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intel®

31 October 1988

Mr. Tom Bispham
Administrator, Regional Operations Division
Department of Enviromental Quality
811 W Sixth Avenue
Portland, OR 97204

Reference: Intel, Jones Farm, Groundwater

Dear Tom:

Enclosed is the report, prepared by Geotechnical Resources, Inc., addressing the technical issues raised by DEQ, concerning Intel Jones Farm Campus groundwater. Please call me at 696-3011 after you have an opportunity to review the report so we can discuss it.

Simcerely,

John

John Harland

cc: E. Woods, DEQ w/o attachments
T. McManus, Intel, DV2-53 w/o attachments

dvh

SUMMARY REPORT

GEOHYDROLOGIC STUDY AT INTEL CORPORATION'S JONES FARM CAMPUS

Hillsboro, Oregon

prepared by

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Portland, Oregon

prepared for

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Hillsboro, Oregon

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INTRODUCTION

At the request of Intel Corporation, Geotechnical Resources, Inc. (GRI) has conducted a geohydrologic study at the Jones Farm campus in Hillsboro, Oregon. This report comprises a review of an on-going groundwater quality monitoring program which GRI has conducted at the Jones Farm campus since 1984. The purpose of this report is to provide background information, summarize the findings of the monitoring program, and address the three technical questions dated September 14, 1988 (see Appendix A), that were submitted to Intel by the Oregon Department of Environmental Quality (DEQ).

BACKGROUND

The Jones Farm facility was constructed by Intel in 1981 and began operation in December 1982. The Vicinity Map, Figure 1, shows the general location of the Jones Farm site. The Property Plan, Figure 2, shows the location of Intel's Jones Farm campus, Intel's undeveloped property west and north of the campus, and an approximate 35-acre parcel of land northwest of the facility that Intel is in the process of purchasing. The Facility Plan, Figure 3, shows the configuration of the Jones Farm facility and other site improvements. The figure also shows the location of a buried solvent tank that was removed in 1985 and the utility lines in the service yard area.

According to Intel personnel, for approximately the first year of operation the Jones Farm facility used a waste solvent system which consisted of a buried waste solvent storage tank and a buried collection line that extended eastward from the tank for a distance nearly equal to the length of the building. According to Intel, waste solvents collected in the solvent system included 1,1,1-trichloroethane, methylene chloride, n-methyl-2-pyrrolidone, and Freon TF. Intel installed a groundwater monitoring well immediately adjacent to and down-gradient from the solvent tank when the tank was installed. In May 1984, trace levels of solvents were detected in a groundwater sample obtained from the monitoring well. The solvent collection system was immediately taken out of operation. The solvent tank was removed and the solvent collection line sealed by Intel in July 1985. A detailed 2-year chronology of events/actions that followed the detection of solvents in the monitoring well is presented in a November 21, 1986, letter from Intel to the DEQ. A copy of the letter is provided in Appendix A.

SITE DESCRIPTION

Topography

The original topography in the vicinity of JF-1 is shown on the Property Plan, Figure 2, and in cross section on the Geohydrologic Cross Sections, Figure 4. The original ground sloped gently to the north across the footprint of the building and toward a minor drainage swale in the east parking area. Minor cuts and fills made during construction of the JF-1 building have resulted in the finished building and parking area grades shown on Figure 4.

Regional Geology

The site is underlain by Willamette Silt which is composed of unconsolidated beds and lenses of fine sand, silt, and clay with occasional scattered pebbles. Stratification within this formation commonly consists of 4- to 6-in.-thick beds, although 3- to 4-ft beds are present locally. In some areas, the silt is massive and bedding is indistinct or non-existent. The silt is typically tan to light brown in its upper layers and light gray below depths of about 10 to 30 ft.

The Troutdale Formation, which consists of greenish to bluish gray silt and clayey silt, is commonly found underlying the Willamette Silt in this area at depths of less than 100 ft.

Regional Geohydrology

The Willamette Silt is generally considered to be an unconfined aquifer with groundwater levels that fluctuate seasonally in response to rainfall recharge. However, due to the layered nature of the sands and silts comprising the formation, the horizontal permeability of the soil is typically higher than the vertical permeability. The Willamette Silt is deposited unconformably on the weathered surface of the underlying Troutdale Formation. In this area, the weathered surface of the Troutdale Formation typically consists of a relatively thick (>10 ft) layer of very stiff to hard, silty clay or clayey silt which acts as an aquatard to permeation of groundwater. Near-surface groundwater flow generally follows the ground surface contours, flowing in a downslope direction.

GROUNDWATER MONITORING PROGRAM

Field Explorations and Methods

In July 1984, GRI installed nine permanent groundwater monitoring wells at the five boring locations shown on the Facility Plan, Figure 3. The purpose of the monitoring wells was to investigate the groundwater quality in the vicinity of the solvent storage tank.

The wells were installed in accordance with GRI's proposal dated May 23, 1984, after review by the DEQ and the Water Resources Department, see Appendix A. On recommendation of the Water Resources Department, the wells were grouped into pairs with one shallow well screened at a depth of approximately 2 to 22 ft, and the other deeper well screened at a depth of approximately 39 to 59 ft. Three pairs of wells were installed approximately 200 ft down-gradient of the solvent tank (JFW-1, JFW-2, and JFW-3), and one pair of wells was located adjacent to and down-gradient of the tank (JFW-5). The up-gradient installation (JFW-4) was a single well extending to a depth of 59 ft and screened at a depth of 9 to 59 ft.

The stratigraphy and well construction details of the borings are shown on Figures 5 through 9. Well screen intervals are also shown on the geohydrologic cross sections, Figure 4. The soil conditions, well installations, well development, and initial groundwater sampling and testing are discussed in detail in GRI's report to Intel dated August 1985. No odors of volatile organics were detected during well installation. Groundwater sampling procedures were conducted in accordance with Intel's September 1985 Groundwater Monitoring Program, see Appendix B.

Groundwater Levels, Gradient, and Flow Rate

Since installation of the monitoring wells in July 1984, GRI has sampled the groundwater monitoring wells seven times. Groundwater levels in each well were measured relative to the top of the well casing prior to each groundwater sampling. At locations where both shallow and deep wells were installed, the upper and lower screened zones are separated by about 11 to 13 ft. The difference between measured groundwater levels in shallow-and-deep well installations ranged from 0.1 to 1.2 ft. The relative elevations of groundwater in shallow and deep wells varied from location to location and time to time. For purposes of graphical representation of water levels on Figures 3 and 4, an average of deep and shallow well water levels is calculated at each well pair location. Tables 1 through 9 present water level data recorded between July 1984 and June 1988. The elevation of the maximum groundwater elevation recorded during this period, occurring on January 27 and 28, 1988, is plotted on the Facility Plan, Figure 3. The range in recorded groundwater levels measured during the same period, is shown in cross section on the hydrogeologic cross sections, Figure 4.

Analysis of the water levels by descriptive geometry methods for individual sampling periods indicates a groundwater gradient between 0.5% and 1.0% in a northwest direction. Based on an estimated maximum permeability of 10^{-2} and 10^{-3} cm/sec for cleaner fine sands and a maximum gradient of 1.0%, the maximum horizontal groundwater flow rates are estimated to be in the range of 10 to 100 ft per year. Based on the maximum observed difference in head of 1.2 ft between deep and shallow wells and an estimated permeability of 10^{-4} to 10^{-5} cm/sec for the silt layers of the layered sand and silt unit, the maximum vertical flow rates through the layered sand and silt are estimated to be in the range of 0.3 to 3 ft per year.

LABORATORY ANALYSES

Soil Analysis

Soil samples recovered from the borings were analyzed for volatile organics using gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS) methods by Lauck's Testing Laboratories in Seattle, Washington. The results of these analyses are presented and discussed in GRI's report to Intel, dated August 1985. GRI concluded that the results of the soil analyses should not be considered valid because of dissipation and cross contamination of the samples at Lauck's laboratory. For this reason, the results have not been included in this report.

Groundwater Analysis

A total of seven separate sets of analyses were conducted on groundwater samples obtained from the nine monitoring wells during the period of July 19, 1984, to June 21, 1988. Groundwater samples were analyzed for the quantitative determination of volatile organics, including Freon TF, using GC and GC-MS methods in accordance with EPA methods 601 and 624, respectively. These analytical methods detect both primary solvents and breakdown products.

The initial groundwater samples collected by GRI in July 1984, were analyzed by Lauck's Testing Laboratories. Subsequent samplings were analyzed by Analytical Technologies, Inc., (ATI) in San Diego, California, and Renton, Washington, with duplicate samples analyzed by Brown and Caldwell Analytical Laboratories in Emeryville, California. ATI's laboratory and reporting procedures are in accordance with their in-house quality assurance/quality control program (see Appendix B) and Intel's March 1985 Water Quality Analysis Specifications and includes analysis of trip, field, and reagent blanks, as well as duplicate groundwater samples.

Results of Groundwater Analyses. The results of analyses performed on groundwater samples are summarized on Tables 1 through 9 in Appendix C. The results indicate that only groundwater samples from well JFW-5-22, which is the shallow well immediately adjacent to the location of the former solvent tank, have had analytically significant levels of volatile organics, namely 1,1-Dichloroethane (DCA), 1,1-Dichloroethene (DCE), 1,1,1-Trichloroethane (TCA) and 1,1,2-Trichlor-1,2,2-Trifluoroethane (Freon TF). No other wells contained groundwater with detectable levels of volatile organics. A plot of volatile organics concentration versus time for well JFW-5-22 is shown on Figure 17 and indicates that the concentrations of these chemicals have decreased with time. All detectable levels were below 10 parts per billion (ppb) for the samples collected on June 22, 1988. The observed levels are below EPA drinking water standards for TCA (200 ppb) and DCE (7 ppb). Federal drinking water standards have not been established for DCA and Freon TF.

ENVIRONMENTAL SCREENING OF INTEL UNDEVELOPED PROPERTY AND PROPOSED PURCHASE PROPERTY

Intel is currently in the process of purchasing an approximate 35-acre parcel of land located northwest of the Jones Farm campus, as shown on Figure 2. As part of the purchase process, GRI is conducting an environmental site screening of the proposed purchase property and Intel's undeveloped property north and west of the JF-1 campus. The site screening includes sampling and analysis of groundwater, surface drainage water, and near-surface soils. The locations of seven shallow groundwater monitoring wells, designated JFW-6 through JFW-12; three surface water samples from the northwest-flowing drainage; and six near-surface soil samples are shown on Figure 2. Graphical logs of the well borings and well construction details are shown on Figure 10 through 16.

Groundwater and surface water samples were analyzed for volatile organics, priority pollutant metals, herbicides, and pesticides. Groundwater samples were also analyzed for nitrates. Near-surface soil samples were analyzed for herbicides and pesticides. The results of the chemical analysis performed on groundwater, surface water, and near-surface soil samples are presented in the ATI report dated October 6, 1988, see Appendix D. The chemical analyses did not detect volatile organics in the groundwater samples obtained from the seven monitoring wells. These data indicate that volatile organics that may have originated from the former solvent tank have not migrated to these monitoring well locations.

CONCLUSIONS

Based on laboratory analysis of groundwater samples from the Jones Farm campus and Intel's adjoining undeveloped parcel and proposed purchase property, we conclude that the occurrence of volatile organics at the Jones Farm campus is limited to near-surface groundwater near the location of the solvent storage tank that was removed in 1985. With regard to potential horizontal transport rates, in the 4-year period since detection of solvents in the monitoring well adjacent to the tank, volatile organics have not migrated (at detectable levels) to monitoring wells located approximately 200 ft down-gradient from the tank area.

It is our opinion that over time and with increasing distance from the tank, dispersion, diffusion, adsorption, and biodegradation will continue to reduce the existing low levels of volatile organics in the groundwater. It should be noted that Intel's property line, in a direction down-gradient (northwest) from the tank area, is about 1,500 ft.

The Facility Plan, Figure 3, shows underground utility lines in the service yard area. The subsurface drain (French drain) shown on Figure 3 is approximately 1 to 2 ft above the anticipated higher groundwater levels. Movement of volatile organics along the 6-in.-drain would require groundwater levels at or above the drain level. The indicated sanitary sewer has a slight downward gradient to the east and is 2 to 3 ft below the anticipated high groundwater levels in the service yard area. However, due to the indicated groundwater flow direction, we consider it unlikely that volatile organics from the service yard would migrate up-gradient along the sanitary sewer trench. In summary, based on a review of underground utility lines in the service yard area, it appears unlikely, in our opinion, that more rapid horizontal migration could occur locally through the gravel backfill in the utility trenches. This conclusion is also supported by the absence of detectable volatile organics in the downgradient wells on the undeveloped property.

As discussed previously, it is estimated that the rate of downward vertical groundwater flow is in the range of 0.3 to 3 ft per year which is at least one or two orders of magnitude less than the estimated rate of horizontal groundwater flow. The vertical flow rate could be higher if the sand layers and lenses that are interlayered in the Willamette Silt Formation are connected. However, for more rapid vertical migration due to interconnected sand layers to be significant, widespread horizontal migration would also occur and be observed in the monitoring wells. Since this has not been observed during 4 years of monitoring, it is our opinion that vertical migration of volatile organics will be relatively slow and significant horizontal movements will occur before any appreciable vertical movement of contaminants occurs in the groundwater. This conclusion is supported by the stratigraphy and observation that volatile organics have not been detected in groundwater samples from well JFW-5-59, completed below the level of the solvent tank.

In summary, it is our overall conclusion that very low levels of volatile organics in the shallow groundwater are localized near the location of the solvent tank that was removed in 1985. The 4-year-old monitoring program by GRI has established that the volatile organics levels in JFW-5-22 are very low (currently below 10 ppb), and continue to gradually decrease. The six down-gradient wells do not contain volatile organics at detectable levels. Since the source of potential volatile organics has been removed and since the concentration levels are very low (i.e., less than 10 ppb), it is our opinion that further remedial measures are not necessary and that further soil and groundwater sampling are not warranted.

It is our interpretation that the Intel Jones Farm facility is a non-permitted facility as defined by the Federal Register (FR Vol. 51, No. 143) and operates as a generator site only under RCRA. It is also our interpretation that the appropriate rules governing this groundwater incident are the Oregon Groundwater Protection Rules and the proposed modifications of these rules. We have reviewed our conclusions with respect to Section (2)(f) "Non Permitted Activities" of the proposed Groundwater Protection Rules under Oregon Administrative Rule (OAR) 340-41-029. This section requires a preliminary assessment to determine whether remedial action is required to restore and/or maintain groundwater quality to achieve the concentration levels at the department-approved compliance points. In our opinion, the appropriate compliance points at the Jones Farm facility are the three down-gradient well pairs; JFW-1, JFW-2, and JFW-3. These compliance points are at background levels and therefore achieve the desired concentration limits, indicating that remedial action is not required.