OCT 2 5 1990

MEMORANDUM FOR: James H. Joyner, Chief
Facilities Radiological Safety and Safeguards Branch
Division of Radiation Safety and Safeguards, RI

FROM: John H. Austin, Chief
Regulatory Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

SUBJECT: REVIEW OF HYDROGEOLOGIC REPORTS SUBMITTED BY TEXAS INSTRUMENTS

Enclosed is an evaluation of hydrogeological information submitted by Texas Instruments, Inc. (TI) for their Attleboro, Massachusetts site. We received several hydrogeologic reports and studies from TI in response to a NRC request for additional groundwater information that was made during a special safety inspection on April 24, 1990.

Based on our evaluation of the information submitted by TI and information provided in a January 1985 Oak Ridge Associated Universities survey report of the site, we recommend that additional groundwater monitoring wells be installed at two locations to better characterize the extent of radiological contamination. TI should sample these wells on a monthly basis for three to six months after installation and note any trends in the data that may necessitate sampling beyond a six month period. In addition, it is recommended that specific monitoring well tests be performed to obtain information about the hydraulic properties of the material near the contaminated areas and that well construction information be provided by TI for those wells being sampled for radioactive contamination. We understand that TI is scheduled to file additional site information in November. Following review of this information, we may have additional concerns about the site.

The enclosed report by Mark Thaggard of the Technical Branch, Division of Low-Level Waste Management and Decommissioning, is provided for your information. Should you have questions concerning the report, please contact Mr. Thaggard at FTS 492-0568 or Tony Huffert of my staff at FTS 492-0529.

(Original Signed by T. Johnson for

John H. Austin, Chief
Regulatory Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

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TECHNICAL ASSISTANCE ON TEXAS INSTRUMENTS DECOMMISSIONING PROJECT

BACKGROUND

The Texas Instruments, Inc., Attleboro, Massachusetts site fabricated uranium foils, fuel components, and fuel cores for the U.S. Navy in the mid-fifties and early sixties. Work with nuclear materials ceased in 1983; accordingly, Texas Instruments would like to decommission the site. Indoor areas were released for unrestricted use by the NRC in 1983; however, two outdoor areas identified as contaminated were not released. One area is located around the loading dock of Building No. 10 and the other area is a former on-site burial area near Building No. 12.

PURPOSE

The purpose of this report is to provide technical assistance to the Low-Level Regulatory Branch (LLRB) in their review of Texas Instruments' request to decommission the site. LLRB requested assistance in the following areas:

1) A review of the groundwater monitoring program utilized by Texas Instruments for monitoring volatile organic compounds (VOCs) movement, to determine the adequacy of this program for characterizing groundwater radiological contamination in the two areas where radiological contamination were identified. In addition to reviewing the adequacy of the program for this purpose, LLRB wanted specific recommendations on changes that should be made to the monitoring program to characterize the radiological contamination.

2) An evaluation of the influence of Texas Instruments' groundwater extraction and treatment system on the existing groundwater radiological contamination.

Assistance in the above areas are based solely upon a review of several Texas Instruments' reports and the ORAU radiological assessment; no site visit has been made.

ADEQUACY OF THE EXISTING GROUNDWATER MONITORING PROGRAM

Disposal Area near Building No. 12

The disposal area near Building No. 12, termed the "NRC Disposal Area" by Texas Instruments, originally covered an area of roughly 2.7 acres; however, the area was disturbed during the construction of Building 12 and now may cover an area as large as

15 acres. The disposal area originally had a four-foot soil cap, which was probably also disturbed.

It is unclear exactly as to what was disposed of in this area. It is believed that some noncombustible uranium and thorium scrap metal and machinery may have been buried in this area; however, these items were not located by a ground penetrating radar survey performed in 1983. ORAU analyzed water samples for gross alpha and gross beta in 11 boreholes, penetrating the uppermost part of the overburden aquifer, around the area. In comparing the results against background concentrations, it is obvious that the groundwater in this area has some radiological contamination. The gross alpha concentration measured in borehole no. 17 was more than six times the EPA limit (15 pCi/l) for gross alpha. Gross alpha concentrations measured in the other boreholes were below the EPA limit, but significantly above background.

The uppermost aquifer in the area, referred to as the overburden aquifer by Texas Instruments, is composed of glaciofluvial material with some peat. The principal materials identified, in descending order, are: peat, fill, alluvial, and till. There may be several orders of magnitude difference in permeability between these materials; therefore, determining the likely pathway for contaminants within the aquifer is more difficult to determine. The peat, fill, and alluvial materials are not present throughout the site; however, they would be expected to have the largest permeabilities and thus allow the most rapid spreading of contaminants.

The concentration of radionuclides within the overburden aquifer will be largely influenced by the materials from where the samples are collected since the contaminant velocities are expected to be slightly different within each material. Therefore, it is important that in characterizing the extent of radiological contamination within this aquifer, samples be collected from different zones within the aquifer. Further, it is also important that adequate well construction information be obtained for any existing well sampled, in order to identify where the samples are being collected.

Because of a groundwater divide, within the area, groundwater, in the overburden aquifer, flows both to the northwest and the northeast.

Underlying the overburden aquifer is a bedrock aquifer composed primarily of sandstone. The bedrock aquifer is separated from the overlying overburden aquifer by glacial till at the base of the overburden aquifer. Hydraulic connection between the two aquifers appear to be good, based upon potentiometric maps. In the disposal area, water from the overburden aquifer recharges the bedrock aquifer; therefore, the bedrock aquifer will also need to be sampled for radiological contamination.

During the period between 1980 - 1983, six - seven wells were installed around the disposal area, at the request of the NRC, to monitor for radiological contamination of the groundwater. Several of these wells were paved over during the construction of building no. 12, which is one reason for the request to evaluate the adequacy of the VOCs monitoring program. No water quality data are available from these wells.

Of the original six or seven NRC wells, it appears that there are only four remaining. These four, which appear to be very shallow wells, are all located within the immediate area designated as the former disposal area; therefore, these wells alone will likely be inadequate for delineating the extent of radiological contamination.

Over the years, Texas Instruments has installed numerous wells throughout the facility (see figure 1) as part of their VOCs characterization effort. Although analyzing samples for radiological contamination from some of these wells will likely be useful, it is unlikely that radionuclides have reached most of these wells. Conservative travel time calculations show that it is unlikely that radionuclides will have traveled farther than 1000 feet down-gradient from the center of the disposal area. Of the existing wells, in addition to the NRC wells, the ones located closest to the disposal area appear most suited for taking initial samples. These would include the following wells: MW-4s; TI-4s; TI-15; and GEI-104. In addition, several existing up-gradient wells could be used for determining background concentrations. Wells OW-6 and 7, GEI- 107-109, TI-16, and TI-8 appear most suitable for this purpose. However, prior to using any of the existing wells, Texas Instruments needs to obtain well depth, casing depth, and screen length information to determine which zones are being tested.

Although several of the existing wells could be used to help initially identify the extent of radiological contamination, additional wells are needed, especially closer to the disposal area. These wells should be installed as well nests (i.e., with sampling points at different depths) because of the variability of the overburden material. Slug tests should be ran on several of these wells to obtain hydraulic properties of the materials close to the disposal area; this will facilitate determining the likely contaminant flow paths.

Contaminated Area near Building No. 10

The exact cause of the radiological contamination near building no. 10 is not known; however, it can be reasonably postulated that it is associated with some type of spill during loading and unloading of radioactive shipments. ORAU analyzed groundwater samples for gross alpha and gross beta from four boreholes around

building no. 10, and found gross alpha and gross beta concentrations above background. Although the concentrations were generally lower than those measured in boreholes in the disposal area, the fact that they were above background indicates that some radiological contamination of the aquifer has occurred in this area. Elevated gross alpha and gross beta concentrations were found in boreholes located on both the western and eastern sides of the building.

The groundwater system in the area of building no. 10 is very similar to the disposal area; however, peat is generally absent in the overburden aquifer. In addition, flow in the overburden aquifer is generally to the southwest and west. Based upon potentiometric maps, the hydraulic connection between the overburden and bedrock aquifers appear to be stronger in this area than in the disposal area. Therefore, samples from the bedrock aquifer should be analyzed for radionuclides.

In their effort to delineate the extent of radiological contamination within the area, Texas Instruments may want to initially analyze samples from existing wells. However, as with the disposal area, conservative travel time calculations show that it unlikely that radionuclides will have reached many of these wells. The existing wells that appear most suited for initial sampling are BW-5, MW-8s, GEI-102, MW-5s, and MW-6s because of their proximity to building no. 10. As with the disposal area, well construction information should be obtained to determine which zones are being tested. The existing up-gradient wells used for the disposal area should also be suitable for this area, since this area is hydrologically cross-gradient from the disposal area.

Additional monitor wells will be needed to characterize the extent of radiological contamination immediately around the building area. As before, these new wells should be installed as well nests. Further, slug tests or pump tests should be performed on several wells to determine hydraulic properties of the aquifer materials.

INFLUENCE OF THE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

Texas Instruments' groundwater extraction and treatment system consists of a ring of 25 well-points completed in the overburden, pumping at a combined rate of 100 gpm, and one bedrock aquifer well pumping at a rate of 15 gpm. Water contaminated with volatile organic compounds (VOCs) is pumped into an air-stripper and then discharged through a drainage system.

A groundwater divide has been identified on the site, which runs from the northwest to the southeast. This divide formerly coincided with a surface water divide that runs from the north to

the south of the property, and bisects building no. 10. Because of an underground drain the groundwater divide has shifted to its present location. In its present location, the divide appears to bisect the disposal area, as a result contaminants within the disposal area are either moving to the northwest or remaining stationary.

Modeling analyses performed by Texas Instruments, to assess the effectiveness of their collection system, shows that the well extraction system has had very minimal effects on the disposal area. The modeling results show that the collection system is causing the groundwater divide to shift farther to the south; this would have the effect of actually causing radiological contaminants within that area to remain fairly stationary.

Since it is reported that VOCs contamination exist in the disposal area, it is very likely that Texas Instruments will have to establish a collection system closer to or within the disposal area.

Effects on radiological contaminants within the area of building no. 10 should also be minimal; however, they are expected to be greater than those experienced at the disposal area, because of the closer proximity of contaminants in this area to the collection system. Based on potentiometric maps of the overburden aquifer, the collection system has not altered the historical west - southwest groundwater flow direction, within the area of building no. 10. The flow has historically, as it is now, moved toward the west -southwest. However, drawdown calculations show that pumpage within the overburden aquifer is causing a small amount of drawdown in the area of building no. 10; therefore, it must be concluded that the collection system is causing some migration of radiological contaminants.

SUMMARY

For the most part, the monitoring system currently being used by Texas Instruments in their VOCs clean-up program is inadequate for characterizing radiological contaminants near building nos. 10 and 12. While initial samples should be analyzed from several of the existing wells to help delineate the extent of radiological contamination, additional wells will have to be installed in order to better characterize the extent of radiological contamination closer to the two areas of concern.

Because of the complexity of the overburden materials, all new wells should be installed as well nests to sample multiple zones. Further, well construction information should be obtained for any existing well used to assist in the characterization.

Texas Instruments well extraction and treatment program appears

to be having only minimal effects on radiological contaminants in both areas. Greater effects from the system are likely to occur, in the future, when Texas Instruments initiates clean-up of VOCs on the eastern side of the property.

RECOMMENDATION

Texas Instruments should sample existing wells near the two areas of concern to initially determine the extent of radiological contamination. Well construction information, such as well depth, casing depth, and screen length should be obtained for any well used for this purpose.

Additional wells should be installed at both locations in order to better characterize the extent of radiological contamination. In addition pump test or slug tests should be performed on several wells to obtain hydraulic properties of the materials in the immediate areas of concern.

Several existing up-gradient wells could be used to determine background concentrations in the overburden and bedrock aquifers. Again, well construction information should be gathered on these wells.

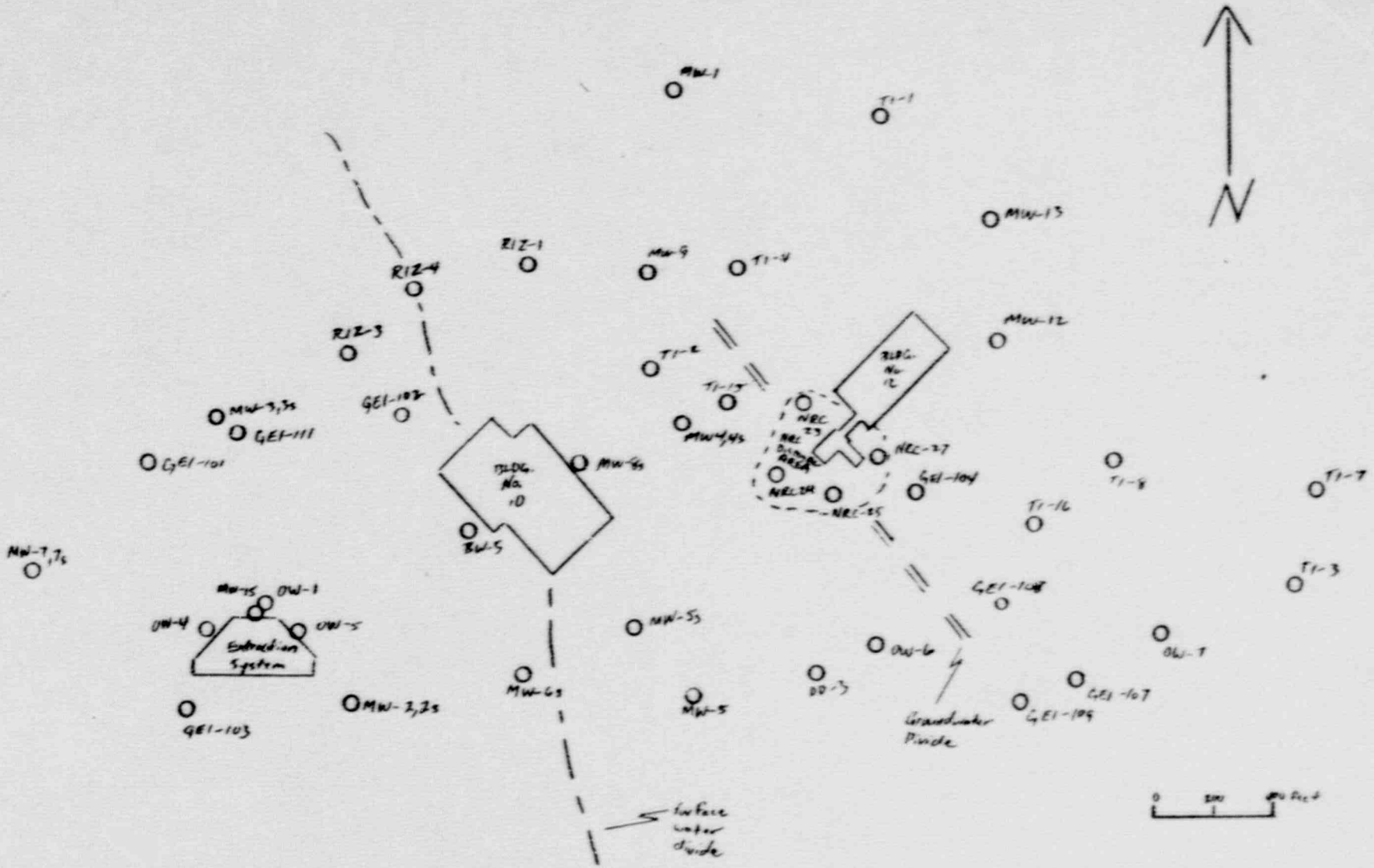

Figure 1. Location map of wells on the property.