
Oakland, CA 94607-4041	Analysis Method: EPA 8240	Analyzed:	May 9, 1989
Attention: Alan Lattaner	Lab Number: 905-0090 F-G	Reported:	May 11, 1989

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acetone	10.0	N.D.
Benzene	2.0	14
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	2.0	N.D.
2-Butanone	10.0	N.D.
Carbon disulfide	2.0	3.3
Carbon tetrachloride	2.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	2.0	N.D.
2-Chloroethyl vinyl ether	10.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	2.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	2.0	N.D.
Total 1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis 1,3-Dichloropropene	2.0	N.D.
trans 1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10.0	N.D.
Methylene chloride	2.0	N.D.
4-Methyl-2-pentanone	10.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	2.0	N.D.
Vinyl acetate	2.0	N.D.
Vinyl chloride	2.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants	Client Project ID:	#8820135A-4000	Sampled:	May 3, 1989
500 12th St., Suite 100	Sample Descript:	Water, MW-3	Received:	May 4, 1989
Oakland, CA 94607-4041	Analysis Method:	EPA 8240	Analyzed:	May 10, 1989
Attention: John McMillan	Lab Number:	905-0267 F,G	Reported:	May 15, 1989

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acetone	10.0	N.D.
Benzene	2.0	2.5
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	2.0	N.D.
2-Butanone	10.0	N.D.
Carbon disulfide	2.0	N.D.
Carbon tetrachloride	2.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	2.0	N.D.
2-Chloroethyl vinyl ether	10.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	2.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	2.0	N.D.
Total 1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis 1,3-Dichloropropene	2.0	N.D.
trans 1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10.0	N.D.
Methylene chloride	2.0	N.D.
4-Methyl-2-pentanone	10.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	2.0	N.D.
Vinyl acetate	2.0	N.D.
Vinyl chloride	2.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-4
Analysis Method: EPA 8240
Lab Number: 905-0268 F,G

Sampled: May 3, 1989
Received: May 4, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acetone	**10.0**	**13**
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	2.0	N.D.
2-Butanone	**10.0**	**13**
Carbon disulfide	**2.0**	**2.0**
Carbon tetrachloride	2.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	2.0	N.D.
2-Chloroethyl vinyl ether	10.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	2.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	2.0	N.D.
Total 1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis 1,3-Dichloropropene	2.0	N.D.
trans 1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10.0	N.D.
Methylene chloride	2.0	N.D.
4-Methyl-2-pentanone	10.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	**2.0**	**4.3**
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	2.0	N.D.
Vinyl acetate	2.0	N.D.
Vinyl chloride	2.0	N.D.
Total Xylenes	**2.0**	**4.3**

Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Alan Lattaner

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-5
Analysis Method: EPA 8240
Lab Number: 905-0091 F-G

Sampled: May 2, 1989
Received: May 3, 1989
Analyzed: May 10, 1989
Reported: May 11, 1989

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acetone	10.0	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	2.0	N.D.
2-Butanone	10.0	N.D.
Carbon disulfide	2.0	9.5
Carbon tetrachloride	2.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	2.0	N.D.
2-Chloroethyl vinyl ether	10.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	2.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	2.0	N.D.
Total 1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis 1,3-Dichloropropene	2.0	N.D.
trans 1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10.0	N.D.
Methylene chloride	2.0	N.D.
4-Methyl-2-pentanone	10.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	3.3
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	2.0	N.D.
Vinyl acetate	2.0	N.D.
Vinyl chloride	2.0	N.D.
Total Xylenes	2.0	3.0

Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-1
Analysis Method: EPA 8270
Lab Number: 905-0266 H

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 10, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acenaphthene	4.0	N.D.
Acenaphthylene	4.0	N.D.
Aniline	4.0	N.D.
Anthracene	4.0	N.D.
Benzidine	100.0	N.D.
Benzoic Acid	20.0	620
Benzo(a)anthracene	4.0	N.D.
Benzo(b)fluoranthene	4.0	N.D.
Benzo(k)fluoranthene	4.0	N.D.
Benzo(g,h,i)perylene	4.0	N.D.
Benzo(a)pyrene	4.0	N.D.
Benzyl alcohol	4.0	N.D.
Bis(2-chloroethyoxy)methane	4.0	N.D.
Bis(2-chloroethyl)ether	4.0	N.D.
Bis(2-chloroisopropyl)ether	4.0	N.D.
Bis(2-ethylhexyl)phthalate	20.0	N.D.
4-Bromophenyl ether	4.0	N.D.
Butyl benzyl phthalate	4.0	N.D.
4-Chloroaniline	4.0	N.D.
2-Chloronaphthalene	4.0	N.D.
4-Chloro-3-methylphenol	4.0	N.D.
2-Chlorophenol	4.0	N.D.
4-Chlorophenyl phenyl ether	4.0	N.D.
Chrysene	4.0	N.D.
Dibenz(a,h)anthracene	4.0	N.D.
Dibenzofuran	4.0	N.D.
Di-N-butyl phthalate	20.0	N.D.
1,3-Dichlorobenzene	4.0	N.D.
1,4-Dichlorobenzene	4.0	N.D.
1,2-Dichlorobenzene	4.0	N.D.
3,3-Dichlorobenzidine	20.0	N.D.
2,4-Dichlorophenol	4.0	N.D.
Diethyl phthalate	4.0	N.D.
2,4-Dimethylphenol	4.0	190
Dimethyl phthalate	4.0	N.D.
4,6-Dinitro-2-methylphenol	20.0	N.D.
2,4-Dinitrophenol	20.0	N.D.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-1
Analysis Method: EPA 8270
Lab Number: 905-0266

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 10, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
2,4-Dinitrotoluene	4.0	N.D.
2,6-Dinitrotoluene	4.0	N.D.
Di-N-octyl phthalate	4.0	N.D.
Fluoranthene	4.0	N.D.
Fluorene	4.0	N.D.
Hexachlorobenzene	4.0	N.D.
Hexachlorobutadiene	4.0	N.D.
Hexachlorocyclopentadiene	4.0	N.D.
Hexachloroethane	4.0	N.D.
Indeno(1,2,3-cd)pyrene	4.0	N.D.
Isophorone	4.0	N.D.
2-Methylnaphthalene	4.0	N.D.
2-Methylphenol	4.0	92
4-Methylphenol	4.0	290
Naphthalene	4.0	140
2-Nitroaniline	4.0	N.D.
3-Nitroaniline	4.0	N.D.
4-Nitroaniline	4.0	N.D.
Nitrobenzene	4.0	N.D.
2-Nitrophenol	4.0	N.D.
4-Nitrophenol	20.0	N.D.
N-Nitrosodiphenylamine	4.0	N.D.
N-Nitroso-di-N-propylamine	4.0	N.D.
Pentachlorophenol	20.0	N.D.
Phenathrene	4.0	N.D.
Phenol	4.0	130
Pyrene	4.0	N.D.
1,2,4-Trichlorobenzene	4.0	N.D.
2,4,5-Trichlorophenol	4.0	N.D.
2,4,6-Trichlorophenol	4.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

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Woodward-Clyde Consultants
500 12th St., Suite 100
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Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-3
Analysis Method: EPA 8270
Lab Number: 905-0267 H

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 10, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acenaphthene	2.0	N.D.
Acenaphthylene	2.0	N.D.
Aniline	2.0	N.D.
Anthracene	2.0	N.D.
Benzidine	50.0	N.D.
Benzoic Acid	10.0	N.D.
Benzo(a)anthracene	2.0	N.D.
Benzo(b)fluoranthene	2.0	N.D.
Benzo(k)fluoranthene	2.0	N.D.
Benzo(g,h,i)perylene	2.0	N.D.
Benzo(a)pyrene	2.0	N.D.
Benzyl alcohol	2.0	N.D.
Bis(2-chloroethyoxy)methane	2.0	N.D.
Bis(2-chloroethyl)ether	2.0	N.D.
Bis(2-chloroisopropyl)ether	2.0	N.D.
Bis(2-ethylhexyl)phthalate	10.0	N.D.
4-Bromophenyl ether	2.0	N.D.
Butyl benzyl phthalate	2.0	N.D.
4-Chloroaniline	2.0	N.D.
2-Chloronaphthalene	2.0	N.D.
4-Chloro-3-methylphenol	2.0	N.D.
2-Chlorophenol	2.0	N.D.
4-Chlorophenyl phenyl ether	2.0	N.D.
Chrysene	2.0	N.D.
Dibenz(a,h)anthracene	2.0	N.D.
Dibenzofuran	2.0	N.D.
Di-N-butyl phthalate	10.0	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,2-Dichlorobenzene	2.0	N.D.
3,3-Dichlorobenzidine	10.0	N.D.
2,4-Dichlorophenol	2.0	N.D.
Diethyl phthalate	2.0	N.D.
2,4-Dimethylphenol	2.0	N.D.
Dimethyl phthalate	2.0	N.D.
4,6-Dinitro-2-methylphenol	10.0	N.D.
2,4-Dinitrophenol	10.0	N.D.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-3
Analysis Method: EPA 8270
Lab Number: 905-0267

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 10, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
2,4-Dinitrotoluene	2.0	N.D.
2,6-Dinitrotoluene	2.0	N.D.
Di-N-octyl phthalate	2.0	N.D.
Fluoranthene	2.0	N.D.
Fluorene	2.0	N.D.
Hexachlorobenzene	2.0	N.D.
Hexachlorobutadiene.	2.0	N.D.
Hexachlorocyclopentadiene	2.0	N.D.
Hexachloroethane	2.0	N.D.
Indeno(1,2,3-cd)pyrene	2.0	N.D.
Isophorone	2.0	N.D.
2-Methylnaphthalene	2.0	N.D.
2-Methylphenol	2.0	N.D.
4-Methylphenol	2.0	N.D.
Naphthalene	2.0	N.D.
2-Nitroaniline	2.0	N.D.
3-Nitroaniline	2.0	N.D.
4-Nitroaniline	2.0	N.D.
Nitrobenzene	2.0	N.D.
2-Nitrophenol	2.0	N.D.
4-Nitrophenol	10.0	N.D.
N-Nitrosodiphenylamine	2.0	N.D.
N-Nitroso-di-N-propylamine	2.0	N.D.
Pentachlorophenol	10.0	N.D.
Phenathrene	2.0	N.D.
Phenol	2.0	N.D.
Pyrene	2.0	N.D.
1,2,4-Trichlorobenzene	2.0	N.D.
2,4,5-Trichlorophenol	2.0	N.D.
2,4,6-Trichlorophenol	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
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Client Project ID: #8820135A-4000
Sample Descript: Water, MW-4
Analysis Method: EPA 8270
Lab Number: 905-0268 H

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 10, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acenaphthene	**2.0**	**3.4**
Acenaphthylene	2.0	N.D.
Aniline	2.0	N.D.
Anthracene	2.0	N.D.
Benzidine	50.0	N.D.
Benzoic Acid	**10.0**	**52**
Benzo(a)anthracene	2.0	N.D.
Benzo(b)fluoranthene	2.0	N.D.
Benzo(k)fluoranthene	2.0	N.D.
Benzo(g,h,i)perylene	2.0	N.D.
Benzo(a)pyrene	2.0	N.D.
Benzyl alcohol	2.0	N.D.
Bis(2-chloroethyoxy)methane	2.0	N.D.
Bis(2-chloroethyl)ether	2.0	N.D.
Bis(2-chloroisopropyl)ether	2.0	N.D.
Bis(2-ethylhexyl)phthalate	10.0	N.D.
4-Bromophenyl ether	2.0	N.D.
Butyl benzyl phthalate	2.0	N.D.
4-Chloroaniline	2.0	N.D.
2-Chloronaphthalene	2.0	N.D.
4-Chloro-3-methylphenol	2.0	N.D.
2-Chlorophenol	2.0	N.D.
4-Chlorophenyl phenyl ether	2.0	N.D.
Chrysene	2.0	N.D.
Dibenz(a,h)anthracene	2.0	N.D.
Dibenzofuran	2.0	N.D.
Di-N-butyl phthalate	10.0	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,2-Dichlorobenzene	2.0	N.D.
3,3-Dichlorobenzidine	10.0	N.D.
2,4-Dichlorophenol	2.0	N.D.
Diethyl phthalate	2.0	N.D.
2,4-Dimethylphenol	2.0	N.D.
Dimethyl phthalate	2.0	N.D.
4,6-Dinitro-2-methylphenol	10.0	N.D.
2,4-Dinitrophenol	10.0	N.D.

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Woodward-Clyde Consultants
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Oakland, CA 94607-4041
Attention: John McMillan

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-4
Analysis Method: EPA 8270
Lab Number: 905-0268

Sampled: May 3, 1989
Received: May 4, 1989
Extracted: May 10, 1989
Analyzed: May 10, 1989
Reported: May 15, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
2,4-Dinitrotoluene	2.0	N.D.
2,6-Dinitrotoluene	2.0	N.D.
Di-N-octyl phthalate	2.0	N.D.
Fluoranthene	2.0	N.D.
Fluorene	**2.0**	**2.0**
Hexachlorobenzene	2.0	N.D.
Hexachlorobutadiene.	2.0	N.D.
Hexachlorocyclopentadiene	2.0	N.D.
Hexachloroethane	2.0	N.D.
Indeno(1,2,3-cd)pyrene	2.0	N.D.
Isophorone	2.0	N.D.
2-Methylnaphthalene	**2.0**	**6.8**
2-Methylphenol	2.0	N.D.
4-Methylphenol	**2.0**	**36**
Naphthalene	**2.0**	**20**
2-Nitroaniline	2.0	N.D.
3-Nitroaniline	2.0	N.D.
4-Nitroaniline	2.0	N.D.
Nitrobenzene	2.0	N.D.
2-Nitrophenol	2.0	N.D.
4-Nitrophenol	10.0	N.D.
N-Nitrosodiphenylamine	2.0	N.D.
N-Nitroso-di-N-propylamine	2.0	N.D.
Pentachlorophenol	10.0	N.D.
Phenathrene	**2.0**	**4.0**
Phenol	2.0	N.D.
Pyrene	2.0	N.D.
1,2,4-Trichlorobenzene	2.0	N.D.
2,4,5-Trichlorophenol	2.0	N.D.
2,4,6-Trichlorophenol	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Alan Lattaner

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-2
Analysis Method: EPA 8270
Lab Number: 905-0090 H

Sampled: May 2, 1989
Received: May 3, 1989
Extracted: May 9, 1989
Analyzed: May 10, 1989
Reported: May 11, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acenaphthene	2.0	N.D.
Acenaphthylene	2.0	N.D.
Aniline	2.0	N.D.
Anthracene	2.0	N.D.
Benzidine	50.0	N.D.
Benzoic Acid	10.0	12
Benzo(a)anthracene	2.0	3.6
Benzo(b)fluoranthene	2.0	5.7
Benzo(k)fluoranthene	2.0	7.5
Benzo(g,h,i)perylene	2.0	7.8
Benzo(a)pyrene	2.0	6.8
Benzyl alcohol	2.0	N.D.
Bis(2-chloroethyoxy)methane	2.0	N.D.
Bis(2-chloroethyl)ether	2.0	N.D.
Bis(2-chloroisopropyl)ether	2.0	N.D.
Bis(2-ethylhexyl)phthalate	10.0	N.D.
4-Bromophenyl ether	2.0	N.D.
Butyl benzyl phthalate	2.0	N.D.
4-Chloroaniline	2.0	N.D.
2-Chloronaphthalene	2.0	N.D.
4-Chloro-3-methylphenol	2.0	N.D.
2-Chlorophenol	2.0	N.D.
4-Chlorophenyl phenyl ether	2.0	N.D.
Chrysene	2.0	4.0
Dibenz(a,h)anthracene	2.0	7.9
Dibenzofuran	2.0	N.D.
Di-N-butyl phthalate	10.0	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,2-Dichlorobenzene	2.0	N.D.
3,3-Dichlorobenzidine	10.0	N.D.
2,4-Dichlorophenol	2.0	N.D.
Diethyl phthalate	2.0	N.D.
2,4-Dimethylphenol	2.0	N.D.
Dimethyl phthalate	2.0	N.D.
4,6-Dinitro-2-methylphenol	10.0	N.D.
2,4-Dinitrophenol	10.0	N.D.

Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Alan Lattaner

Client Project ID: #8820135A-4000
Sample Descript: Water, MW-2
Analysis Method: EPA 8270
Lab Number: 905-0090

Sampled: May 2, 1989
Received: May 3, 1989
Extracted: May 9, 1989
Analyzed: May 10, 1989
Reported: May 11, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
2,4-Dinitrotoluene	2.0	N.D.
2,6-Dinitrotoluene	2.0	N.D.
Di-N-octyl phthalate	2.0	N.D.
Fluoranthene	2.0	N.D.
Fluorene	2.0	N.D.
Hexachlorobenzene	2.0	N.D.
Hexachlorobutadiene.	2.0	N.D.
Hexachlorocyclopentadiene	2.0	N.D.
Hexachloroethane	2.0	N.D.
Indeno(1,2,3-cd)pyrene	2.0	8.1
Isophorone	2.0	N.D.
2-Methylnaphthalene	2.0	N.D.
2-Methylphenol	2.0	N.D.
4-Methylphenol	2.0	N.D.
Naphthalene	2.0	2.2
2-Nitroaniline	2.0	N.D.
3-Nitroaniline	2.0	N.D.
4-Nitroaniline	2.0	N.D.
Nitrobenzene	2.0	N.D.
2-Nitrophenol	2.0	N.D.
4-Nitrophenol	10.0	N.D.
N-Nitrosodiphenylamine	2.0	N.D.
N-Nitroso-di-N-propylamine	2.0	N.D.
Pentachlorophenol	10.0	N.D.
Phenathrene	2.0	N.D.
Phenol	2.0	N.D.
Pyrene	2.0	N.D.
1,2,4-Trichlorobenzene	2.0	N.D.
2,4,5-Trichlorophenol	2.0	N.D.
2,4,6-Trichlorophenol	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

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Woodward-Clyde Consultants	Client Project ID: #8820135A-4000	Sampled:	May 2, 1989
500 12th St., Suite 100	Sample Descript: Water, MW-5	Received:	May 3, 1989
Oakland, CA 94607-4041	Analysis Method: EPA 8270	Extracted:	May 9, 1989
Attention: Alan Lattaner	Lab Number: 905-0091 H	Analyzed:	May 10, 1989
		Reported:	May 11, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
Acenaphthene	2.0	N.D.
Acenaphthylene	2.0	N.D.
Aniline	2.0	N.D.
Anthracene	2.0	N.D.
Benzidine	50.0	N.D.
Benzoic Acid	10.0	N.D.
Benzo(a)anthracene	2.0	N.D.
Benzo(b)fluoranthene	2.0	N.D.
Benzo(k)fluoranthene	2.0	N.D.
Benzo(g,h,i)perylene	2.0	N.D.
Benzo(a)pyrene	2.0	N.D.
Benzyl alcohol	2.0	N.D.
Bis(2-chloroethyoxy)methane	2.0	N.D.
Bis(2-chloroethyl)ether	2.0	N.D.
Bis(2-chloroisopropyl)ether	2.0	N.D.
Bis(2-ethylhexyl)phthalate	10.0	N.D.
4-Bromophenyl ether	2.0	N.D.
Butyl benzyl phthalate	2.0	N.D.
4-Chloroaniline	2.0	N.D.
2-Chloronaphthalene	2.0	N.D.
4-Chloro-3-methylphenol	2.0	N.D.
2-Chlorophenol	2.0	N.D.
4-Chlorophenyl phenyl ether	2.0	N.D.
Chrysene	2.0	N.D.
Dibenz(a,h)anthracene	2.0	N.D.
Dibenzofuran	2.0	N.D.
Di-N-butyl phthalate	10.0	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,2-Dichlorobenzene	2.0	N.D.
3,3-Dichlorobenzidine	10.0	N.D.
2,4-Dichlorophenol	2.0	N.D.
Diethyl phthalate	2.0	N.D.
2,4-Dimethylphenol	2.0	N.D.
Dimethyl phthalate	2.0	N.D.
4,6-Dinitro-2-methylphenol	10.0	N.D.
2,4-Dinitrophenol	10.0	N.D.

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Alan Lattaner

Client Project ID:	#8820135A-4000	Sampled:	May 2, 1989
Sample Descript:	Water, MW-5	Received:	May 3, 1989
Analysis Method:	EPA 8270	Extracted:	May 9, 1989
Lab Number:	905-0091	Analyzed:	May 10, 1989
		Reported:	May 11, 1989

SEMI-VOLATILE ORGANICS by GC/MS (EPA 8270)

Analyte	Detection Limit µg/L	Sample Results µg/L
2,4-Dinitrotoluene	2.0	N.D.
2,6-Dinitrotoluene	2.0	N.D.
Di-N-octyl phthalate	2.0	N.D.
Fluoranthene	2.0	N.D.
Fluorene	2.0	N.D.
Hexachlorobenzene	2.0	N.D.
Hexachlorobutadiene.	2.0	N.D.
Hexachlorocyclopentadiene	2.0	N.D.
Hexachloroethane	2.0	N.D.
Indeno(1,2,3-cd)pyrene	2.0	N.D.
Isophorone	2.0	N.D.
2-Methylnaphthalene	2.0	N.D.
2-Methylphenol	2.0	N.D.
4-Methylphenol	2.0	45
Naphthalene	2.0	N.D.
2-Nitroaniline	2.0	N.D.
3-Nitroaniline	2.0	N.D.
4-Nitroaniline	2.0	N.D.
Nitrobenzene	2.0	N.D.
2-Nitrophenol	2.0	N.D.
4-Nitrophenol	10.0	N.D.
N-Nitrosodiphenylamine	2.0	N.D.
N-Nitroso-di-N-propylamine	2.0	N.D.
Pentachlorophenol	10.0	N.D.
Phenathrene	2.0	N.D.
Phenol	2.0	N.D.
Pyrene	2.0	N.D.
1,2,4-Trichlorobenzene	2.0	N.D.
2,4,5-Trichlorophenol	2.0	N.D.
2,4,6-Trichlorophenol	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

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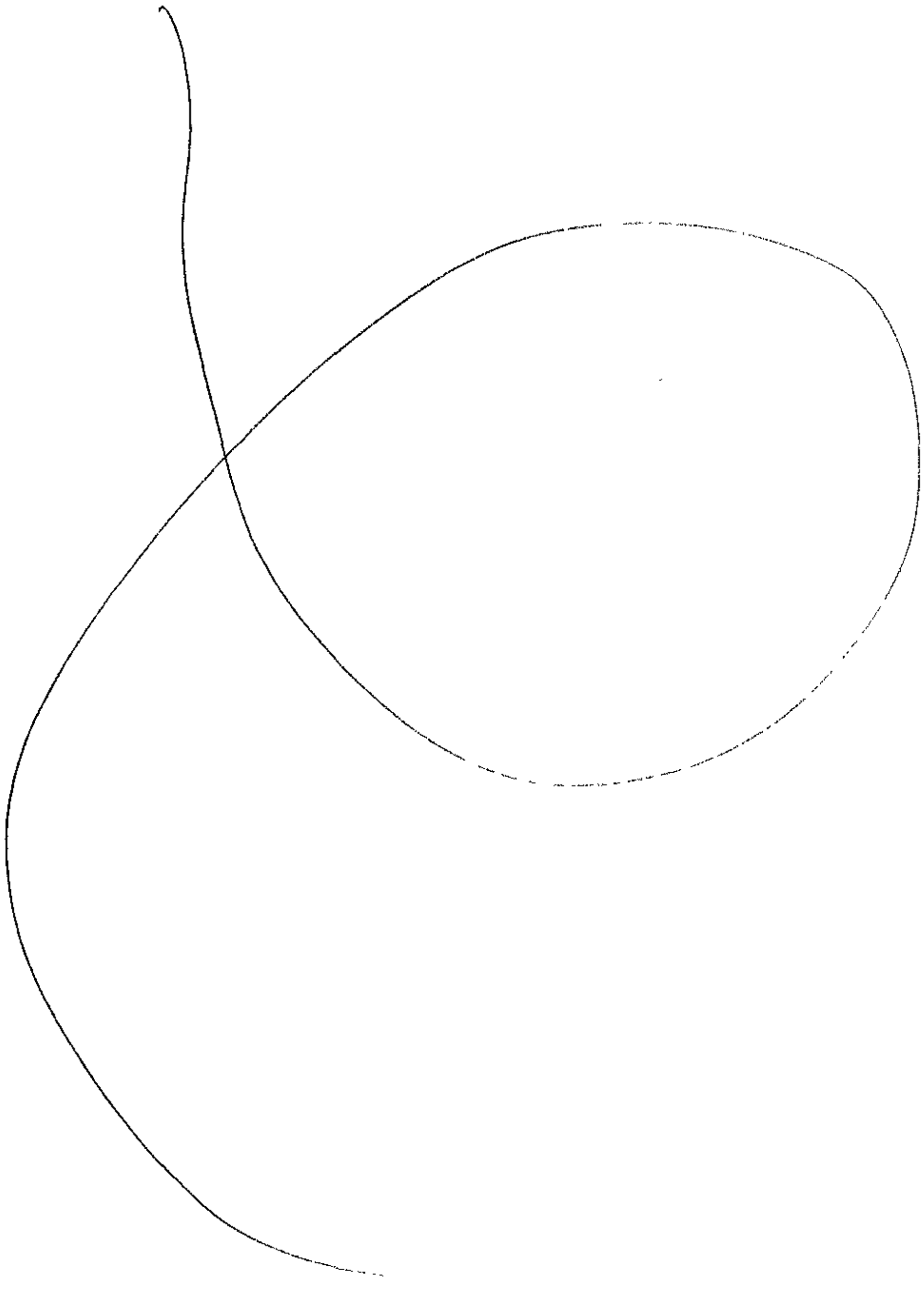

APPENDIX B
TOXICOLOGY INFORMATION

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN STREET
SCHENECTADY, NY 12303-1836 USA
(518) 377-8855

NO. 425

METHYL n-BUTYL KETONE

Date October 1979

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: METHYL n-BUTYL KETONE
OTHER DESIGNATIONS: MBK, 2-Hexanone, $CH_3CO(CH_2)_3CH_3$, nButyl Methyl Ketone
CAS #000 591 786

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Methyl n-Butyl Ketone	ca 100	8-hr TWA 5 ppm(skin)* or 20 mg/m^3 Rat, oral LD_{50} 2590 mg/kg

*ACGIH (1979 Intended Changes List); OSHA TLV is 100 ppm. NIOSH (1978) proposed a 10-hr TWA of 1 ppm. (skin) notation indicates a significant contribution to overall exposure via skin absorption.

SECTION III. PHYSICAL DATA

Boiling point at 1 atm, deg C	128	Specific gravity, 20/4C	0.811
Vapor pressure at 38.8 C, mm Hg	10	Volatiles, %	ca 100
Vapor density (Air=1)	3.45	Molecular weight	100.16
Water solubility at 25 C, g/100 g H_2O	3.5	Melting point, deg C	-57

Appearance & Odor: Clear, colorless liquid.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
95 F (oc)	991 F	Volume %	1.22	8.0

Extinguishing Media: Foam, dry chemical, carbon dioxide. Use water spray to cool fire-exposed metal containers.

This material is a moderate fire and explosion hazard when exposed to heat and flames. Heavier than air vapors can flow along surfaces to distant ignition sources & flash back.

Firefighters should use self-contained breathing equipment in fighting fires in which this material is involved.

SECTION V. REACTIVITY DATA

This flammable material (OSHA Class IC Liquid) is stable in sealed containers under normal room temperature conditions. It does not undergo hazardous polymerization.

Thermal-oxidative degradation in air can produce toxic vapors and gases, including CO. MBK is incompatible with oxidizing agents.

SECTION VI. HEALTH HAZARD INFORMATION

TLV 5 ppm (skin) (See Sect. II)

MBK can cause nerve damage when excessively inhaled, swallowed or absorbed through the skin, resulting in a progressive loss of sensitivity from the peripheral nervous system. [It is believed that MBK is metabolized in the body to produce a neurotoxin which causes nerve fiber (axon) damage.] The condition appears to be reversible when detected early enough. Excessive vapor inhalation can irritate the respiratory tract and cause impaired judgement and then narcosis by affecting the CNS at high concentration. Liquid contact is irritating to the eyes and drying and defatting to the skin. Dermatitis can result from prolonged or repeated liquid contact. MBK readily penetrates the skin to produce systemic effects. MBK is toxic when ingested.

FIRST AID: Get medical help when overexposed to MBK!

Eye Contact: Flush with plenty of running water for 15 minutes. Get medical help if irritation persists.

Skin Contact: Immediately wash affected area with soap and water. Remove contaminated clothing. Get medical help for persistent irritation or if large are of skin affected.

Inhalation: Remove to fresh air. Restore or support breathing if required. Contact a physician.

Ingestion: Contact a physician.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Prepare plans to handle large spills. Notify safety personnel of spills or leakage. Provide optimum explosion-proof ventilation. Eliminate ignition sources. Exclude all from area except trained clean-up personnel who are using protection against inhalation of vapors and contact with liquid.

Contain spill. Collect for disposal. Absorbent material such as vermiculite, rags, etc. can be used. Collected liquid and absorbent material should be held in a closed metal container for disposal. Use precautions against starting fire in clean-up of this flammable liquid.

DISPOSAL:

Scrap material can be burned in an approved incinerator system. Follow Federal, State and local regulations for any disposal method used. Discharges of ventilation systems must not pose a hazard in the outside environment.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. For emergency and nonroutine conditions above the TLV respiratory protection is required. A full-facepiece gas mask with organic vapor canister (or self-contained breathing apparatus) can be used up to about 50 to 250 ppm; for higher or unknown concentrations an air-supplied respirator (positive pressure) should be used.

Gloves of material resistant to MBK and additional protective clothing (apron, boots, coveralls, etc.) as appropriate to working conditions shall be used to prevent skin contact with liquid. Chemical safety goggles and/or face shield shall be used to keep splashes out of the eyes, as required.

Eyewash stations, safety showers, and washing facilities shall be readily available to workers where contact with liquid is likely.

Clothing contaminated with MBK must be removed promptly and the liquid washed off the skin.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, clean well ventilated area away from sources of heat and ignition and away from oxidizing agents. Protect containers from physical damage. Bond and ground metallic containers for transfers of liquid to prevent static sparks. No smoking in handling or use areas. Storage must be suitable for OSHA Class IC liquids.

Use only with adequate ventilation. Avoid breathing vapors or any contact of liquid with the skin, especially repeated or prolonged contact. Follow good hygienic practice.

Provide preplacement and periodic medical examinations for exposed workers with special attention given to the central and peripheral nervous system, the respiratory system, skin and eyes. Monitor nerve conduction velocity, if neuropathies are suspected.

DATA SOURCE(S) CODE: 2-4,6,7,10-12,19,26

APPROVALS: MIS, CRD J. M. Nielsen

Industrial Hygiene and Safety

MEDICAL REVIEW: 12/79

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN STREET
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(518) 377-8855

GENIUM PUBLISHING CORP.

NO. 435
DIETHYL PHTHALATE

Date July 1980

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: DIETHYL PHTHALATE
OTHER DESIGNATIONS: DEP, $C_6H_4(CO_2C_2H_5)_2$, CAS #000 864 662

MANUFACTURER & TRADE NAME:	Ashland Chem. Box 2219 Columbus, Ohio 43216 (614) 889-3333	Eastman Chem. Prod. Inc. PO Box 431 Kingsport, TN 37662 (800) 251-0351

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Diethyl Phthalate	>95	8-hr TWA 5 mg/m^3* Human, Oral LDLo: 500 mg/kg Human, inhalation TCLo: 1000 mg/m^3 (Toxic irritant effect-systemic) Rat, Interperitoneal LD_{50}: 5058 mg/kg Rat, Interperitoneal 5-15 day pregnant TDLo: 1232 mg/kg (Teratogenic effect)
*Current (1979) OSHA and ACGIH TLV.		

SECTION III. PHYSICAL DATA

Boiling point, 760 mm Hg, deg C -----	298	Specific gravity 20/20 C ---------	1.12
Viscosity at 20 C, cps -------------	9.5	Melting point, deg C -------------	-40
Vapor density ----------------------	7.66	Molecular weight -----------------	222.2

Appearance & Odor: Clear, colorless, odorless liquid.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
322 F (OC)	855 F	% by Volume at 368 F	0.7	--

Extinguishing Media: Use water spray, dry chemical, CO_2, or foam. Water or foam may cause some frothing. Use water to cool fire-exposed containers.
Firefighters should use self-contained breathing equipment in enclosed areas.

SECTION V. REACTIVITY DATA

Diethyl phthalate is a stable liquid under normal storage conditions. It does not polymerize.
It is incompatible with strong acids and strong oxidizing agents, nitric acid, permanganates, etc.
Thermal-oxidative degradation can produce toxic vapors and gases, including carbon, monoxide, carbon dioxide, and various hydrocarbons.

No. 435

SECTION VI. HEALTH HAZARD INFORMATION

TLV 5 mg/m^3

As determined by acute animal testing DEP is low in toxicity, but has the second highest acute toxic effects of the dialkyl phthalates. Due to low water solubility and relatively high lipid solubility, DEP is bioaccumulative in body tissues. As a result, chronic, exposure tends to be more important than acute exposure. Inhalation causes irritation to nasal and respiratory tract. Will cause skin irritation. Is an eye irritant causing redness and tearing. When swallowed, burning like irritation to mucous membranes occurs. Vapor or high density acts as narcotic.

FIRST AID:

Skin Contact: Wash affected area well with soap and water. Remove contaminated clothing.

Eye Contact: Flush promptly and thoroughly with lots of running water, including under eyelids, for 15 minutes.

Inhalation: Remove to fresh air.

Ingestion: If amount swallowed was large and medical help or advice unavailable, give conscious victim milk or water to drink and induce vomiting.

Seek medical attention for treatment, observation, and support.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of major spill. Provide ventilation. Contain spills and collect for recovery or disposal. Prevent flushing to sewer or to watercourse. Pick up small spills and residues with paper or other absorbent for disposal. Those involved with clean-up need protection against contact with liquid and fume or mist inhalation.

DISPOSAL: Burn waste material and scrap in an approved incinerator. Combustibility may be improved by mixing with more flammable solvents. (ex. waste alcohol) Follow Federal, State, and Local regulations in disposing of material.

NOTE! Possible ecological effects in aquatic systems. Because of stability, DEP can be persistent in the environment and should be considered an environmental pollutant.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. When DEP is heated or misted, approved respiratory equipment may be needed on an emergency or nonroutine basis.

Workers should use rubber or neoprene gloves and safety goggles. Additional protection such as apron or face shield should be used where needed to avoid repeated or prolonged skin contact.

An eyewash station and washing facilities should be available where DEP is handled. If large amounts are used, a safety shower should be available.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated area, away from acids, bases, and strong oxidizing agents. Protect containers from physical damage. Since chronic effects are not fully known, follow good hygienic practice. Wear clean work clothing. Wash hands and face after working with this material and before eating or smoking. Avoid prolonged or repeated contact. Avoid breathing mist or vapors.

Containers of this material may be hazardous when emptied due to retained product residues.

Dialkyl phthalates as a class have been recommended for further study of possible environmental and chronic toxic effects.

Use DEP with care!

DATA SOURCE(S) CODE: 1,2,4,8,10,11,20,23

APPROVALS: MIS CRD

Industrial Hygiene and Safety 7-3-80

MEDICAL REVIEW: 14 July 1980

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IDENTITY

NTP PREFERRED NAME: Benzo(a)pyrene

Synonyms:
- 3,4-Benzpyrene
- 3,4-Benzopyrene
- 6,7-Benzopyrene
- B(a)P
- BAP

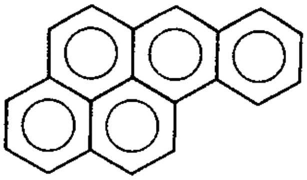
CAS Registry Number: 50-32-8

NIOSH Registry Number: DJ3675000

Formula: $C_{20}H_{12}$

Molecular Weight: 252.32

WLN: L D6 B6666 2AB TJ



PHYSICAL PROPERTIES

Physical Description: Pale yellow crystals.

Melting Point:	177°C	**Boiling Point:**	475°C
Density:	1.35 g/mL	**Specific Gravity:**	Not available
Flammability:	Not available	**Stability:**	Pure material is stable but solutions are air and light sensitive.
Flash Point:	Not available		

Reactivity: Can react with oxidizing materials.

Solubility In:

Water:	0.004 - 0.012 mg/L	**Acetone:**	Slightly soluble
DMSO:	Slightly soluble	**Ether:**	Soluble
Ethanol:	Slightly soluble	**Benzene:**	Soluble

Other Physical Data: Soluble in toluene, xylene, chloroform, tetrahydrofuran and concentrated sulfuric acid.

SHIPPING

D.O.T. Shipping Name: Hazardous Substance, Solid, N.O.S.

D.O.T. Identification Number: NA9188

D.O.T. Hazard Classification: ORM-E

Other Shipping Regulations: None; no limit with passenger or cargo aircraft.

Exceptions: None. Specific requirements, 173.1300 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: Benzo(a)pyrene

Acute Hazards: Toxic, may cause mild irritation.

Symptoms: Irritation to tissues, dermatitis, bronchitis, cough and dyspnea.

Exposure Limits: The PEL is 0.2 mg/m^3 (coal tar pitch volatiles); it is listed as a suspect carcinogen by ACGIH.

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

Storage Precautions: Store in a cool, dry place or in a refrigerator. Protect solutions from air and light.

Spills and Leakage: Dampen spilled material with toluene to avoid dust, then transfer material to a suitable container. Use absorbent paper dampened with toluene to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Organic synthesis

Additional Reference Sources:

Dangerous Properties of Industrial Materials, N. I. Sax, 5th Ed., p. 445 (1979), Van Nostrand Reinhold.
Handbook of Lab. Safety, N. V. Steere, 2nd Ed., p. 728 (1971), CRC Press.
Merck Index, M. Windholz et al, 9th Ed., p. 144 (1976), Merck.

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IDENTITY

NTP PREFERRED NAME: Benzyl alcohol

Synonyms:
alpha-Hydroxytoluene
Benzenemethanol
(Hydroxymethyl)benzene
Phenylcarbinol

CAS Registry Number:

100-51-6

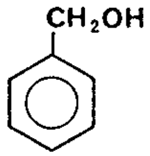
NIOSH Registry Number:

DN3150000

Formula: C_7H_8O

Molecular Weight: 108.14

WLN: Q1R



PHYSICAL PROPERTIES

Physical Description: Colorless liquid

Melting Point: -15.2°C

Boiling Point: 204.7°C at 760 mm Hg

Density: 1.04 - 1.05 g/mL

Specific Gravity: 1.040 - 1.050 at 25°/25°C

Flammability: Combustible

Stability: Stable under normal laboratory storage conditions.

Flash Point: 100.5°C (213°F)

Reactivity: Can react with oxidizing materials and acids.

Solubility In:

Water:	1 g/25 mL	**Acetone:**	Soluble
DMSO:	Not available	**Ether:**	Soluble
Ethanol:	Soluble	**Benzene:**	Soluble

Other Physical Data: Vapor density is 3.72; Vapor pressure is 0.15 mm Hg at 25°C and 1 mm Hg at 58°C. Soluble in chloroform. Autoignition temperature is 436°C.

SHIPPING

D.O.T. Shipping Name: Hazardous Substance, Liquid, N.O.S.

D.O.T. Identification Number: NA9188

D.O.T. Hazard Classification: ORM-E

Other Shipping Regulations: None; no limit with passenger or cargo aircraft.

Exceptions: None. Specific Requirements, 173.1300 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: Benzyl alcohol

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HEALTH HAZARDS

Acute Hazards: Irritant. Absorbed through skin.

Symptoms: Vomiting, diarrhea, central nervous system depression, vertigo, headache, weight loss, skin irritation, surface anesthesia, eye irritation

Exposure Limits: Not regulated

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

ADDITIONAL INFORMATION

Storage Precautions: Store in a cool, dry place or in a refrigerator. Keep tightly capped. Protect from oxidizing materials and acids.

Spills and Leakage: Use absorbent paper to pick up spilled material. Follow by washing surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Perfumes and flavors, bacteriostatic, solvent.

Additional Reference Sources:

Dangerous Properties of Industrial Materials, N. I. Sax, 5th Ed., p.409 (1979), Van Nostrand Reinhold.

Condensed Chemical Dictionary, G. Hawley, 9th Ed., p.121 (1977), Van Nostrand Reinhold.

Merck Index, M. Windholz et al, 9th Ed., p.148 (1976), Merck.

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IDENTITY

NTP PREFERRED NAME: Carbon disulfide

Synonyms:

Carbon bisulfide
Carbon sulfide

S=C=S

CAS Registry Number: 75-15-0

NIOSH Registry Number: FF6650000

Formula: CS_2

Molecular Weight: 76.14

WLN: SCS

PHYSICAL PROPERTIES

Physical Description: Colorless liquid

Melting Point: -110.8°C

Boiling Point: 46.3°C

Density: 1.26 g/mL

Specific Gravity: 1.26 at 20°/4°C

Flammability: Flammable

Stability: Decomposes on standing for long periods.

Flash Point: -30°C (-22°F)

Reactivity: Reacts vigorously with oxidizing agents and active metals.

Solubility In:

Water:	<1 mg/mL	Acetone:	Very soluble
DMSO:	≥10 mg/mL	Ether:	Very soluble
Ethanol:	≥10 mg/mL	Benzene:	Soluble

Other Physical Data: Soluble in carbon tetrachloride. Odor like decaying cabbage. Vapor density is 2.6. Explosive Limits: 1.3% Lower, 50% Upper. Ignition temperature is 100°C.

SHIPPING

D.O.T. Shipping Name: Carbon bisulfide or carbon disulfide (RQ-5000/2270)

D.O.T. Identification Number: UN1131

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Forbidden on aircraft. Forbidden on any vessel carrying explosives.

Exceptions: None. Specific Requirements, 173.121 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: Carbon disulfide **127**

HEALTH HAZARDS

Acute Hazards: Toxic, irritant, acute fire and explosion risk.

Symptoms: Irritation of eyes, nose, and mucous membranes; contact may cause blistering with second or third degree burns; skin absorption may cause peripheral nerve degeneration especially of the hands; bronchitis, and emphysema. Early acute poisoning resembles alcohol intoxication.

Exposure Limits: The ACGIH listed TWA is 10 ppm (skin).

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

ADDITIONAL INFORMATION

Storage Precautions: Store in a freezer under an inert atmosphere or in an explosion-proof refrigerator. Protect from oxidizing agents and metals. Keep container very tightly capped.

Spills and Leakage: Use absorbent paper to pick up spilled material. Follow by washing surfaces well first with alcohol, then with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Permeation tests indicate that Viton or PVA gloves may provide protection from exposure to this compound.

Uses: Chemical intermediate, catalyst and solvent. Used in manufacture of rayon, paints, enamels, and varnishes.

Additional Reference Sources:

Dangerous Properties of Industrial Materials, N. I. Sax, 5th Ed., p. 469 (1979), Van Nostrand Reinhold.
Chem. Hazards of Workplace, W. Proctor et al, p. 148 (1978), Lippincott.
Handbook of Lab. Safety, N. V. Steere, 2nd Ed., p. 738 (1971), CRC Press.
Hazardous Chemicals Data Book, G. Weiss, p. 232 (1980), Noyes.

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IDENTITY

NTP PREFERRED NAME: o-Cresol

Synonyms:
2-Methylphenol
2-Hydroxytoluene
o-Cresylic acid

CAS Registry Number:

95-48-7

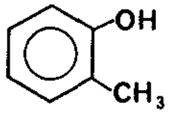
NIOSH Registry Number:

GO6300000

Formula: C_7H_8O

Molecular Weight: 108.14

WLN: QR B1



PHYSICAL PROPERTIES

Physical Description: Colorless crystals

Melting Point:	30.9°C	**Boiling Point:**	191-192°C
Density:	1.05 g/mL	**Specific Gravity:**	1.048 at 20°/40°C
Flammability:	Combustible	**Stability:**	Sensitive to light and air.
Flash Point:	81°C (178°F)		

Reactivity: Reacts with oxidizers. Poisonous gases may be produced during combustion.

Solubility In:				
	Water:	Soluble	**Acetone:**	Soluble
	DMSO:	Not available	**Ether:**	Soluble
	Ethanol:	Soluble	**Benzene:**	Soluble

Other Physical Data: Phenol-like odor; soluble in most organic solvents. Boiling point is 120°C at 76 mm Hg and 70°C at 6 mm Hg.

SHIPPING

D.O.T. Shipping Name: Cresol (RA-1000/454)

D.O.T. Identification Number: UN2076

D.O.T. Hazard Classification: Corrosive Material

Other Shipping Regulations: Corrosive label required; 1 qt. limit on passenger aircraft; 10 gallon limit on cargo aircraft.

Exceptions: 173.244. Specific Requirements, 173.245 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: o-Cresol

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HEALTH HAZARDS

Acute Hazards: Toxic; corrosive; may be absorbed through skin.

Symptoms: Skin contact produces intensive burning. Signs of systemic poisoning are headache, dizziness, dimmed vision, rapid breathing; weakness and loss of consciousness.

Exposure Limits: TLV-TWA is 5 ppm with a "skin" notation to denote possible cutaneous absorption.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

ADDITIONAL INFORMATION

Storage Precautions: Store in a cool, dry place or in a refrigerator. Protect from oxidizers, light and air for long term storage.

Spills and Leakage: Dampen spilled material with water to avoid dust, then transfer material to a suitable container. Use absorbent paper dampened with water to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Disinfectant; phenolic resins; ore flotation; textile scouring agent; manufacture of tricresyl phosphate, salicylaldehyde, coumarin and insecticides; explosives; surfactant and as synthetic food flavoring.

Additional Reference Sources:

<u>Handbook of Lab. Safety</u>, N. V. Steere, 2nd Ed., p. 285 (1971), CRC Press.

<u>Dictionary of Organic Compounds</u>, J. Buckingham, 5th Ed., p.3985 (1982), Chapman and Hall.

<u>Patty's Industrial Hygiene and Toxicology</u>, G. C. Clayton and F. E. Clayton, 3rd Revised Ed., p.2597 (1981), John Wiley and Sons.

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IDENTITY

NTP PREFERRED NAME: p-Cresol

Synonyms:
4-Methyl phenol
4-Hydroxytoluene
p-Cresylic acid

CAS Registry Number:

106-44-5

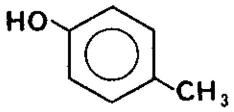
NIOSH Registry Number:

GO6475000

Formula: C_7H_8O

Molecular Weight: 108.14

WLN: QR D1



PHYSICAL PROPERTIES

Physical Description: Colorless crystals

Melting Point: 36°C

Boiling Point: 202.5°C

Density: 1.04 g/mL at 20°C

Specific Gravity: 1.035 at 20°/40°C

Flammability: Combustible

Stability: Sensitive to air and light.

Flash Point: 86°C (187°F)

Reactivity: Reacts with oxidizers. Poisonous gases may be produced during combustion.

Solubility In:

Water:	25 mg/mL at 50°C	**Acetone:**	Soluble
DMSO:	Not available	**Ether:**	Soluble
Ethanol:	Soluble	**Benzene:**	Soluble

Other Physical Data: Phenol-like odor; soluble in carbon tetrachloride and organic solvents; solubility in water at 100°C is 50 mg/mL. Boiling point is 90°C at 11 mm Hg.

SHIPPING

D.O.T. Shipping Name: Cresol (RQ-1000/454)

D.O.T. Identification Number: UN2076

D.O.T. Hazard Classification: Corrosive Material

Other Shipping Regulations: Corrosive label required; 1 quart limit on passenger aircraft; 10 gallon limit on cargo aircraft.

Exceptions: 173.244. Specific Requirements, 173.245 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: p-Cresol

195

Acute Hazards: Toxic, corrosive, may be absorbed through skin.

Symptoms: Skin contact produces intensive burning. Signs of systemic poisoning are dizziness, headache, dimmed vision, rapid breathing, weakness and loss of consciousness.

Exposure Limits: TLV-TWA is 5 ppm with a "skin" notation to indicate possible cutaneous absorption.

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

Storage Precautions: Store in a cool, dry place or in a refrigerator. Protect from light and air for long term storage.

Spills and Leakage: Dampen spilled material with alcohol to avoid dust, then transfer material to a suitable container. Use absorbent paper dampened with alcohol to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Disinfectant; phenolic resins; ore flotation; textile scouring agent; organic intermediate; manufacture of tricresyl phosphate, salicylaldehyde, coumarin and insecticides; explosives; surfactant; and as a synthetic food flavoring.

Additional Reference Sources:

<u>Dangerous Properties of Industrial Materials</u>, N. I. Sax, 5th Ed., p. 521 dsm.), Van Nostrand Reinhold.

<u>Condensed Chemical Dictionary</u>, G. Hawley, 9th Ed., p. 285 (1977), Van Nostrand Reinhold.

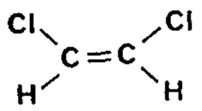
<u>Dictionary of Organic Compounds</u>, J. Buckingham, 5th Ed., p.3986 (1982), Chapman and Hall.

256

IDENTITY

NTP PREFERRED NAME: cis-1,2-Dichloroethylene

Synonyms:
1,2-Dichloroethylene
cis-Acetylene dichloride



CAS Registry Number: 156-59-2

NIOSH Registry Number: KV9420000

Formula: $C_2H_2Cl_2$

Molecular Weight: 96.94

WLN: G1U1G -C

PHYSICAL PROPERTIES

Physical Description: Colorless liquid

Melting Point: -80°C (cis)

Boiling Point: 60°C (cis)

Density: 1.27 - 1.29 g/mL

Specific Gravity: 1.291 at 15°/4°C (c)

Flammability: Flammable

Stability: Sensitive to moisture, air, heat and light.

Flash Point: 2°C (36°F)

Reactivity: Reacts with strong alkalies and oxidizers; can react with copper to form explosive chloroacetylene.

Solubility In:

Water:	Insoluble	**Acetone:**	Soluble
DMSO:	Not available	**Ether:**	Soluble
Ethanol:	Soluble	**Benzene:**	Soluble

Other Physical Data: Pleasant odor; vapor pressure is 400 mm Hg at 30.8°C; vapor density is 3.34. Explosive Limits: 9.7% Lower, 12.8% Upper; autoignition temperature is 460°C.

SHIPPING

D.O.T. Shipping Name: Dichloroethylene

D.O.T. Identification Number: UN1150

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Passenger aircraft limit is 1 qt.; cargo aircraft limit is 10 gal.

Exceptions: 173.118. Specific Requirements, 173.119 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: cis-1,2-Dichloroethylene

256

HEALTH HAZARDS

Acute Hazards: Toxic, irritant; toxic decomposition products.

Symptoms: Local irritation of eyes, mucous membranes and upper respiratory tract; nausea, vomiting, weakness, tremors and cramps, dermatitis, CNS depression and narcotic effect at high concentrations.

Exposure Limits: The TLV-TWA is 200 ppm in air. A STEL of 250 ppm has been proposed.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

ADDITIONAL INFORMATION

Storage Precautions: Store in an explosion proof refrigerator under an inert atmosphere. Keep tightly closed and protect from moisture. Keep away from copper caps, washers, containers, etc.

Spills and Leakage: Use absorbent paper to pick up spilled material. Follow by washing surfaces well first with alcohol, then with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Solvent for waxes, resins, and rubber; refrigerant; used in the manufacture of pharmaceuticals and artificial pearls; and used in the extraction of oils and fats from meats and fish.

Additional Reference Sources:

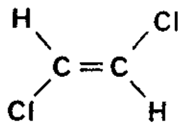
Condensed Chemical Dictionary, G. Hawley, 9th Ed., p. 335 (1977), Van Nostrand Reinhold.
Dictionary of Organic Compounds, J. Buckingham, 5th Ed., p. 1733 (1982), Chapman and Hall.
Hazardous Chemicals Data Book, G. Weiss, p. 324 (1980), Noyes.
Handbook of Toxic and Hazardous Chemicals, M. Sittig, p. 234 (1981), Noyes.

257

IDENTITY

NTP PREFERRED NAME: trans-1,2-Dichloroethylene

Synonyms:
trans-Acetylene dichloride



CAS Registry Number:

156-60-5

NIOSH Registry Number:

KV9400000

Formula: $C_2H_2Cl_2$

Molecular Weight: 96.94

WLN: G1U1G -T

PHYSICAL PROPERTIES

Physical Description: Colorless liquid

Melting Point:	-49.4°C	**Boiling Point:**	48°C
Density:	1.25 g/mL	**Specific Gravity:**	1.249 at 25°/4°C
Flammability:	Flammable	**Stability:**	Sensitive to moisture, air and light.
Flash Point:	2°C (36°F)		

Reactivity: Reacts with strong alkalis and oxidizers; can react with copper to form explosive chloroacetylene.

Solubility In:	**Water:**	Nearly insoluble	**Acetone:**	Soluble
	DMSO:	Not available	**Ether:**	Soluble
	Ethanol:	Soluble	**Benzene:**	Soluble

Other Physical Data: Vapor pressure is 400 mm Hg at 40°C; vapor density is about 3.34. Boiling point is 47°C at 745 mm Hg. Explosive Limits: 9.7% Lower, 12.8% Upper.

SHIPPING

D.O.T. Shipping Name: Dichloroethylene

D.O.T. Identification Number: UN1150

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Passenger aircraft limit is 1 qt.; cargo aircraft limit is 10 gal.

Exceptions: 173.118. Specific Requirements, 173.119 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: trans-1,2-Dichloroethylene

257

HEALTH HAZARDS

Acute Hazards: Toxic, irritant; toxic decomposition products.

Symptoms: Nausea, vomiting, weakness, tremor and cramps, dermatitis, irritation of eyes, mucous membranes and upper respiratory tract, CNS depression and narcotic effect at high concentrations.

Exposure Limits: The TLV-TWA is 200 ppm in air. A STEL of 250 ppm has been proposed.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

ADDITIONAL INFORMATION

Storage Precautions: Store in an explosion proof refrigerator under an inert atmosphere. Keep tightly closed and protect from moisture. Keep away from copper caps, washers, containers, etc.

Spills and Leakage: Use absorbent paper to pick up spilled material. Follow by washing surfaces well first with alcohol, then with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Solvent for waxes, resins, acetylcellulose, and rubber; a a *refrigerant; used in the manufacture of* pharmaceuticals and as an intermediate in chemical synthesis.

Additional Reference Sources:

Dangerous Properties of Industrial Materials, N. I. Sax, 5th Ed., p. 561 (1979), Van Nostrand Reinhold.

Patty's Industrial Hygiene and Toxicology, G. C. Clayton and F. E. Clayton, 3rd Revised Ed., p. 3550 (1981), John Wiley and Sons.

Dictionary of Organic Compounds, J. Buckingham, 5th Ed., p. 1733 (1982), Chapman and Hall.

338

IDENTITY

NTP PREFERRED NAME: 2,4-Dimethylphenol

Synonyms:
2,4-Xylenol
1-Hydroxy-2,4-dimethylbenzene
4-Hydroxy-m-xylene

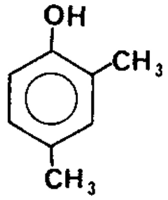
CAS Registry Number: 105-67-9

NIOSH Registry Number: ZE5600000

Formula: $C_8H_{10}O$

Molecular Weight: 122.18

WLN: QR B1 E1



PHYSICAL PROPERTIES

Physical Description: Colorless crystals

Melting Point: 27-28°C

Boiling Point: 210°C

Density: 1.03 g/mL

Specific Gravity: 1.0298 at 15°/4°C

Flammability: Combustible

Stability: Stable under normal laboratory storage conditions.

Flash Point: >112°C (>235°F)

Reactivity: Not available

Solubility In:

Water:	Slightly soluble	**Acetone:**	Not available
DMSO:	Not available	**Ether:**	Soluble
Ethanol:	Soluble	**Benzene:**	Soluble

Other Physical Data: Soluble in chloroform and sodium hydroxide solution.

SHIPPING

D.O.T. Shipping Name: Hazardous Substance, Solid, N.O.S.

D.O.T. Identification Number: NA9188

D.O.T. Hazard Classification: ORM-E

Other Shipping Regulations: None; no limit with passenger or cargo aircraft.

Exceptions: None. Specific Requirements, 173.1300 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: 2,4-Dimethylphenol

Acute Hazards: Toxic, corrosive

Symptoms: Unknown

Exposure Limits: No standards have been set, but this compound is considered a potential carcinogen.

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

Storage Precautions: Store in a cool, dry place or in a refrigerator.

Spills and Leakage: Dampen spilled material with alcohol to avoid dust, then transfer material to a suitable container. Use absorbent paper dampened with alcohol to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Disinfectant, solvents, pharmaceuticals, insecticides and fungicides, plasticizers, rubber chemicals, additives to lubricants and gasolines, wetting agents, dyestuffs.

Additional Reference Sources:

Handbook of Chemistry and Physics, R. Weast et al, 63rd Ed., p. C-434 (1982), CRC Press.

Merck Index, M. Windholz et al, 9th Ed., p. 1301 (1976), Merck.

Dictionary of Organic Compounds, J. Buckingham, 5th Ed., p. 2201 (1982), Chapman and Hall.

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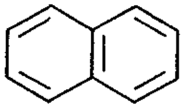
IDENTITY

NTP PREFERRED NAME: Naphthalene

Synonyms:
Albocarbon
Naphthaline
Naphthene



CAS Registry Number:

91-20-3

NIOSH Registry Number:

QJ0525000

Formula: $C_{10}H_8$

Molecular Weight: 128.17

WLN: L66J

PHYSICAL PROPERTIES

Physical Description: Colorless, crystalline solid.

Melting Point: 80-81°C

Boiling Point: 218°C

Density: 1.145 g/mL at 20°C

Specific Gravity: 0.9625 at 100°/4°C

Flammability: Combustible

Stability: Volatilizes appreciably at room temperatures; sublimes at temperatures above the melting point.

Flash Point: 79°C (174°F)

Reactivity: May react violently with water (above 110°C); incompatible with strong oxidizers.

Solubility In:

Water:	Insoluble	Acetone:	Soluble
DMSO:	Not available	Ether:	Soluble
Ethanol:	1 g/13 mL	Benzene:	1 g/3.5 mL

Other Physical Data: Boiling point is 87.5°C at 10 mm Hg; Refractive Index is 1.5898 at 85°C. Odor of moth balls; autoignition temperature is 567°C; vapor pressure is 1 mm Hg at 52.6°C; vapor density is 4.42.

SHIPPING

D.O.T. Shipping Name: Naphthalene (RQ 5000/2270)

D.O.T. Identification Number: UN1334

D.O.T. Hazard Classification: ORM-A

Other Shipping Regulations: None. Passsenger aircraft limit is 25 lbs.; cargo aircraft limit is 300 lbs.

Exceptions: 173.505. Specific Requirements, 173.655 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: Naphthalene

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HEALTH HAZARDS

Acute Hazards: Moderately toxic, local irritant, toxic vapors may be produced in a fire.

Symptoms: Irritating to eyes and skin, dermatitis, headache, nausea, vomiting, diaphoresis, hematuria, hemolytic anemia, fever, hepatic necrosis, convulsions, coma, diarrhea, profuse perspiration.

Exposure Limits: Current OSHA standards are: TLV-TWA of 10 ppm, STEL of 15 ppm. ACGIH concurs in this recommendation.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

ADDITIONAL INFORMATION

Storage Precautions: Store in a refrigerator and keep away from moisture and oxidizers.

Spills and Leakage: Dampen spilled material with alcohol to avoid dust, then transfer material to a suitable container. Use absorbent paper dampened with alcohol to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Raw material and intermediate in the chemical plastics and dye industries; moth repellent, air freshener; manufacture of insecticides, lacquers, varnishes, and fungicides; antiseptic, anthelmintic, lubricant.

Additional Reference Sources:

<u>Merck Index</u>, M. Windholz et al, 9th Ed., p. 828 (1976), Merck.

<u>Hazardous Chemicals Data Book</u>, G. Weiss, p. 636 (1980), Noyes.

<u>Handbook of Chemistry and Physics</u>, R. Weast et al, 63rd Ed., p. C-380 (1982), CRC Press.

<u>Condensed Chemical Dictionary</u>, G. Hawley, 9th Ed., p. 713 (1977), Van Nostrand Reinhold.

660

IDENTITY

NTP PREFERRED NAME: Phenol

Synonyms:

Hydroxybenzene
Phenyl alcohol
Carbolic acid

CAS Registry Number:

108-95-2

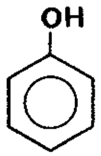
NIOSH Registry Number:

SJ3325000

Formula: C_6H_6O

Molecular Weight: 94.11

WLN: QR



PHYSICAL PROPERTIES

Physical Description: Translucent, colorless crystals.

Melting Point: 41-43°C

Boiling Point: 182°C

Density: 1.058 g/mL

Specific Gravity: 1.0576 at 20°/4°C

Flammability: Combustible

Stability: Crystals redden on exposure to air and light; hastened by alkalinity.

Flash Point: 79°C (175°F)

Reactivity: May react with calcium hypochlorite and other oxidizing materials.

Solubility In:

Water:	50-100 mg/mL at 19°C	**Acetone:**	≥100 mg/mL at 19°C
DMSO:	≥100 mg/mL at 19°C	**Ether:**	Very soluble
Ethanol:	≥100 mg/mL at 19°C	**Benzene:**	Very soluble

Other Physical Data: Soluble in carbon tetrachloride, chloroform and carbon disulfide; vapor pressure is 1 mm Hg at 40.1°C; vapor density is 3.24; pKa is 9.89; Refractive Index is 1.54 at 45°C; autoignition temperature is 715°C.

SHIPPING

D.O.T. Shipping Name: Phenol (RQ-1000/454)

D.O.T. Identification Number: UN1671

D.O.T. Hazard Classification: Poison B

Other Shipping Regulations: Poison label required. Passenger aircraft limit is 50 lbs.; cargo aircraft limit is 250 lbs.

Exceptions: 173.364. Specific Requirements, 173.369 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: Phenol

660

HEALTH HAZARDS

Acute Hazards: Toxic, irritant and may be absorbed by the skin.

Symptoms: Nausea, vomiting, circulatory collapse; tachypnea, paralysis, convulsions, coma, greenish or smoky colored urine, necrosis of mouth and gastrointestinal tract, jaundice.

Exposure Limits: OSHA Standard for air TWA is 5 ppm (skin) (SCP-L). The STEL is 10 ppm (skin).

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

ADDITIONAL INFORMATION

Storage Precautions: Store in a refrigerator or in a cool, dry place and protect from prolonged exposure to light. Keep away from oxidizing materials.

Spills and Leakage: Dampen spilled material with alcohol to avoid dust, then transfer material to a suitable container. Use absorbent paper dampened with alcohol to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Permeation tests indicate that butyl rubber, Viton or neoprene gloves may provide protection from exposure to this compound.

Uses: Application and curing of bonding resins in plywood manufacture; molding resins; intermediate in synthesis of pharmaceuticals, rubber and plastics; synthesis of preservatives for dyes, perfumes and fungicides.

Additional Reference Sources:

Merck Index, M. Windholz et al, 9th Ed., p. 940 (1976), Merck.
Patty's Industrial Hygiene and Toxicology, G. C. Clayton and F. E. Clayton, 3rd Revised Ed., p. 2567 (1981), John Wiley and Sons.
Hazardous Chemicals Data Book, G. Weiss, p. 742 (1980), Noyes.
Dangerous Properties of Industrial Materials, N. I. Sax, 5th Ed., p. 897 (1979), Van Nostrand Reinhold.

789

IDENTITY

NTP PREFERRED NAME: Toluene

Synonyms:

Methylbenzene
Phenylmethane
Toluol

CAS Registry Number:

108-88-3

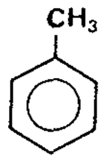
NIOSH Registry Number:

XS5250000

Formula: C_7H_8

Molecular Weight: 92.15

WLN: 1R



PHYSICAL PROPERTIES

Physical Description: Clear, colorless liquid.

Melting Point: -93°C

Boiling Point: 110.6°C

Density: 0.87 g/mL

Specific Gravity: 0.866 at 20°/4°C

Flammability: Flammable

Stability: Stable under normal laboratory storage conditions.

Flash Point: 4°C (40°F)

Reactivity: Reacts with strong oxidiers.

Solubility In:

Water:	<1 mg/mL at 18°C	**Acetone:**	≥100 mg/mL at 18°C
DMSO:	≥100 mg/mL at 18°C	**Ether:**	Miscible
Ethanol:	≥100 mg/mL at 18°C	**Benzene:**	Soluble

Other Physical Data: Soluble in carbon disulfide; vapor density is 3.1; vapor pressure is 55 mm Hg at 25°C; autoignition temperature is 536°C (997°F); Refractive Index is 1.4967 at 20°C; miscible with chloroform.

SHIPPING

D.O.T. Shipping Name: Toluene (toluol) (RQ-1000/454)

D.O.T. Identification Number: UN1294

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Passenger aircraft limit is 1 qt.; cargo aircraft limit is 10 gal.

Exceptions: 173.118. Specific Requirements, 173.119 in Hazardous Materials Regulations of the Department of Transportation (1981).

NTP PREFERRED NAME: *Toluene* 789

HEALTH HAZARDS

Acute Hazards: Toxic, irritant; narcotic in high concentrations; can be absorbed through the skin.

Symptoms: Dizziness, headaches, unconsciousness, defatted skin, irritation, dermatitis, macrocytic anemia, vomiting, griping, diarrhea, depressed respiration. If aspirated causes coughing, gagging, distress, pulmonary edema.

Exposure Limits: The ACGIH listed TWA is 100 ppm; the STEL is 150 ppm.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If convulsions are not present, give a glass or two of water or milk to dilute the substance. Assure that the person's airway is unobstructed and contact a hospital or poison center immediately for advice on whether or not to induce vomiting.

ADDITIONAL INFORMATION

Storage Precautions: Store in an explosion-proof refrigerator or a flame proof storage cabinet and away from oxidizers.

Spills and Leakage: Use absorbent paper to pick up spilled material. Follow by washing surfaces well first with alcohol, then with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Literature indicates that PVA gloves may provide protection from exposure to this compound.

Uses: Manufacture of benzoic acid, benzaldehyde, explosives, dyes, and other organics; solvent, aviation gasoline, scintillation counter, diluent and thinner in nitrocellulose lacquers.

Additional Reference Sources:

Merck Index, M. Windholz et al, 9th Ed., p. 1225 (1976), Merck.

Condensed Chemical Dictionary, G. Hawley, 9th Ed., p. 1030 (1977), Van Nostrand Reinhold.

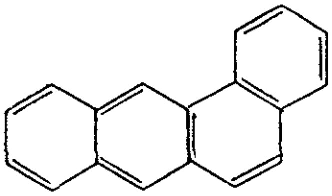
Hazardous Chemicals Data Book, G. Weiss, p. 870 (1980), Noyes.

956

IDENTITY

PREFERRED NAME: Benz(a)anthracene

Synonyms:
1,2-Benzanthracene
2,3-Benzophenanthrene
2,3-Benzphenanthrene
Tetraphene



CAS Registry Number: 56-55-3

NIOSH Registry Number: CV9275000

Formula: $C_{18}H_{12}$

Molecular Weight: 228.28

WLN: L D6 B666J

PHYSICAL PROPERTIES

Physical Description: Colorless leaflets or plates

Melting Point: 162°C

Boiling Point: 435°C (sublimes)

Density: Not available

Specific Gravity: Not available

Flammability: Not available

Stability: Stable under normal laboratory storage conditions.

Flash Point: Not available

Reactivity: Not available

Solubility In:

Water:	<1 mg/mL @ 20°C	**Acetone:**	10-50 mg/mL @ 20°C
DMSO:	10-50 mg/mL @ 20°C	**Ether:**	Soluble
Ethanol:	<1 mg/mL @ 20°C	**Benzene:**	Very soluble

Other Physical Data: Soluble in toluene.

SHIPPING

D.O.T. Shipping Name: Poisonous solid, n.o.s.

D.O.T. Identification Number: UN2811

D.O.T. Hazard Classification: Poison B

Other Shipping Regulations: Poison label required. Passenger aircraft limit is 50 lbs.; cargo aircraft limit is 200 lbs.

Exceptions: 173.364. Specific requirements, 173.365 in Code of Federal Regulations, Title 49 (1984).

956

PREFERRED NAME: Benz(a)anthracene

HEALTH HAZARDS

Acute Hazard: *Highly toxic;* emits acrid smoke and irritating fumes when when heated to decomposition.

Symptoms & Signs: Unknown

Exposure Limits: Not regulated

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: Contact a physician, hospital or poison center at once. If the victim is unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that his airway is open and lay him on his side with his head lower than his body and transport immediately to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. Vomiting should not be induced without a physician's advice.

ADDITIONAL INFORMATION

Storage Precautions: Store in a refrigerator or in a cool, dry place.

Spills and Leakage: Remove all sources of ignition and dampen spilled material with toluene to avoid airborne dust, then transfer material to a suitable container. Ventilate the spill area and use absorbent paper dampened with toluene to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: No commercial uses are known but it is found naturally in oils, waxes, smoke, food and drugs.

Additional Reference Sources:

Handbook of Chemistry and Physics, R. Weast et al, CRC Press.

Dangerous Properties of Industrial Materials, N. I. Sax, 6th Ed., pp. 355-356 (1984), Van Nostrand Reinhold.

IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man, Vol. 3, pp. 45-68 (1973), IARC.

Merck Index, M. Windholz et al, 10th Ed., p. 1055 (1983), Merck.

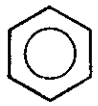
958

IDENTITY

PREFERRED NAME: Benzene

Synonyms:

Benzol
Cyclohexatriene
Phenyl hydride



CAS Registry Number:
71-43-2

NIOSH Registry Number:
CY1400000

Formula: C_6H_6

Molecular Weight: 78.12

WLN: R

PHYSICAL PROPERTIES

Physical Description: Colorless to light yellow liquid

Melting Point: 5.5°C

Boiling Point: 80.1°C

Density: 0.905 g/mL @ 21°C

Specific Gravity: 0.88 @ 20/4°C

Flammability: Highly flammable

Stability: Stable under normal laboratory storage conditions.

Flash Point: -11°C

Reactivity: Reacts vigorously with strong oxidizers, chlorine and bromine with iron.

Solubility In:

Water:	1-5 mg/mL @ 18°C	**Acetone:**	>=100 mg/mL @ 22°C
DMSO:	>=100 mg/mL @ 22°C	**Ether:**	Miscible
Ethanol:	>=100 mg/mL @ 22°C	**Benzene:**	Miscible

Other Physical Data: LEL is 1.4%; UEL is 8.0%; refractive index is 1.501 @ 20°C; miscible in most organic solvents, acetic acid, chloroform, carbon tetrachloride; vapor pressure is 74.6 mm Hg @ 20°C; vapor density is 2.77.

SHIPPING

D.O.T. Shipping Name: Benzene (RQ-1000/454)

D.O.T. Identification Number: UN1114

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Passenger aircraft limit is 1 qt.; cargo aircraft limit is 10 gal.

Exceptions: 173.118. Specific requirements, 173.119 in Code of Federal Regulations, Title 49 (1984).

PREFERRED NAME: Benzene

958

HEALTH HAZARDS

Acute Hazard: Highly toxic by inhalation and skin contact.

Symptoms & Signs: Headache; giddiness; euphoria; dizziness; restlessness; confusion; unsteady gait; tremors; coma; seizures; skin irritation and redness, blisters; bleeding mucous membranes, burning sensation of the mouth and stomach, nausea, vomiting, salivation, loss of appetite, substernal pain, cough, hoarseness, hemorrhagic pneumonitis, leukemia.

Exposure Limits: OSHA- the TWA is 10 ppm, the ceiling limit is 25 ppm, the peak is 50 ppm for 10 min (per 8 hr); ACGIH- the TLV-TWA is 10 ppm, the TLV-STEL is 25 ppm (with notice of intent to delete); ACGIH suspect carcinogen.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area *immediately; breathe fresh air.* Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: Contact a physician, hospital or poison center at once. If the victim is unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that his airway is open and lay him on his side with his head lower than his body and transport immediately to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. Vomiting should not be induced without a physician's advice.

ADDITIONAL INFORMATION

Storage Precautions: Store in an explosion-proof refrigerator and keep away from oxidizing materials and sources of ignition.

Spills and Leakage: Remove all sources of ignition, ventilate the spill area, and use absorbent paper to pick up spilled material. Follow by washing surfaces well, first with 60-70% ethanol, then with soap and with 60-70% ethanol, then with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Viton gloves have been tested and found to be resistant to permeation by benzene.

Uses: Solvent; manufacture of medicines, dyes, artificial leather, linoleum, oil cloth, airplane dope, varnishes, lacquers and many other organics.

Additional Reference Sources:

Handbook of Chemistry and Physics, R. Weast et al, CRC Press.

Dangerous Properties of Industrial Materials, N. I. Sax, 6th Ed., pp. 360-362 (1984), Van Nostrand Reinhold.

IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man, Vol. 7, pp. 203-230 (1974), IARC.

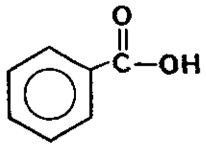
Merck Index, M. Windholz et al, 10th Ed., p. 151 (1983), Merck.

964

IDENTITY

PREFERRED NAME: Benzoic acid

Synonyms:
Benzene carboxylic acid
Benzene formic acid
Carboxybenzene
Diacyclic acid



CAS Registry Number:
65-85-0

NIOSH Registry Number:
DG0875000

Formula: $C_7H_6O_2$

Molecular Weight: 122.12

WLN: QVR

PHYSICAL PROPERTIES

Physical Description: White crystalline solid

Melting Point: 122.4°C

Boiling Point: 249°C

Density: 1.321 g/mL @ 19°C

Specific Gravity: 1.266 @ 15/4°C

Flammability: Combustible

Stability: Stable under normal laboratory storage conditions.

Flash Point: 121-131°C (250°F)

Reactivity: Reacts exothermically with bases and can generate hydrogen gas when a water solution reacts with metals.

Solubility In:

Water:	<1 mg/mL @ 20°C	**Acetone:**	>=100 mg/mL @ 20°C
DMSO:	>=100 mg/mL @ 20°C	**Ether:**	Very soluble
Ethanol:	>=100 mg/mL @ 20°C	**Benzene:**	Soluble

Other Physical Data: Refractive index is 1.504 @ 32°C; soluble in chloroform, carbon tetrachloride, turpentine; pKa @ 25°C is 4.2; pH of a saturated solution @ 25°C is 2.8; vapor pressure is 1 mm Hg @ 96°C; vapor density is 4.21.

SHIPPING

D.O.T. Shipping Name: Benzoic acid (RQ-5000/2270)

D.O.T. Identification Number: NA9094

D.O.T. Hazard Classification: ORM-E

Other Shipping Regulations: None; no limit with passenger or cargo aircraft.

Exceptions: None. Specific requirements, 173.510 in Code of Federal Regulations, Title 49 (1984).

PREFERRED NAME: Benzoic acid **964**

HEALTH HAZARDS

Acute Hazard: Toxic by skin absorption; mild irritant to skin, eyes, and mucous membranes; emits acrid smoke and irritating fumes when heated to decomposition.

Symptoms & Signs: Irritation of skin, eyes, and respiratory system; gastric pain, nausea, vomiting; and allergic reactions.

Exposure Limits: Not regulated

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: Contact a physician, hospital or poison center at once. If the victim is unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that his airway is open and lay him on his side with his head lower than his body and transport immediately to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. Vomiting should not be induced without a physician's advice.

ADDITIONAL INFORMATION

Storage Precautions: Store in a refrigerator or in a cool, dry place.

Spills and Leakage: Remove all sources of ignition and dampen spilled material with 60-70% ethanol to avoid airborne dust, then transfer material to a suitable container. Ventilate the spill area and use absorbent paper dampened with 60-70% ethanol to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Preserving foods, fats, fruit juices, alkaloidal solutions, etc.; manufacture of benzoates, and benzoyl compounds, dyes; as a mordant in calico printing; for curing tobacco; as a standard in analytical chemistry; an antifungal agent; also used in plasticizers, perfumes, and dentifrices.

Additional Reference Sources:

Handbook of Chemistry and Physics, R. Weast et al, CRC Press.

Merck Index, M. Windholz et al, 10th Ed., p. 155 (1983), Merck.

Condensed Chemical Dictionary, G. Hawley, 10th ed., p. 118 (1981), Van Nostrand Reinhold.

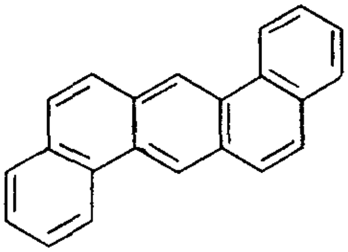
Dictionary of Organic Compounds, J. Buckingham, 5th Ed., p. 560 (1982), Chapman and Hall.

1077

IDENTITY

PREFERRED NAME: Dibenz(a,h)anthracene

Synonyms:
1,2,5,6-Dibenzanthracene
Dibenzo(a,h)anthracene



CAS Registry Number: 53-70-3

NIOSH Registry Number: HN2625000

Formula: $C_{22}H_{14}$

Molecular Weight: 278.36

WLN: L G6 D6 B666J

PHYSICAL PROPERTIES

Physical Description: Pale yellow solid

Melting Point: 266°C (sublimes)

Boiling Point: 524°C

Density: 1.282 g/mL @ 20°C

Specific Gravity: Not available

Flammability: Not available

Stability: May be sensitive to light.

Flash Point: Not available

Reactivity: Not available

Solubility In:

Water:	<1 mg/mL @ 19°C	**Acetone:**	1-10 mg/mL @ 19°C
DMSO:	1-10 mg/mL @ 19°C	**Ether:**	Slightly soluble
Ethanol:	<1 mg/mL @ 19°C	**Benzene:**	Soluble

Other Physical Data: Soluble in acetic acid, toluene, petroleum ether and oils; solution in concentrated sulfuric acid is red.

SHIPPING

D.O.T. Shipping Name: Poisonous solid, n.o.s.

D.O.T. Identification Number: UN2811

D.O.T. Hazard Classification: Poison B

Other Shipping Regulations: Poison label required. Passenger aircraft limit is 50 lbs.; cargo aircraft limit is 200 lbs.

Exceptions: 173.364. Specific requirements, 173.365 in Code of Federal Regulations, Title 49 (1984).

PREFERRED NAME: Dibenz(a,h)anthracene

1077

HEALTH HAZARDS

Acute Hazard: Toxic; emits acrid smoke and irritating fumes when heated to decomposition.

Symptoms & Signs: Unknown

Exposure Limits: Not regulated. For similar compounds (coal tar pitch volatiles-the Benzene soluble fraction): OSHA- the TWA is 0.2 mg/m^3; ACGIH- the TLV-TWA is 0.2 mg/m^3; an ACGIH human carcinogen.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: Contact a physician, hospital or poison center at once. If the victim is unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that his airway is open and lay him on his side with his head lower than his body and transport immediately to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. Vomiting should not be induced without a physician's advice.

ADDITIONAL INFORMATION

Storage Precautions: Store in a refrigerator or in a cool, dry place, and protect from exposure to light.

Spills and Leakage: Remove all sources of ignition and dampen spilled material with toluene to avoid airborne dust, then transfer material to a suitable container. Ventilate the spill area and use absorbent paper dampened with toluene to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Not available

Additional Reference Sources:

Handbook of Chemistry and Physics, R. Weast et al, CRC Press.
Aldrich Catalog Handbook of Fine Chemicals, Aldrich Chemical Co.
Dictionary of Organic Compounds, J. Buckingham, 5th Ed., p. 1591 (1982), Chapman and Hall.
Merck Index, M. Windholz et al, 10th Ed., pp. 435-436 (1983), Merck.

1093

IDENTITY

PREFERRED NAME: cis-1,2-Dichloroethylene

Synonyms:

cis-1,2-Dichloroethane
cis-Acetylene dichloride
cis-Dichloroethylene
1,2-cis-Dichloroethylene

CAS Registry Number:

156-59-2

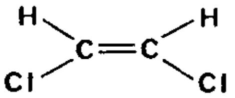
NIOSH Registry Number:

KV9420000

Formula: $C_2H_2Cl_2$

Molecular Weight: 96.94

WLN: G1U1G -C



PHYSICAL PROPERTIES

Physical Description: Colorless liquid

Melting Point: -80°C

Boiling Point: 60°C

Density: Not available

Specific Gravity: 1.2837 @ 20/4°C

Flammability: Flammable

Stability: Sensitive to air, light, moisture and elevated temperatures.

Flash Point: 6°C (43°F)

Reactivity: Reacts vigorously with oxidizing materials; reacts violently with N_2O_4, KOH, Na and NaOH. It may release explosive chloroacetylene on contact with copper or copper alloys.

Solubility In:

Water:	1-5 mg/mL @ 16°C	**Acetone:** >=100 mg/mL @ 17°C
DMSO:	>=100 mg/mL @ 17°C	**Ether:** Soluble
Ethanol:	>=100 mg/mL @ 17°C	**Benzene:** Soluble

Other Physical Data: LEL is 9.7%; UEL is 12.8%; refractive index is 1.4462 @ 20°C; soluble in chloroform; autoignition temperature is 460°C; boiling point @ 745 mm Hg is 59.6°C; chloroform-like odor.

SHIPPING

D.O.T. Shipping Name: Dichloroethylene

D.O.T. Identification Number: UN1150

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Passenger aircraft limit is 1 qt.; cargo aircraft limit is 10 gal.

Exceptions: 173.118. Specific requirements, 173.119 in Code of Federal Regulations, Title 49 (1984).

1093

PREFERRED NAME: cis,1,2-Dichloroethylene

HEALTH HAZARDS

Acute Hazard: Moderately toxic by ingestion, inhalation and skin contact; irritating and narcotic in high concentrations.

Symptoms & Signs: Irritation of eyes (conjunctivitis), mucous membranes, and upper respiratory tract; dermatitis; nausea, vomiting; cramps, and digestive disturbances; weakness, dizziness, tremors; at high concentrations, narcosis and central nervous system depression, loss of consciousness; possible liver and kidney damage.

Exposure Limits: Not regulated. For a similar compound (1,2-Dichloroethylene): OSHA- the TWA is 100 ppm; ACGIH- the TLV-TWA is 200 ppm.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under *the water stream.* Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: Contact a physician, hospital or poison center at once. If the victim is unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that his airway is open and lay him on his side with his head lower than his body and transport immediately to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. Vomiting should not be induced without a physician's advice.

ADDITIONAL INFORMATION

Storage Precautions: Store in an explosion-proof refrigerator or freezer and protect from air and light. Keep away from sources of ignition.

Spills and Leakage: Remove all sources of ignition, ventilate the spill area, and use absorbent paper to pick up spilled material. Follow by washing surfaces well, first with 60-70% ethanol, then with soap and with 60-70% ethanol, then with soap and water. Seal all wastes in vapor-tight plastic bags for *eventual disposal.*

Suggested Gloves: Viton gloves have been tested and found to be resistant to permeation by cis-1,2-dichloroethylene.

Uses: In medicine; solvents for waxes, resins, rubber, fats, phenol, camphor, etc.; refrigerant; manufacture of pharmaceuticals and artificial pearls; fermentation retardant; extraction of oils and fats; dye extraction; perfumes; lacquers; thermoplastics; organic synthesis.

Additional Reference Sources:

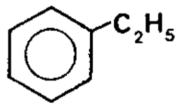
Handbook of Chemistry and Physics, R. Weast et al, CRC Press.
Dangerous Properties of Industrial Materials, N. I. Sax, 6th Ed., p. 946 (1984), Van Nostrand Reinhold.
Aldrich Catalog Handbook of Fine Chemicals, Aldrich Chemical Co.
Merck Index, M. Windholz et al, 10th Ed., pp. 13-14 (1983), Merck.

1190

IDENTITY

PREFERRED NAME: Ethylbenzene

Synonyms:
Phenylethane
Ethylbenzol



CAS Registry Number:
100-41-4

NIOSH Registry Number:
DA0700000

Formula: C_8H_{10}

Molecular Weight: 106.17

WLN: 2R

PHYSICAL PROPERTIES

Physical Description: Clear colorless liquid

Melting Point: -95°C

Boiling Point: 136.2°C

Density: 0.866 g/cm3 @ 21°C

Specific Gravity: 0.8670 @ 20/4°C

Flammability: Flammable

Stability: Stable under normal laboratory storage conditions.

Flash Point: 15°C (59°F)

Reactivity: Reacts vigorously with strong oxidizing materials.

Solubility In:

Water:	<1 mg/mL @ 23°C	**Acetone:**	>=100 mg/mL @ 23°C
DMSO:	>=100 mg/mL @ 23°C	**Ether:**	Soluble
Ethanol:	1-10 mg/mL @ 23°C	**Benzene:**	Soluble

Other Physical Data: LEL is 1.2%; UEL is 6.8%; autoignition temperature is 432°C (810°F); vapor pressure is 7 mm Hg @ 20°C; vapor density is 3.66; viscosity is 0.64 cp @ 25°C; refractive index is 1.4959 @ 20°C; aromatic odor.

SHIPPING

D.O.T. Shipping Name: Ethyl benzene (RQ-1000/454)

D.O.T. Identification Number: UN1175

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Passenger aircraft limit is 1 qt.; cargo aircraft limit is 10 gal.

Exceptions: 173.118. Specific requirements, 173.119 in Code of Federal Regulations, Title 49 (1984).

PREFERRED NAME: Ethylbenzene **1190**

Acute Hazard: Toxic; irritant; narcotic in high concentrations; lachrymator.

Symptoms & Signs: Irritation, redness and inflammation of the skin (dermatitis); irritation of the nose, throat and eyes with lachrymation and conjunctivitis, corneal erosion; dizziness, a sense of constriction of the chest, and narcosis.

Exposure Limits: OSHA- the TWA is 100 ppm; ACGIH- the TLV-TWA is 100 ppm, the TLV-STEL is 125 ppm, and a notice of intent to establish a BEI.

HEALTH HAZARDS

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that victim's airway is open and lay him on his side with his head lower than his body and transport at once to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. If medical advice is not readily available, DO NOT INDUCE VOMITING, and rush the victim to the nearest medical facility.

FIRST AID

Storage Precautions: Store in an explosion-proof refrigerator or a flammable solvents cabinet.

Spills and Leakage: Remove all sources of ignition, ventilate the spill area, and use absorbent paper to pick up spilled material. Follow by washing surfaces well, first with 60-70% acetone, then with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Viton gloves have been tested and found to be resistant to permeation by ethylbenzene.

Uses: Intermediate in production of styrene; organic synthesis; solvent; dilutant; anti-knock agent; acetophenone manufacture; asphalt constituent; naphtha constituent.

Additional Reference Sources:

Handbook of Chemistry and Physics, R. Weast et al, CRC Press.
Dangerous Properties of Industrial Materials, N. I. Sax, 6th Ed., p. 1322 (1984), Van Nostrand Reinhold.
Hazardous Chemicals Data Book, G. Weiss, p. 420 (1980), Noyes.
Merck Index, M. Windholz et al, 10th Ed., p. 546 (1983), Merck.
Registry of Toxic Effects of Chemical Substances, R. Lewis (1985), NIOSH.

ADDITIONAL INFORMATION

1310

IDENTITY

PREFERRED NAME: Methyl ethyl ketone

Synonyms:
2-Butanone
Ethyl methyl ketone
Methyl acetone
MEK

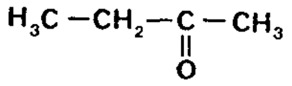
CAS Registry Number:
78-93-3

NIOSH Registry Number:
EL6475000

Formula: C_4H_8O

Molecular Weight: 72.11

WLN: 2V1



$H_3C-CH_2-\underset{\underset{O}{\|}}{C}-CH_3$

PHYSICAL PROPERTIES

Physical Description: Clear colorless liquid

Melting Point: -87°C

Boiling Point: 79.6°C

Density: Not available

Specific Gravity: 0.805 @ 20/4°C

Flammability: Flammable

Stability: Stable under normal laboratory storage conditions.

Flash Point: -7°C (22°F)

Reactivity: Strong oxidizing agents can cause spontaneous ignition and violent reaction; ignition on reaction with potassium t-butoxide; can attack many plastics, resins, and rubber; incompatible with chlorosulfonic acid, oleum, chloroform, hydrogen peroxide, and nitric acid.

Solubility In:

Water:	>=100 mg/mL @ 19°C	**Acetone:**	>=100 mg/mL @ 19°C
DMSO:	>=100 mg/mL @ 19°C	**Ether:**	Soluble
Ethanol:	>=100 mg/mL @ 19°C	**Benzene:**	Soluble

Other Physical Data: LEL is 1.8%; UEL is 10.0%; autoignition temperature is 516°C (960°F); vapor pressure is 77.5 mm Hg @ 20°C; vapor density is 2.42; refractive index is 1.379 @ 20°C; miscible with oils.

SHIPPING

D.O.T. Shipping Name: Methyl ethyl ketone

D.O.T. Identification Number: UN1193

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Passenger aircraft limit is 1 qt.; cargo aircraft limit is 10 gal.

Exceptions: 173.118. Specific requirements, 173.119 in Code of Federal Regulations, Title 49 (1984).

1310

PREFERRED NAME: Methyl ethyl ketone

HEALTH HAZARDS

Acute Hazard: Irritant of the skin, eyes, nose, throat, mucous membranes and digestive tract; narcotic by inhalation; absorbed through the skin.

Symptoms & Signs: Irritation of the skin (dermatitis), eyes (eye burns), nose, throat, mucous membranes and digestive tract; headache, dizziness, upset stomach, vomiting, weakness, narcosis, and unconsciousness.

Exposure Limits: OSHA- the TWA is 200 ppm; ACGIH- the TLV-TWA is 200 ppm and the TLV-STEL is 300 ppm.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that victim's airway is open and lay him on his side with his head lower than his body and transport at once to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. If medical advice is not readily available, DO NOT INDUCE VOMITING, and rush the victim to the nearest medical facility.

ADDITIONAL INFORMATION

Storage Precautions: Store in an explosion proof refrigerator or in a flammable materials storage cabinet.

Spills and Leakage: Ventilate the spill area and use absorbent paper to pick up spilled material. Follow by washing surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Butyl rubber gloves have been tested and found to be resistant to permeation by methyl ethyl ketone.

Uses: Solvent in nitrocellulose coatings and vinyl films; "Glyptol resins; paint removers; cement and adhesives; organic synthesis; manufacture of smokeless powder; cleaning fluids; printing; catalyst carrier; acrylic coatings; intermediate in the manufacture of ketones and amines.

Additional Reference Sources:

Hazards in the Chemical Laboratory, L. Bretherick, 3rd Ed., pp. 214-215 (1981), The Royal Society of Chemistry.

Handbook of Environmental Data on Organic Chemicals, Karel Verschueren, 2nd Ed., pp. 850-852 (1983), Van Nostrand Reinhold.

Patty's Industrial Hygiene and Toxicology, G. C. Clayton and F. E. Clayton, 3rd Revised Ed., pp. 4728-4733 (1981), John Wiley and Sons.

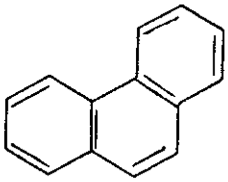
Hazardous Chemicals Data Book, G. Weiss, p. 610 (1980), Noyes.

1431

IDENTITY

PREFERRED NAME: Phenanthrene

Synonyms:
Phenanthren
Phenantrin



CAS Registry Number: 85-01-8

NIOSH Registry Number: SF7175000

Formula: $C_{14}H_{10}$

Molecular Weight: 178.24

WLN: L B666J

PHYSICAL PROPERTIES

Physical Description: Colorless crystals

Melting Point: 100°C

Boiling Point: 340°C

Density: 1.179 g/mL @ 25°C

Specific Gravity: Not available

Flammability: Combustible

Stability: Stable under normal laboratory storage conditions.

Flash Point: 171°C (340°F)

Reactivity: May react with oxidizing materials; forms molecular compounds with picric acid, picryl chloride, dinitrobenzene, and similar nitro compounds.

Solubility In:

Water:	<1 mg/mL @ 26°C	**Acetone:**	>=100 mg/mL @ 26°C
DMSO:	>=100 mg/mL @ 26°C	**Ether:**	Very soluble
Ethanol:	>=100 mg/mL @ 26°C	**Benzene:**	Very soluble

Other Physical Data: Vapor pressure is 1 mm Hg @ 118.2°C; vapor density is 6.14; refractive index is 1.5943; soluble in acetic acid, carbon disulfide, and common organic solvents; sublimes in high vacuum; solutions exhibit a blue fluorescence.

SHIPPING

D.O.T. Shipping Name: Hazardous substance, solid, n.o.s.

D.O.T. Identification Number: NA9188

D.O.T. Hazard Classification: ORM-E

Other Shipping Regulations: None; no limit with passenger or cargo aircraft.

Exceptions: None. Specific requirements, 173.1300 in Code of Federal Regulations, Title 49 (1984).

1431

PREFERRED NAME: Phenanthrene

HEALTH HAZARDS

Acute Hazard: Toxic; local irritant; human skin photosensitizer; emits acrid smoke and fumes when heated to decomposition.

Symptoms & Signs: Skin irritation and sensitization, dermatitis; respiratory irritation with cough, dyspnea, and bronchitis; respiratory neoplasms, kidney neoplasms.

Exposure Limits: For coal tar pitch volatiles (the Benzene soluble fraction): OSHA- the TWA is 0.2 mg/m^3; ACGIH- the TLV-TWA is 0.2 mg/m^3.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: Contact a physician, hospital or poison center at once. If the victim is unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that his airway is open and lay him on his side with his head lower than his body and transport immediately to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. Vomiting should not be induced without a physician's advice.

ADDITIONAL INFORMATION

Storage Precautions: Store in a refrigerator or in a cool, dry place. Protect from oxidizing materials.

Spills and Leakage: Remove all sources of ignition and dampen spilled material with 60-70% ethanol to avoid airborne dust, then transfer material to a suitable container. Ventilate the spill area and use absorbent paper dampened with 60-70% ethanol to pick up remaining material. Wash surfaces well with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Dyestuffs, explosives, medical synthesis, biochemical studies.

Additional Reference Sources:

Merck Index, M. Windholz et al, 10th Ed., p. 1037 (1983), Merck.

Dangerous Properties of Industrial Materials, N. I. Sax, 6th Ed., p. 2154 (1984), Van Nostrand Reinhold.

Patty's Industrial Hygiene and Toxicology, G. C. Clayton and F. E. Clayton, 3rd Revised Ed., pp. 3346, 3347-3350 (1981), John Wiley and Sons.

Dictionary of Organic Compounds, J. Buckingham, 5th Ed., p. 4571 (1982), Chapman and Hall.

1599

IDENTITY

PREFERRED NAME: Xylenes (mixed)

Synonyms:
Xylol
Dimethylbenzenes

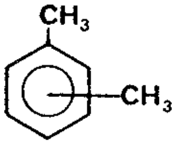
CAS Registry Number: 1330-20-7

NIOSH Registry Number: ZE2100000

Formula: C_8H_{10}

Molecular Weight: 106.17

WLN: 1R X1



PHYSICAL PROPERTIES

Physical Description: Clear colorless liquid

Melting Point: Not available

Boiling Point: 137-140°C

Density: 0.860 g/mL

Specific Gravity: 0.864 @ 20/4°C

Flammability: Flammable

Stability: Stable under normal laboratory storage conditions.

Flash Point: 29°C (85°C)

Reactivity: Reacts with oxidizing materials; will attack some forms of plastics, rubber and coatings.

Solubility In:

Water:	<1 mg/mL @ 22°C	**Acetone:**	>=100 mg/mL @ 22°C
DMSO:	>=100 mg/mL @ 22°C	**Ether:**	Miscible
Ethanol:	>=100 mg/mL @ 22°C	**Benzene:**	Not available

Other Physical Data: Vapor pressure is 6.72 mm Hg @ 21°C, 10 mm Hg @ 28°C; vapor density is 3.7; miscible with many other organic liquids; refractive index is 1.4970 @ 20°C.

SHIPPING

D.O.T. Shipping Name: Xylene (RQ-1000/454)

D.O.T. Identification Number: UN1307

D.O.T. Hazard Classification: Flammable liquid

Other Shipping Regulations: Flammable liquid label required. Passenger aircraft limit is 1 qt.; cargo aircraft limit is 10 gal.

Exceptions: 173.118. Specific requirements, 173.119 in Code of Federal Regulations, Title 49 (1984).

PREFERRED NAME: Xylenes (mixed)

HEALTH HAZARDS

Acute Hazard: Toxic by ingestion and inhalation; local irritant; may be narcotic in high concentrations; emits acrid smoke and fumes when heated to decomposition.
Symptoms & Signs: Temporary corneal effects, conjunctival irritation; dizziness; headache; nausea and vomiting; mental confusion; weakness; euphoria; tightness in the chest; shallow and rapid respiration; staggering; tremors; ventricular irregularities including fibrillation; paralysis, unconsciousness, and convulsions. Violent excitement or delirium may precede unconsciousness. It may cause kidney or liver damage.
Exposure Limits: OSHA- the TWA for Xylene is 100 ppm; ACGIH- the TLV-TWA for Xylene (o-, m-, and p- isomers) is 100 ppm and the TLV-STEL is 150 ppm; NIOSH- the TWA is 100 ppm and the ceiling limit is 200 ppm/10 min.

FIRST AID

Skin Contact: Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact: Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation: Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion: If unconscious or convulsing, DO NOT INDUCE VOMITING or give anything by mouth. Assure that victim's airway is open and lay him on his side with his head lower than his body and transport at once to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. If medical advice is not readily available, DO NOT INDUCE VOMITING, and rush the victim to the nearest medical facility.

ADDITIONAL INFORMATION

Storage Precautions: Store in a refrigerator or in a cool, dry place away from oxidizing materials.

Spills and Leakage: Remove all sources of ignition, ventilate the spill area, and use absorbent paper to pick up spilled material. Follow by washing surfaces well, first with 60-70% ethanol, then with soap and with 60-70% ethanol, then with soap and water. Seal all wastes in vapor-tight plastic bags for eventual disposal.

Suggested Gloves: Not available

Uses: Solvent; raw material for production of benzoic acid, phthalic anhydride, isophthalic and terephthalic acids as well as their dimethyl esters used in the manufacture of polyester fibers; manufacture of dyes and other organics; sterilizing catgut; cleaning agent in microsope techniques.
Additional Reference Sources:

Merck Index, M. Windholz et al, 10th Ed., pp. 1447-1448 (1983), Merck.
Dangerous Properties of Industrial Materials, N. I. Sax, 6th Ed., p. 2739 (1984), Van Nostrand Reinhold.
Hazards in the Chemical Laboratory, L. Bretherick, 3rd Ed., p. 533 (1981), The Royal Society of Chemistry.
Handbook of Poisoning: Prevention, Diagnosis and Treatment, R. H. Dreisbach, 11th Ed., pp. 208-209 (1983), Lange Medical Publications.