# FUSRAP TECHNICAL MEMORANDUM

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From: James C. McCague, Project Engineering Manager - FUSRAP
Subject: Environmental Surveillance Results for 1995 for the Maywood Interim Storage Site

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## SUMMARY

This memorandum presents and interprets analytical results and measurements obtained as part of the 1995 environmental surveillance program for the Maywood Interim Storage Site (MISS) under the Formerly Utilized Sites Remedial Action Program (FUSRAP). The discussion provides a comparative analysis of average historical background conditions and applicable regulatory criteria to the 1995 results reported for external gamma radiation measurements and samples from the media investigated (air, streambed sediments, and groundwater).

Results of the 1995 surveillance program indicate that applicable U.S. Department of Energy (DOE) guidelines were not exceeded for any measured parameter or for any dose calculated for potentially exposed members of the general public, with the following exceptions:

- Radon-220 concentrations exceeded the DOE limit of 3.0 pCi/L at three locations in the immediate vicinity of the former location of the thorium processing building and at two downwind locations south-southwest of MISS on the Stepan Company property.

- In the absence of sediment guidelines, DOE soil guidelines serve as a standard of comparison for radiological data obtained for streambed sediment; samples from two locations in the eastern tributary in Lodi Brook exceeded the soil guidelines for radium-228 and thorium-232.

Conservative Federal and state standards for chemical contamination in soils and water were used as guidelines to evaluate surveillance results for streambed sediments and groundwater. Some sampled concentrations of metals in sediment and metals and volatile organic compounds (VOCs) in groundwater exceeded these standards:

- Sediment sampling also included analysis for metals along Westerly Brook and the upper catchment of Lodi Brook. Concentrations of metals in sediment were compared to proposed New Jersey soil cleanup standards for residential sites. Use of residential standards is highly conservative given the industrial nature of the area. Metals and radioactive constituents in sediment exhibited similar concentration patterns, with the highest concentrations of both

(and concentrations above criteria) being detected in the eastern branch of Lodi Brook. In Westerly Brook and in the western branch of Lodi Brook (with the exception of one anomalously high set of results for a field duplicate), radioactive constituents and metals were detected at or near levels reported for the baseline location in 1995 and previous years. Lead and cadmium were present at upstream (background) and downstream locations at concentrations in excess of the proposed state standards, with the highest concentrations occurring at the farthest downstream sampling point in the eastern branch of Lodi Brook.

- Although groundwater at MISS is not used to provide a public drinking water supply, state and Federal drinking water standards were used as a conservative basis of comparison for chemical constituents in groundwater. Metals that may have been associated with site operations and that exceed either the Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs) or New Jersey Groundwater Quality Standards for Class IIA aquifers for at least one groundwater sample include arsenic, cadmium, and chromium. Arsenic and chromium were detected both on and offsite; cadmium was detected in only one well (onsite).

- Volatile organic compounds (VOCs) (i.e., tetrachloroethene and its degradation products) are present in onsite (bedrock only) and offsite (shallow and bedrock) groundwater. This pattern of contamination may be a function of proximity to former offsite retention ponds or may suggest transport of VOCs in the bedrock upward into the shallow groundwater (DOE 1996). Supplementary studies to define the VOC plume at MISS are being developed. The concentrations reported in the downgradient offsite monitoring wells are substantially higher than onsite VOC concentrations.

  Elevated concentrations of benzene were detected in some deep wells onsite, but not in the shallow wells of the pairs, suggesting that the overlying soils are not the source of the contamination.

## 1.0 INTRODUCTION

MISS is located in Bergen County, New Jersey, approximately 20 km north-northeast of New York City and 21 km northeast of Newark, New Jersey.

From 1916 to 1959, Maywood Chemical Works (MCW) extracted radioactive thorium and rare earth metals from monazite sand to produce mantles for gas lanterns. The waste materials generated during this process contained thorium-232 and its associated decay products, with lesser amounts of radionuclides in the uranium-238 decay series. The slurry containing waste from these operations was pumped into two earthen-diked retention ponds west of the plant. Some process wastes, along with tea and coca leaves from other MCW operations, were removed from the property and used as mulch and fill on nearby properties. Additional waste migrated offsite through natural drainage associated with the former Lodi Brook. In 1959 the facility was sold to the Stepan Company. The Stepan Company has never processed radioactive material (BNI 1992).

In 1961, the Atomic Energy Commission issued a radioactive material license to Stepan Company for radioactive material storage and remediation of the facility. From 1966 to 1968, contaminated material was removed from the property west of New Jersey Route 17 and buried in three pits on the Stepan Company property. In 1983, the Environmental Protection Agency (EPA) added the Maywood site to the National Priorities List, and the following year cleanup of radioactive contamination at the Maywood site was assigned by Congress to DOE. To expedite remediation of the site and its vicinity properties, DOE purchased a 4.7-ha portion of the Stepan Company property for use as an interim storage facility for radioactively contaminated materials (BNI 1992). This property was referred to as MISS. From 1984 to 1986, approximately 27,000 $m^3$ of radioactively contaminated soil were excavated to remediate 25 vicinity properties, and these soils were used to create the waste storage pile at MISS. In 1994 and 1995, approximately 11,500 $m^3$ of the MISS pile were removed during partial remediation of the site (Figure 1). This material was sent for disposal at Envirocare of Utah, Inc.

### 1.1 Measured Parameters

The key elements of the 1995 environmental surveillance program at MISS were as follows:

- measurement of external gamma radiation;
- measurement of radon gas concentrations in air (combined contributions from radon-220 and radon-222; see note below);
- monitoring of radon-222 flux (rate of radon-222 emission from the storage piles);
- sampling and analysis of streambed sediment for total uranium, radium-226, thorium-230, and thorium-232 (hereafter referred to collectively as radioactive constituents) and for metals;
- sampling and analysis of groundwater for radioactive constituents, metals, VOCs, total petroleum hydrocarbons (TPH), and water quality parameters.

Surface water sampling at MISS was discontinued in 1994. Analytical results for the preceding 5 years indicated that concentrations of analyzed radionuclides in surface water were indistinguishable from background.

[Note: radon gas consists of two isotopes, radon-220 and radon-222. Radon-220, traditionally referred to as "thoron," is the immediate decay product of radium-224, originating from thorium-232. Radon-222 is the immediate decay product of radium-226, originating from uranium-238. In this document, radon-220 and radon-222 will be referred to as radon gas, unless isotopic specificity is required.]

## 1.2 Unit Conversions

The following tables provide the units of measurement and appropriate abbreviations used in this document. Conventional units for radioactivity are used in this document because the applicable regulatory guidelines are generally provided in these terms; Système Internationale (SI) units of measurement are used in the discussion of all other parameters. Unit conversions will be provided in the text only for water level information.

**Units of Measurement and Conversion Factors - Radioactivity**

| Parameter | Conventional Units | SI Units | Conversion Factor |
|---|---|---|---|
| Dose | millirem (mrem) | milliSievert (mSv) | 1 mrem = 0.01 mSv |
| Activity | picocurie (pCi) | becquerel (Bq) | 1 pCi = 0.037 Bq |

**Units of Measurement and Conversion Factors - Mass, Length, Area, and Volume**

| Parameter | SI Units | English Units | Conversion Factor |
|---|---|---|---|
| Mass | gram (g) | ounce (oz) | 1 g = 0.035 oz |
| | kilogram (kg) | pound (lb) | 1 kg = 2.2046 lb |
| Length | centimeter (cm) | inch (in) | 1 cm = 0.394 in |
| | meter (m) | foot (ft) | 1 m = 3.281 ft |
| | kilometer (km) | mile (mi) | 1 km = 0.621 mi |
| Area | hectare (ha) | acre | 1 ha = 2.47 acres |
| Volume | milliliter (mL) | fluid ounce (fl. oz.) | 1 mL = 0.0338 fl. oz. |
| | liter (L) | gallon (gal) | 1 L = 0.264 gal |
| | cubic meter ($m^3$) | cubic yard ($yd^3$) | 1 $m^3$ = 1.307 $yd^3$ |

## 2.0 REGULATORY GUIDELINES

The primary regulatory guidelines that apply to FUSRAP sites are found in DOE Orders, Federal statutes and regulations, and state regulations. DOE Orders (5400 series and 5820.2A) were applicable to all FUSRAP sites in 1995, while the applicability of other Federal and state regulations varied from site to site. The regulatory criteria that were used to evaluate the results of the 1995 environmental surveillance program at MISS are summarized below, categorized by applicable medium and parameter.

<u>External Gamma Radiation and Air (Radon Gas and Airborne Particulates)</u>
Applicable regulatory criteria for evaluating the calculated maximum doses from external gamma radiation and inhalation of radioactive particulates, and the measured concentrations of radon gas are as follows:

- DOE Order 5400.5

  Dose limits for members of the public are presented in this DOE Order. The primary dose limit is expressed as an effective dose equivalent. The limit of 100 mrem effective dose equivalent above background in a year from all sources is specified in this Order; external gamma radiation dose and the calculated doses from airborne particulate releases are included in the calculation of the effective dose equivalent total. DOE limits for radon concentrations in air are also presented in this Order. The limits for radon-220 and radon-222 concentrations in air are both 3.0 pCi/L above background concentrations. If both isotopes are present, the sum of the ratios of the concentration of each isotope to the allowable limit must be less than one.

- Clean Air Act

  Section 112 of the Clean Air Act authorized the EPA to promulgate the National Emission Standards for Hazardous Air Pollutants (NESHAPs), which is applicable at MISS under Subpart H (for nonradon, radioactive constituents) and Subpart Q (for radon emissions). Compliance with Subpart H is verified by applying the EPA-approved CAP88-PC model (EPA 1992a). Compliance with Subpart Q is verified by annual monitoring of the piles for radon-222 flux.

**Summary of Radiological Standards and Guidelines**
**- External Gamma Radiation and Air -**

| Radioactive Parameter | DOE Order 5400.5 [a] | Federal Standard or Guideline |
|---|---|---|
| Radon-222 flux | --- | 20 $pCi/m^2/s$ [b] |
| Radon-222 | 3.0 pCi/L [c] | 4 pCi/L [d] |
| Radon-220 | 3.0 pCi/L [c] | 8.0 pCi/L [e] |
| Radionuclide Emissions (airborne particulates and radioactive gases excluding radon-222 and radon-220) | 10 mrem/yr | 10 mrem/yr [b] |
| Effective Dose Equivalent (total contribution from all sources [f]) | 100 mrem/yr | --- |

[a] *Guidelines provided in the DOE Order are above background concentrations or exposure rates.*
[b] *Federal (EPA) Standard from 40 CFR, Part 61.*
[c] *If both isotopes of radon gas are present, then the sum of the ratios of the concentration of each isotope to the allowable limit must be less than one.*
[d] *EPA action level for radon concentration in homes (reference EPA 400-R-92-011).*
[e] *Federal (DOE) Guideline from 10 CFR Part 835 for occupational (worker) exposure.*
[f] *Contributing sources at MISS consist of external gamma radiation exposure, radionuclide emissions listed above, and ingested radionuclides in water and soil/sediment (listed in the following table).*
– *No existing standard.*

Sediment and Groundwater - Radioactive Parameters

Applicable regulatory criteria for evaluating the measured concentrations of radionuclides in sediment and groundwater at MISS are as follows:

- DOE Order 5400.5

  DOE Order 5400.5 states that the guideline concentration for residual concentrations of radium-226, radium-228, thorium-230, and thorium-232 in soil is 5 pCi/g above background, based on an average of the first 15 cm of soil below the surface. The MISS site-specific DOE soil cleanup criterion for total uranium is 100 pCi/g (DOE 1994). For mixtures of radionuclides, the Order prescribes that the data be evaluated by the sum-of-the-ratios. By this method, the above-background concentration of each of the radioisotopes (radium-226 or thorium-230, whichever is greater; thorium-232 or radium-228, whichever is greater; and total uranium) is divided by the respective criterion, and the ratios are summed. If the result is greater than 1, the mixture of radionuclides fails the sum-of-the-ratios test and is considered to exceed the soil guidelines.

  The environmental surveillance program does not include analysis of onsite soils; however, because there are no standards for sediment, the residual soil cleanup criteria are used to provide a basis for evaluation of analytical results of radium, thorium, and uranium in sediment. The soil guidelines are health-based values that are established based on future use scenarios, such as farming and grazing livestock.

  DOE derived concentration guides (DCGs) for water are also presented in this Order. The DCG for each radionuclide represents the concentration that would result in a dose of 100 mrem during a year, conservatively calculated for continuous exposure conditions. The drinking water equivalent values, determined as 4 percent of the DOE DCGs, are used to evaluate analytical data for groundwater at MISS, and are called out in the appropriate data tables within this report. Related state and Federal drinking water standards identified in this section were used to provide a secondary basis for comparison of analytical data. These values are used to evaluate analytical data for groundwater at MISS.

**Summary of Radiological Standards and Guidelines - Water and Sediment**

| Radioactive Parameter | DOE DCG[a] for Water[b] | DOE Soil Cleanup Criterion[c,d] |
|---|---|---|
| Thorium-230 | 300 pCi/L | N/A |
| Thorium-232 | 50 pCi/L | 5 pCi/g |
| Total uranium | 600 pCi/L | 100 pCi/g |
| Radium-226 | 100 pCi/L | 5 pCi/g |
| Radium-228 | N/A | 5 pCi/g |

a *DOE Derived Concentration Guide (DOE Order 5400.5)*

b *Surface water and groundwater (non-drinking water values); represent concentrations above background.*

c *Above background concentration in soil, averaged over the topmost 15 cm of soil.*

d *There are no standards for sediment; therefore, the DOE residual (radium and thorium) and site-specific (uranium) soil cleanup criteria are used to provide a basis for evaluation of analytical results for sediment. If a mixture of the radionuclides is present, then the sum of the ratios of the concentration of each isotope (radium-226 or thorium-230, whichever is greater; radium-228 or thorium-232, whichever is greater; and uranium) to the allowable limit must be less than one.*

N/A *not applicable; this constituent in this medium is not measured under the environmental surveillance program for MISS.*

**Sediment - Chemical Parameters**

Applicable regulatory criteria for evaluating the measured concentrations of chemical parameters in sediment at MISS are as follows:

- New Jersey Proposed Cleanup Standards for Contaminated Sites: Residential Soil Cleanup Standards (NJDEP, 1992)

  These standards are currently being used as guidance by the New Jersey Department of Environmental Protection (NJDEP). Because there are no standards for sediment, in addition to the DOE soil cleanup criteria for radioactive constituents, the New Jersey proposed cleanup standards for residential properties were used to provide a conservative basis for evaluation of metals concentrations detected in sediment. New Jersey has also proposed non-residential soil clean up standards, which are more directly applicable to the site given its industrial location; however, in the document the more conservative residential standards were used as the standard of comparison. In future environmental surveillance documents more realistic standards of comparison will also be included.

**Groundwater - Chemical Parameters**

Although the groundwater at MISS does not provide a public drinking water supply, state and Federal standards for drinking water are used in this document to provide a conservative basis for comparison of chemical analytical results.

- SDWA

  SDWA is the primary Federal regulation applicable to the operation of a public water system and the development of drinking water quality standards. These regulations, found in 40 Code of Federal Regulations (CFR) Part 141, set maximum permissible levels of organic, inorganic, and microbial contaminants in drinking water by specifying the maximum contaminant level (MCL) for each [*EPA Drinking Water Regulations and Health Advisories* (EPA 1994)].

- New Jersey Groundwater Quality Standards - Class IIA
  Groundwater in New Jersey is classified according to its hydrogeological characteristics and uses. As described in *New Jersey Drinking Water Regulations* (NJAC 7:10-1), the primary designated use for Class IIA groundwater is potable water supply, although Class IIA uses also include agricultural and industrial water. New Jersey also incorporates by reference all the Federal drinking water standards, unless a more stringent state standard for a hazardous contaminant has been promulgated.

## 3.0 SAMPLING LOCATIONS AND RATIONALE

Contamination at MISS is present in the interim storage pile, former retention ponds, the ground surface, and onsite structures. Exposure of members of the public to radioactivity at MISS is unlikely due to site access restrictions (e.g., fences) and engineering controls; however, potential pathways include direct exposure to external gamma radiation; inhalation of radon or radioactively contaminated particulates in air; and contact with, or ingestion of, contaminated streambed sediments or groundwater. The environmental surveillance program at MISS has been developed to evaluate these potential exposure routes through periodic sampling and analysis for radioactive and chemical constituents. Figures 1, 2, and 3 present sampling locations and media, and Table 1 summarizes the 1995 surveillance program.

Measurements of external gamma radiation are taken along fenceline locations surrounding MISS to assess potential exposure levels to the public and site workers (Figure 1).

Atmospheric surveillance of radon gas is conducted onsite in known areas of contamination or emission and at fenceline locations (Figure 1). Because concentrations decrease with distance, placement of these detectors is conservative and in many cases provides worst case results. Radon detectors are changed semiannually at all locations.

Radon-222 flux measurements are obtained at discrete grid intersections on the surface of the storage pile (Figure 2) to determine the rate at which radon is emitted from a specific area of the pile surface.

Sediment sampling includes the analysis for radioactive constituents and metals along both Westerly Brook and the upper catchment of Lodi Brook (Figure 3). Streambed sediment sampling locations along Westerly Brook are used to assess upstream and downstream conditions. Because Lodi Brook receives drainage from areas of known contamination, streambed sediment sampling is also conducted along this stream in its eastern and western tributaries.

Water level measurements and groundwater samples obtained from monitoring wells allow the assessment of groundwater flow patterns and are used to assess groundwater quality upgradient and downgradient of the site, in the source area, and at the MISS/Stepan Company boundary (Figure 1). Groundwater in both the upper unconsolidated sediments and the bedrock is monitored at MISS because there is no competent confining layer between these two groundwater units. There is a downward vertical hydraulic gradient onsite, and radioactive constituents and metals have been detected in a limited number of monitoring wells completed in the bedrock.

## 4.0 SURVEILLANCE METHODOLOGY

Under the MISS environmental surveillance program, standard analytical methods approved and published by EPA and the American Society for Testing and Materials (ASTM) are used for chemical (i.e., all nonradiogical) analyses. The laboratories conducting the radiological analyses adhere to EPA-approved methods and to procedures developed by the Environmental Measurements Laboratory (EML) and ASTM. The specific analytical methods and the sampling locations at MISS are summarized in Table 2.

All 1995 environmental surveillance activities at MISS were conducted in accordance with the FUSRAP *Environmental Monitoring Plan* (BNI 1995a) and the instruction guides (IGs) listed in the following table. The IGs are based on guidelines provided in *RCRA Ground Water Monitoring: Draft Technical Guidance* (EPA 1992b), *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846, EPA 1992c), and *A Compendium of Superfund Field Operations Methods* (EPA 1987).

**FUSRAP Instruction Guides Used for Environmental Surveillance Activities**

| Document Number | Document Title |
|---|---|
| 191-IG-007 | IG for Meteorological and Water Level Measurements |
| 191-IG-011 | IG for Decontamination of Field Sampling Equipment at FUSRAP Sites |
| 191-IG-028 | IG for Surface Water and Sediment Sampling Activities |
| 191-IG-029 | IG for Radon/Thoron and TETLD Exchange |
| 191-IG-033 | IG for Groundwater Sampling Activities |

## 5.0 ANALYTICAL DATA AND INTERPRETATION OF RESULTS

This section presents the data and interpretation of results for the environmental surveillance program at MISS. Data for 1995 are presented in Tables 3 through 13.

Note that in data tables containing analyses for radioactive constituents, some results may be expressed as negative numbers. This phenomenon occurs if the average background activity of the laboratory counting instrument exceeds the measured sample activity. In such cases, when this instrumental background activity is subtracted from the sample activity, a negative number results. For the purposes of interpretation, all values below the baseline minimum detectable activity (MDA) are interpreted as having an unknown value between zero and the MDA. Such a value will be referred to as a nondetect in the text discussion.

For direct comparison of analytical results to the DOE DCGs, average background radioactivity in sediment and groundwater is subtracted from the 1995 results. The reported results and the background corrected results are both provided in the data tables; however, for simplicity, discussion in the text presents the analytical result (background not subtracted) and calls out the above-background concentration only if the measured concentration is near the DCG. All figures displaying results present the analytical results.

Average historical background concentration for each sampled analyte is determined from background sampling results from 1992 to 1995 for sediment and from 1993 to 1995 for groundwater, unless otherwise noted. Subtracting the calculated average background from the sampling results for 1995 then gives an estimate of the above-background concentration of the measured constituent at each location. When background is subtracted from the sampling result, it is possible that a negative number will be obtained, much the same as a negative value may be obtained when the laboratory subtracts instrument background from a sample measurement. A negative number will be considered indistinguishable from background.

The most precise analytical method for analysis of total uranium yields results in µg/L and µg/g for water and sediment samples, respectively. To allow direct comparison of results to the DCGs and soil guidelines, the data must be converted to pCi/L and pCi/g, as appropriate. The specific activity for total uranium in its natural isotopic abundance (uranium that is neither depleted nor enriched) is 0.677 pCi/µg (BNI 1995b), which is used as the conversion factor to convert the data to pCi/L or pCi/g, as appropriate. Only the converted data are provided in the tables and text of this document.

### 5.1 External Gamma Radiation

External gamma radiation dose rates are measured using tissue-equivalent thermoluminescent dosimeters (TETLDs) in place at MISS continuously throughout the year. Each TETLD measures a cumulative dose, which, when divided by the period of exposure (one year), yields the external gamma radiation dose rate at that location. TETLD results for external gamma radiation dose rate in 1995 (both raw data and data corrected for shelter/absorption and background) are summarized in Table 3. TETLD surveillance locations are shown in Figure 1.

After the external gamma radiation data are corrected for shelter/absorption and background conditions, they are used to calculate the external gamma radiation dose rate to a hypothetical maximally exposed individual. The data from the side of the site displaying the highest radiation readings (i.e., location 22) are averaged, and the external gamma dose rate at the distance to individuals at the nearest commercial/industrial facility is then determined. This maximum dose rate was calculated assuming a maximally exposed individual working 40 hours per week at the industrial facility (Stepan Company) southeast of the site, with an average distance of approximately 10 m between the fenceline and the individual. Results of this calculation are expressed as a maximum dose rate to the individual (mrem/yr).

The 1995 external gamma radiation dose to a hypothetical maximally exposed individual 10 m southeast of the MISS fenceline is 32 mrem/yr, consistent with the 28 mrem/yr result obtained in 1994 (BNI 1995c). These values are well below the DOE guideline of 100 mrem/yr (from all sources).

## 5.2 Radon-220 and Radon-222

Results of the 1995 surveillance for radon gas (radon-220 and radon-222) are presented in Table 4; detector locations are shown in Figure 1. At each location, two types of detectors are exposed. One detector, the RadTrack®, contains no membrane, thereby allowing both isotopes of radon to enter. The other detector type, the RadTrack®-modified, contains a membrane that specifically excludes radon-220. Radon-222 results are reported as received from the laboratory (data from the RadTrack® detectors); radon-220 concentrations are calculated from the RadTrack® and RadTrack®-modified data. The 1995 radon-220 concentrations were determined using a revised calculation that considers detector calibration factors to more accurately calculate the concentration of radon-220 (BNI 1995d).

Radon-222 concentrations were always well below the DOE limit of 3.0 pCi/L, ranging from nondetect to 1.2 pCi/L. As in previous years, radon-220 concentrations exceeded the DOE limit of 3.0 pCi/L at location 5 (3.54 to 4.08 pCi/L) and location 22 (8.06 to 11.46 pCi/L). During one six-month period, the radon-220 result at location 23 (3.04 pCi/L) only slightly exceeded the guideline. The above-guideline results for radon-220 in this area were not unexpected because the detectors were located in the area where the former thorium processing building stood and where thorium contamination is known to exist.

In August 1995, locations 30 and 31 were installed to examine radon gas concentrations on the Stepan Company property downwind of location 22 (location where maximum radon-220 concentration was identified). Radon-220 results at these two new locations (7.43 and 5.69 pCi/L, respectively) were above the DOE limit, but were significantly lower than the concentrations detected at location 22, confirming that due to dispersion the concentration decreases with increased distance from the area of contamination.

At locations where concentrations of radon-220 did not exceed the isotopic limit, the mixture of the two isotopes was in compliance with the sum-of-the-ratios criterion for mixtures of radionuclides.

The radon-220 surveillance results reflect the predominance of thorium-232 contamination in the soil at the site. As with most low concentrations of gases in an open, unconfined area, the radon concentrations associated with this area dissipate quickly and do not significantly affect the offsite population.

## 5.3 Radon-222 Flux

Measurement of radon-222 flux provides an indication of the rate of radon-222 emission from a surface. It was measured using activated charcoal canisters placed at 15-m intervals across the surface of the storage pile for a 24-h exposure period. Radon-222 flux results for 1995 are presented in Table 5; measurement locations are shown in Figure 2.

Analytical results from measurements obtained at MISS in 1995 were all less than or equal to 0.07 pCi/m$^2$/s. These results are significantly less than the 20 pCi/m$^2$/s standard specified in 40 CFR Part 61, Subpart Q, and compare favorably with results from previous years (BNI 1995c).

## 5.4 Airborne Particulate Dose

To determine the 1995 dose from airborne particulates at MISS, multiple sources were considered, including wind erosion acting on the site, and removal of contaminated soil from the site for treatment tests or disposal. Airborne particulate release rates from wind erosion were calculated using historical data for site soil contamination and a limited reservoir surface wind erosion model (EPA 1985). The total dose for the year is calculated as the sum of these releases.

Airborne particulate release rates are then entered into the CAP88-PC computer model (EPA 1992b) to perform two calculations. The first calculation estimates the resultant hypothetical doses from airborne particulates to individuals at the distances to the nearest residence (50 m north-northeast of the site) and to the nearest commercial/industrial facility (10 m southeast of the site). Hypothetical doses are then corrected for the occupancy of the nearest residence (conservatively assumed to be 24 hours/day) and the nearest commercial/industrial facility (40 hours/week). The higher of these two hypothetical doses then becomes the hypothetical airborne particulate dose to the maximally exposed individual for the site. The second calculation estimates the hypothetical airborne particulate collective dose to the population within 80 km of the site. The second calculation also uses a population file (generated from county population densities) to determine numbers of people in circular grid sections fanning out to 80 km from the center of the site.

The first of the calculations indicates that the maximally exposed individual in 1995 was an individual with 100 percent occupancy time 50 m north of the site. The 1995 hypothetical airborne particulate dose to that individual, considering all site contributions throughout the year, was 0.13 mrem/yr. A worker 10 m southeast of the site would receive an even lower hypothetical dose (0.031 mrem/yr) due to much shorter residence time. This value is well below the 10 mrem/yr standard specified in 40 CFR, Part 61, Subpart H. The second calculation indicates that the hypothetical airborne particulate collective dose to the population within 80 km of the site was 0.891 person-rem/yr (equivalent to 891 person-mrem/yr).

### 5.5 Sediment

Surface water courses and drainage in the vicinity of MISS include Westerly Brook and Lodi Brook (Figure 3). Westerly Brook flows through a culvert where it enters the northwestern corner of MISS. The subsurface culvert redirects Westerly Brook to the west, the south, and then to the west again along the northern and western property boundaries. After leaving MISS, the culvert remains below grade for approximately 335 m before it terminates. At this point, Westerly Brook reemerges and continues its westward course. Ultimately, Westerly Brook discharges into the Saddle River. Surface water sampling at MISS was discontinued in 1994. Analytical results for the preceding 5 years indicated that concentrations of analyzed radionuclides in surface water were indistinguishable from background. Given the relatively low solubility of the contaminants, the most effective method of surveillance is sediment sampling.

Sampling points for 1995 surveillance of streambed sediment were downstream of the site at location 2 (SWSD002) along Westerly Brook; location 5 (SWSD005) in the eastern tributary of Lodi Brook, used to assess conditions in the western branch of Lodi Brook which drains portions of the MISS, Stepan Company, and Sears properties; and sampling locations 6 (SWSD006) and 7 (SWSD007) in the eastern tributary of Lodi Brook, which are used to evaluate conditions upstream and downstream of a service station north of Route 17. Background sampling was conducted in Westerly Brook upstream (north) of the site at location 3 (SWSD003). The tables refer to the sediment sampling locations by their formal identification numbers; text and figures refer to the locations by the last digit of the formal identifiers.

Sediment was sampled for metal constituents in May and radioactive constituents in May and November (at midyear radium-228 was added to the sediment surveillance program and was therefore analyzed in November samples only). Sediment results are presented in Tables 6 and 7 (radioactive constituents and metals, respectively). Figure 4 shows historical trends in sediment contamination for measured concentrations (background not subtracted) of thorium-232, the primary contaminant at MISS.

Radioactive Constituents

At sampling locations 6 and 7 , added to the environmental surveillance program in 1994, sample results exceeded the DOE soil criteria for radium-228 and thorium-232. For evaluation of any long term fluctuations of radioactive contamination in the sediment in the vicinity of MISS, a graphical presentation of the measured historical and current sediment data (background not subtracted) for thorium-232 is provided in Figure 4. The graph indicates that isolated areas of contamination are present in some areas downstream from MISS. At locations in Westerly Brook and the western tributary of Lodi Brook, 1995 results are generally low and are comparable to or lower than results from previous years. At locations in the eastern tributary of Lodi Brook, where sampling was first initiated in 1994, results are elevated in 1995 as in 1994 and show large fluctuations characteristic of localized contamination.

Specific details of the 1995 surveillance results are discussed below. Unless otherwise indicated, measured results (background not subtracted) are presented:

- At background sampling location 3 north of MISS, traces of radium-226 (0.29 to 0.55 pCi/g), radium-228 (0.9 pCi/g), and thorium-232 (0.32 to 0.56 pCi/g) were detected. All uranium results were nondetects.

- At downstream location 2 on Westerly Brook, traces of radium-226 (0.30 to 0.48 pCi/g), radium-228 (1.6 pCi/g), and thorium-232 (0.39 to 0.50 pCi/g) comparable to those found at background location 3 were detected. No uranium was detected. These results compare favorably with results obtained in previous years (BNI 1995c).

- At location 5 on the western branch of Lodi Brook, samples and quality control duplicates were collected during the 1995 and historical sampling events. Abnormally high results for all radioactive constituents in the November duplicate sample are not in agreement with the regular sample (collected simultaneously with the duplicate at the identical location) nor with historical samples taken at location 5 (BNI 1995c); therefore, it is doubtful that the duplicate sample results accurately reflect conditions at that location. Excluding these duplicate results, radium-226 (1.28 to 1.50 pCi/g), radium-228 (1.6 pCi/g), and thorium-232 (2.40 to 2.53 pCi/g) were detected at this location at concentrations above background but below the DOE residual soil cleanup criterion of 5 pCi/g; no uranium was detected. Detected concentrations were generally comparable in 1995 to data from previous years.

- As in 1994 (BNI 1995c), concentrations of radioactive constituents that exceeded the soil criteria were detected at location 6, in the upper portion of the eastern branch of Lodi Brook south of the Sears property near an area of known soil contamination. During the November sampling period, concentrations of radium-228 (9.60 pCi/g detected, which is equivalent to 9.54 pCi/g above background) and thorium-232 (11.47 pCi/g detected, which is equivalent to 10.95 pCi/g above background) exceeded the respective DOE isotope-specific soil cleanup guidelines (5 pCi/g above background for each isotope). Measured radium-226 results were below the soil guideline and ranged from 1.30 to 4.45 pCi/g. The measured total uranium concentration, ranging from 1.35 to 7.18 pCi/g, was well below the site-specific uranium criterion (100 pCi/g above background). Concentrations of all radionuclides in samples taken at this location in May were uniformly lower than those collected in November and all were below the DOE residual soil cleanup criteria.

- Concentrations of radioactive constituents were detected at location 7 at levels similar to those at location 6, with concentrations exceeding the DOE soil criteria occurring for radium-228 (11.70 pCi/g detected, which is equivalent to 11.64 pCi/g above background) and thorium-232 (ranging from 9.49 to 14.60 pCi/g detected, which is equivalent to a range of 8.97 to 14.08 pCi/L above background). Radium-226 was detected at a concentrations ranging from 3.32 to 5.54 pCi/g (2.89 to 4.97 pCi/g above background), less than the DOE soil criterion. Uranium ranged from nondetect to 7.18 pCi/g and was consistently below the site-specific DOE soil cleanup criterion during both 1995 sampling events.

The temporal fluctuation of contamination exhibited at locations 6 and 7 indicates some redistribution of localized contaminated sediments in 1995 which is likely the result of irregular patterns of precipitation during the year. For example, National Weather Service information for the area (Newark) shows that only 0.91 cm of rain fell in August of 1995, followed in September by 9.25 cm (NOAA 1995). Sediment contamination is more mobile when greater flow occurs, such as that which occurs after a sudden heavy downpour.

With the exception of the samples for which concentrations of individual isotopes exceeded the soil guidelines, no samples exceeded the DOE criterion for mixtures of radioisotopes (sum-of-the-ratios test).

**Metals**

The New Jersey Proposed Residential Soil Cleanup Standards provide a conservative basis for evaluation of metal concentrations in sediment from the mixed land use area around MSP. These standards are provided in Table 7 along with the detected concentrations of metals in sediment. New Jersey has also proposed non-residential standards that are less conservative and more representative of site surroundings. Non-residential standards, which are not included in Table 7, are mentioned in the text when an analytical result exceeds the residential standard but not its non-residential counterpart.

Above non-residential guideline concentrations for lead and cadmium occurred at most sampled locations, including the upstream background location, suggesting that there are offsite contributors of these metals. The highest concentrations of metal contaminants (i.e., lead, cadmium, and chromium) in streambed sediment occurred at location 7, the farthest downstream point sampled in the eastern tributary, and a location which is likely affected by multiple industrial or commercial locations in the area. The metals data is discussed below according to sampling location.

- A lead concentration of 311 mg/kg was reported at background location 3, a concentration which is above the proposed New Jersey residential soil cleanup standard of 100 mg/kg but below the non-residential standard of 600 mg/kg. Cadmium was present at that location at an estimated concentration of 1.5 mg/kg, slightly in excess of the 1.0 mg/kg proposed residential standard but well below the non-residential standard of 100 mg/kg. All other metals at location 3 were below the residential soil cleanup standards. The presence of lead and cadmium in upstream sediments is indicative of a preexisting condition not related to site activities. Lead and cadmium concentrations equal to or less than those found at the upstream location were found at all downstream locations.

- At location 2, the downstream location along Westerly Brook, metals concentrations were similar to or less than those reported for the background location, including a lead concentration of 140 mg/kg. These data indicate that there is no significant effect from MISS on the metals concentrations in sediments in Westerly Brook.

- At location 5, cadmium (1.8 mg/kg) and lead (191 mg/kg) are present in concentrations exceeding the proposed residential standards but generally equivalent to concentrations detected upstream from the site. All other detected metals were present at concentrations below existing proposed state residential soil cleanup standards. These data suggest minimal impact from MISS on metals concentrations in sediments in the western tributary of Lodi Brook.

- At locations 6 and 7 in the eastern tributary of Lodi Brook, cadmium (1.2 and 2.8 mg/kg) and lead (140 and 416 mg/kg) exceeded the New Jersey residential soil cleanup standards (but were below the non-residential standards), with the higher of the two concentrations occurring at location 7, the farther downstream of the two. No other metals concentrations exceeded existing proposed state standards in 1995.

## 5.6 Groundwater

The locations of groundwater monitoring wells at MISS are shown in Figure 1. Background information, descriptions of activities performed under the groundwater surveillance program, and surveillance results are discussed below.

### 5.6.1 Groundwater Flow System

Natural System

Groundwater in the Maywood area occurs in both the bedrock and the overlying unconsolidated sediments. Bedrock is composed of fractured sandstone and shale of the Passaic Formation. Unconsolidated sediments are composed of interbedded sands and clay of glacial origin. There is no confining layer present between the unconsolidated deposits and the bedrock unit; therefore, the units are hydraulically connected, and a downward vertical hydraulic gradient is present. Depth to the water table ranges from approximately 0.6 to 5.1 m (2 to 17 ft) below ground surface.

Water Level Measurements

Water level measurements are obtained quarterly from 35 monitoring wells (Figure 1). Water levels fluctuate in response to short- and long-term seasonal changes in precipitation and evapotranspiration. In the consolidated sediments, groundwater level elevations ranged from 12.15 m (B38W14S) to 16.34 m (MISS3A) above mean sea level (39.85 ft to 53.61 ft). Groundwater level elevations in the bedrock ranged between 12.52 m (B38W14D) and 19.35 m (B38W02D) above mean sea level (41.07 ft and 63.48 ft).

Four-year representative hydrographs are presented in Figures 5 and 6, and show the water level fluctuations in the shallow and deep wells of two representative monitoring well pairs. Generally, the wells with identifiers ending in "A" are shallow, completed in the unconsolidated sediments, and wells with identifiers ending in "D" are deep, completed in bedrock.

The figures show that water levels in the two formations fluctuate similarly, indicating that the two units are hydraulically connected. Seasonal fluctuation in water levels in the unconsolidated sediments ranged between 0.411 and 1.92 m (1.35 to 6.30 ft) in 1995. Water level fluctuations in the bedrock ranged between 0.061 to 1.60 m (0.20 and 5.26 ft). Vertical hydraulic gradients are downward toward the bedrock unit across the site but are upward at offsite monitoring well pairs B38W14S/B38W14D and B38W15S/B38W15D.

Groundwater Flow System

Potentiometric surface maps for the unconsolidated and bedrock groundwater systems, for August 3 and November 14, 1995, are presented in Figures 7 through 10. Lateral groundwater flow at the site is strongly controlled by the morphology of the bedrock surface. The bedrock slopes to the west across the site, flattens, and then rises to a subtle ridge along the Saddle River. Horizontal hydraulic gradients reflect this configuration and flatten offsite to the west. In the unconsolidated sediments, onsite horizontal hydraulic gradients range from 0.004 (August 3, Figure 7) to 0.03 (November 14, Figure 8). The average linear groundwater velocity of 0.02 m/day (0.05 ft/day) has been previously estimated for the unconsolidated sediments (DOE 1992). It is important to note that linear groundwater velocities do not necessarily represent the rate at which a contaminant migrates, because contaminant-dependent transport factors such as retardation (caused by phenomena such as binding to clay particles) can significantly slow the rate of transport.

In the bedrock, onsite horizontal hydraulic gradients range between 0.005 (August 3, Figure 9; November 14, Figure 10;) and 0.03 (November 14, Figure 10). The average linear groundwater velocity of the bedrock has previously been estimated to range from 0.1 to 0.7 m/day (0.3 to 2 ft/day) (DOE 1992). Offsite, to the west, horizontal hydraulic gradients decrease both in the unconsolidated sediments (0.004, Figure 8) and the bedrock (0.006, Figure 10). At monitoring well pairs B38W14S/B38W14D and B38W15S/B38W15D, there is an upward vertical gradient.

### 5.6.2 Groundwater Quality

#### Field Parameters

Table 8 presents a summary of field parameters measured during annual sampling at MISS. Field parameters include temperature, pH, oxidation/reduction potential (Eh), turbidity, specific conductance, and dissolved oxygen. Turbidity, an indicator of the amount of suspended particulate matter in the groundwater, is generally low in all monitored wells. If present in water, radioactive contaminants are typically in the form of suspended particulates rather than in solution due to low solubility.

#### Water Quality Parameters

Groundwater quality at MISS was evaluated in 1995 using samples from six monitoring wells analyzed for the following standard parameters: sodium, potassium, magnesium, calcium, calcium carbonate, calcium bicarbonate, potassium, chloride, nitrate-nitrite, sulfate, and total dissolved solids. The results of these water analyses for 1995 (Tables 9 and 10) and for previous years are graphically presented in a trilinear Piper diagram (Figures 11 and 12), which assists in the determination of inorganic hydrochemical type. Recently recharged water in many aquifers is typically dominated by a calcium/bicarbonate hydrochemical type. This condition plots in the upper left-hand field of the diagram. Natural softening of groundwater via ion exchange with the soil or rock matrix (sodium for calcium) to a sodium/bicarbonate hydrochemical type generally occurs with extended residence time and/or distance traveled in the aquifer (upper right-hand field of the diagram). Oldest waters are generally dominated by the sodium/chloride type and plot in the lower right-hand field of the diagram. These waters represent stagnant or connate groundwater types.

After a background water type has been established for a specific area, comparisons of hydrochemical type can be made. These comparisons can lead to a determination of the presence and possible sources of contaminants entering the local groundwater regime.

State and Federal water quality limits exist for chloride, nitrate-nitrite, sulfate, and total dissolved solids (TDS). These limits were exceeded in some wells for sulfate and TDS (Table 9):

- At MISS, groundwater in the unconsolidated sediments ranges from approximately 800 to 2,000 mg/L TDS, exceeding the SDWA MCL and state Class IIA groundwater standard of 500 mg/L. The groundwater in the unconsolidated deposits appears to be a mixture of calcium/bicarbonate and sodium/sulfate waters. The sodium and sulfate may indicate past infiltration of process water.

  Groundwater samples from the background well (B38W02D) are low in TDS (363 mg/L) and are composed primarily of calcium/carbonate waters.

  These results are generally consistent with the surveillance results from 1994, which ranged from 1,010 to 3,070 mg/L on site, with a background result of 304 mg/L (BNI 1995c).

- Downgradient onsite and offsite wells completed in bedrock have concentrations of sulfate and TDS significantly above background levels. The four downgradient wells are near or immediately downgradient of former retention ponds. Concentrations of sulfate and TDS in all four downgradient wells exceed Federal and state standards.

Manganese, iron, and aluminum are common components of the sandstones that constitute the bedrock aquifer, occurring usually as oxide coating on the surface of mineral grains. The occurrence of these metals in elevated concentrations in the bedrock wells and in the overburden wells is generally attributable to fine grained minerals (particulates). As such, these metals are characteristic of the groundwater formation (DOE 1996). There are no SDWA MCLs for the water quality indicator metals aluminum, iron, manganese, and sodium. Aluminum was detected in all wells at concentrations less than the state Class IIA groundwater standard. Iron, manganese, and sodium were detected in the 23 sampled wells (Table 10), and in the majority of these wells the concentrations of one or more of these metals exceeded the state Class IIA groundwater standard:

- Iron was detected in all 23 sampled wells, with concentrations ranging from 32 µg/L (well B38W14D) to 46,500 µg/L (B38W24S). In background well B38W02D, the iron concentration was 72 µg/L. Concentrations at 20 of these wells exceeded the New Jersey Groundwater Quality standard of 300 µg/L.

- Similarly, manganese exceeded the Class IIA standard (50 µg/L) in all but three of the sampled wells, with results ranging from 5.3 µg/L (B38W14D) to 5,420 µg/L (B38W24S). An above-standard concentration was detected in the background well (1,240 µg/L).

- The Class IIA limit for sodium is 50,000 µg/L. In 9 of the wells sodium concentrations exceeded this limit. Results ranged from 6,050 µg/L (background well) to 986,000 µg/L (MISS02A).

### 5.6.3 Groundwater - Radioactive Constituents

Groundwater samples collected from monitoring wells onsite and offsite (Figure 1) in May 1995 were analyzed for radium-226, thorium-230, thorium-232, and total uranium. Analysis of groundwater for thorium-230 was added to the MISS environmental surveillance program in 1995. Concentrations of radionuclides in all samples were low and were always significantly less than the DOE DCGs. Results are provided in Table 11 and discussed below.

- Background well B38W02D is upgradient of all areas of known soil contamination at the MISS and Stepan Company properties, and is situated northeast of the site on the northern side of the New York, Susquehanna, and Western Railroad line that borders the site on the north and east. The well is completed in the shallow bedrock, near the ground surface, and is considered to represent natural formation water conditions. In this well, neither thorium-230 nor thorium-232 was detected, and trace concentrations of radium-226 (0.23 pCi/L) and total uranium (0.37 pCi/L) were detected. Average historic background concentrations are 0.30 pCi/L for radium-226, 0.06 pCi/L for thorium-232, and 0.26 pCi/L for total uranium.

- Radium-226 results ranged from nondetect to 0.28 pCi/L (B38W15S, B38W17B). These concentrations were indistinguishable from background, and therefore were substantially below the DOE DCG of 100 pCi/L above background. Results in 1994, ranging from nondetect to 1.79 pCi/L in B38W17B (BNI 1995c), were slightly higher than 1995 results but were nevertheless well below the DOE DCG.

- Thorium-230 was detected in only one well, at a trace concentration (B38W14S, 0.31 pCi/L) substantially below the DOE DCG of 300 pCi/L above background.

- A trace of thorium-232 (0.23 pCi/L) was reported in the downgradient onsite well MISS05A only. This thorium-232 concentration is substantially below the DOE DCG of 50 pCi/L above background. Thorium-232 was not detected in any other wells. Results were comparably low in 1994 (BNI 1995c).

- All total uranium concentrations in groundwater were well below (less than 5 percent of) the DOE DCG of 600 pCi/L above background. Groundwater total uranium concentrations were greater than average historical background in monitoring wells near areas of known soil contamination, and trace concentrations were reported in some wells located away from the areas of contaminated soils. The maximum concentrations of total uranium in groundwater at MISS were detected at downgradient onsite monitoring wells MISS05A (27.89 pCi/L) and MISS07B (4.87 pCi/L), near former retention ponds or areas of contaminated soils. Monitoring well B38W18D (bedrock well), located near building 76 in an area of contaminated soils, contained 3.66 pCi/L of total uranium. Figure 13 shows the measured historical and current data (background not subtracted) for these wells; these results suggest that there is no appreciable increase or trend in concentrations of total uranium in groundwater.

  Downgradient monitoring well pair MISS02A and MISS02B have only trace concentrations of total uranium (0.62 and 0.20 pCi/L, respectively). In the northwestern corner of the site, total uranium concentrations were slightly above background in monitoring well MISS01B (0.88 pCi/L) downgradient of the northernmost former retention pond. Downgradient offsite concentrations for total uranium were reported at trace concentrations or were not detected. These data imply that in areas of soil contamination, groundwater has been affected by uranium in solution; however, the uranium is immobile in the subsurface sediments and is not present above background concentrations away from the areas of contaminated soils.

### 5.6.4 Groundwater - Metals

Although groundwater at MISS is not used to provide a public drinking water supply, the SDWA MCLs were used to provide a basis for comparison for chemical (anions, metals, and VOCs) analytical data at MISS (EPA 1994). Water quality indicator metals are discussed in Section 5.6.2.

Metals that may have been associated with site operations and that exceed either the SDWA MCLs or New Jersey Groundwater Quality Standards for Class IIA aquifers in at least one sample include arsenic, cadmium, chromium, and lead (Table 10). Lithium, a metal for which no state or Federal regulatory limits exist for groundwater, has historically been elevated in most wells on and offsite and was not sampled in 1995. It will be sampled again under the 1996 environmental surveillance program.

- Detected concentrations of arsenic have generally decreased by about 10 percent from the 1994 surveillance values (BNI 1995c), which were among the highest annual values reported for the site. Historical and current arsenic concentrations for groundwater are shown in Figure 14. Arsenic concentrations exceeded the SDWA MCL (50 µg/L) in onsite wells MISS07B and MISS02A (53.4 and 6,000 µg/L).

The New Jersey Groundwater Quality standard for arsenic is more conservative than the SDWA MCL, and, in fact, the state standard is less than the published practical quantitation limit (PQL) for the analysis (NJAC 7:10-1), which is the detection limit that can reasonably be expected to be achieved by standard analytical techniques. Therefore, typical analytical methods cannot achieve detection limits adequate to quantify arsenic at the concentration of the state standard.

Detected arsenic concentrations at MISS exceeded the more conservative New Jersey Groundwater Quality standard (0.02 μg/L) and the PQL (8 μg/L) but were less than the SDWA MCL (50 μg/L) in onsite wells B38W19D, MISS01AA, and MISS05B (48.8, 18.7, and 10.9 μg/L, respectively). The wells B38W19D, MISS07B, and MISS05B are downgradient along the western property line near one of the former retention ponds. Well MISS02A is west of Building 76, near the northern property boundary. All of these locations are directly downgradient from railroad tracks, and given that wood was frequently preserved with arsenic, deteriorated railroad ties may also be a source of the metal.

- Cadmium concentrations in 1995 were highest in onsite well MISS01B, and exceeded the New Jersey Groundwater Quality standard (2.0 μg/L) but were less than the SDWA MCL (5 μg/L). The method detection limit for cadmium in groundwater was 3.5 μg/L, and thus other wells may contain cadmium concentrations exceeding the New Jersey Groundwater Quality standard; however, these concentrations would be low (less than 3.5 μg/L) and would be less than the MCL.

- Chromium concentrations in all sampled wells were less than the SDWA MCL of 100 μg/L, although eight wells exceeded the more conservative New Jersey Groundwater Quality standard of 10 μg/L. Concentrations in wells MISS02A and B38W18D (94.5 and 29.9 μg/L, respectively) exceed the New Jersey standard and are associated with known contaminated soils near Building 76. Chromium was not detected in the onsite well MISS01AA, although the highest chromium concentration was detected there in 1994 (BNI 1995c).
Well B38W17A (56.6 μg/L) is completed in the shallow groundwater system near two of the former retention ponds. The deep well of the pair does not contain elevated chromium concentrations, indicating that chromium is present only in the unconsolidated sediments. Historic and current chromium concentrations for groundwater from wells in which chromium has ever equaled or exceeded the state water quality standard are shown in Figure 15.

- Lead was added to the environmental surveillance program for groundwater in 1995. Lead concentrations ranged from nondetect to 3.6 μg/L, significantly less than the state regulatory criterion of 50 μg/L.

### 5.6.5 Groundwater - Organic Compounds

Samples taken from all wells during May were analyzed for total petroleum hydrocarbons. Results of these analyses were all nondetect (less than 1.2 mg/L) except the sample from MISS02A, which showed a trace estimated result of 1.3 mg/L (data not shown).

VOCs were detected at concentrations exceeding the New Jersey Groundwater Quality Class IIA standards and the SDWA MCLs in onsite downgradient wells MISS01B, MISS05B, and MISS07B (all completed in the bedrock) and in offsite downgradient well pairs B38W14S, B38W14D, and B38W15S, B38W15D. Results in 1995 are comparable to results in 1994 (BNI 1995c). In general, measured results have been somewhat higher since the introduction of the low flow sampling technique in 1994. Because the method causes less turbulence during sampling than other techniques, less volatilization of the VOCs occurs during sampling, and consequently measured results are more representative of actual groundwater conditions.

- At onsite monitoring wells MISS01B and MISS07B, tetrachloroethene (20 to 45 µg/L) and its degradation products, trichloroethene (2 to 3 µg/L) and 1,2-dichloroethene (3 to 8 µg/L), were detected. These VOCs were not detected in groundwater from their respective shallow wells MISS01AA and MISS07A.

- Offsite, in deep wells B38W14D and B38W15D and the shallow well B38W14S, tetrachloroethene and its decomposition products were reported at concentrations significantly above both New Jersey Groundwater Quality standards and the SDWA MCLs. Low concentrations of tetrachloroethene degradation products only (1,2-dichloroethene and vinyl chloride) were reported in the sample from the shallow well B38W15S. As indicated previously, there is an upward vertical gradient present at these two monitoring well pair locations, which may account for the presence of the VOCs in the shallow groundwater. Also, the nearby offsite former retention ponds may also have contributed (DOE 1996). The concentrations of tetrachloroethene and its degradation products reported for the downgradient offsite monitoring wells are substantially higher than for the onsite wells.

- Benzene was detected in monitoring well MISS05B at 89 µg/L, in excess of the SDWA MCL of 5 µg/L. As in monitoring well MISS01B, this compound was not reported in samples from the shallow well of this pair, suggesting that the source is not in the overlying sediments or contaminated soils. Benzene concentrations in this well have consistently been above the MCLs (Figure 16).

## 6.0 CONCLUSIONS

### A. External Gamma Radiation

The 1995 dose from direct gamma exposure at MISS to a hypothetical maximally exposed individual 10 m southeast of the fenceline is 32 mrem/yr. This value is well below the DOE guideline of 100 mrem/yr (from all sources).

### B. Radon-220 and Radon-222

Radon-222 concentrations were always well below the DOE limit of 3.0 pCi/L, ranging from nondetect to 1.2 pCi/L. Radon-220 concentrations exceeded the DOE limit of 3.0 pCi/L at three locations (ranging from 3.04 to 11.46 pCi/L) next to the former location of the thorium processing building. At two new locations installed in August on Stepan Company property, downwind of the location exhibiting the highest concentrations of radon-220, above-guideline concentrations of radon-220 were also detected, but at much lower concentrations (5.69 and 7.43 pCi/L). At locations where concentrations of radon-220 did not exceed the limit, the mixture of the two isotopes was in compliance with the sum-of-the-ratios criterion for mixtures of radionuclides.

The radon-220 surveillance results reflect the predominance of thorium-232 contamination in the soil at the site. As with most low concentrations of gases in an open, unconfined area, the radon concentrations associated with this area dissipate quickly and do not affect the offsite population.

### C. Radon-222 Flux

Radon-222 flux results obtained at MISS in 1995 were all equal to or less than 0.07 pCi/m$^2$/s. These results are well below the 20 pCi/m$^2$/s flux standard specified in 40 CFR part 61, Subpart Q of the National Emission Standards for Hazardous Air Pollutants (NESHAPs).

### D. Airborne Particulate Dose

The hypothetical airborne particulate dose to a resident 50 m north of the site is 0.13 mrem/yr. The hypothetical airborne particulate collective dose to the population within 80 km of the site has been calculated to be 0.891 person-rem/yr. The hypothetical dose to an individual is below the 10 mrem/yr standard specified in 40 CFR, Part 61, Subpart H of NESHAPs.

### E. Cumulative Dose from External Gamma Radiation and Airborne Particulates

The calculated cumulative dose from external gamma radiation and airborne particulates to an individual is 32 mrem/yr. This value is below the DOE 100 mrem/yr standard (from all sources).

**F. Sediment**

Radionuclide concentrations in samples collected in Westerly Brook were all well below the DOE soil criteria. Samples collected at both locations in the eastern tributary of Lodi Brook exceeded the DOE soil criteria for radium-228 and thorium-232. The concentrations of radium-226 at these location were below guidelines.

Concentrations of lead and cadmium were present in the upstream (background) sample at concentrations in excess of the New Jersey proposed soil cleanup criteria. These metals were also present in Westerly Brook (location 5) at comparable concentrations, suggesting that the metals detected in Westerly Brook may be attributed to offsite (upstream) sources. The highest concentrations of metal contaminants (i.e.: lead, cadmium, and chromium) occurred at location 7, the farthest downstream point sampled in the eastern tributary of Lodi Brook. All measured concentrations of these metals were less than the proposed non-residential standards.

Fluctuations over time of concentrations of some radioactive constituents and metals at locations in the eastern tributary indicate a redistribution of sediments which is likely the result of irregular patterns of precipitation during the year.

**G. Groundwater**

Concentrations of all radionuclides sampled in groundwater (radium-226, thorium-230, thorium-232, and total uranium) were well below DOE DCGs. The presence of arsenic at concentrations above SDWA drinking water standards was identified in two onsite wells; the more conservative New Jersey Groundwater Quality standards were exceeded in three additional onsite wells. It is noteworthy that all five wells are immediately downgradient from railroad spur or tracks, and that railroad ties frequently contain arsenic as a wood preservative. Chromium concentrations in all wells were less than the Federal SDWA standards, but exceeded the New Jersey Groundwater Quality standards in eight wells (29.9 to 94.5 µg/L). Cadmium concentrations exceeded the New Jersey standards in at least one well.

Tetrachloroethene and its degradation products are present in monitoring wells onsite and offsite in concentrations exceeding New Jersey Groundwater Quality standards for Class IIA aquifers and SDWA MCLs. Offsite concentrations are significantly higher than onsite (for example, offsite tetrachloroethene contamination ranged from 640 to 1500 µg/L as compared to onsite contamination ranging from 20 to 45 µg/L). Onsite, in deep wells only, tetrachloroethene and its degradation products were found at some locations, and at others low concentrations of benzene were detected. For all onsite well pairs, however, the same constituents were not found in the shallow wells.

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**Environmental Surveillance Results for 1995**
**Maywood Interim Storage Site**

## List of Figures

**Environmental Surveillance Results for 1995**
**Maywood Interim Storage Site**

**List of Figures (continued)**

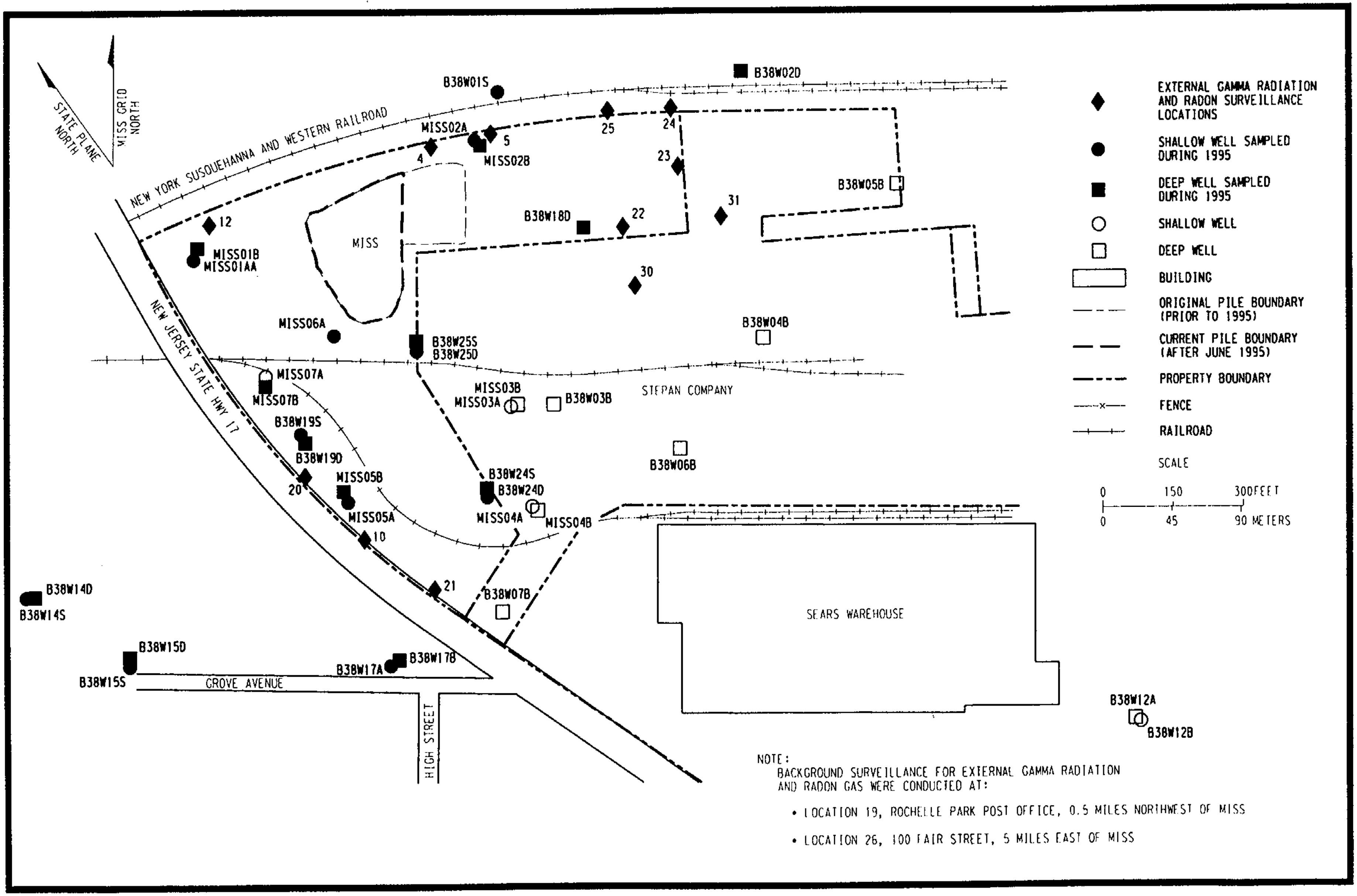


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**Figure 1**
**Maywood Interim Storage Site Environmental Surveillance Locations External Gamma Radiation, Air (Radon), and Groundwater**

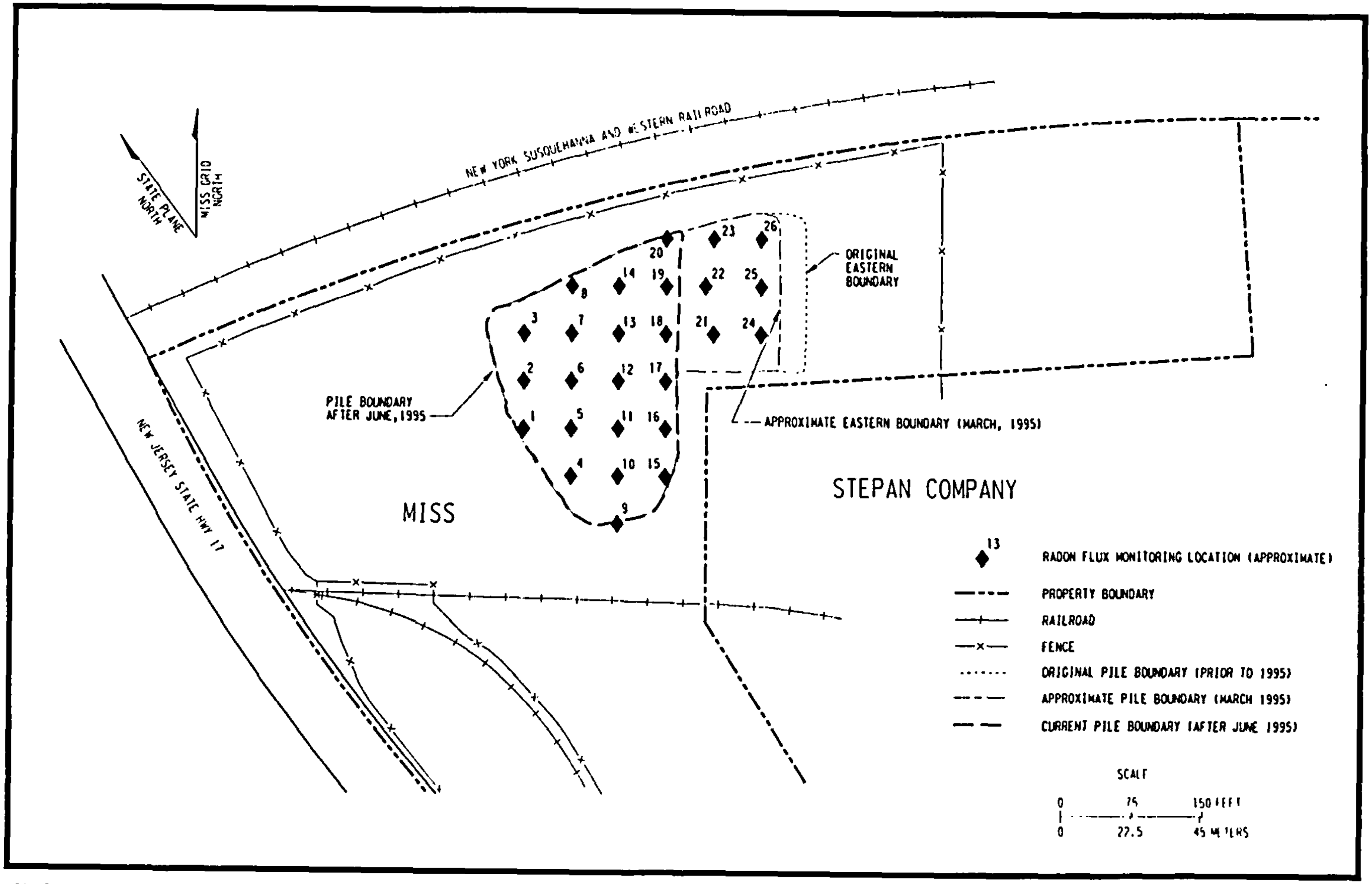


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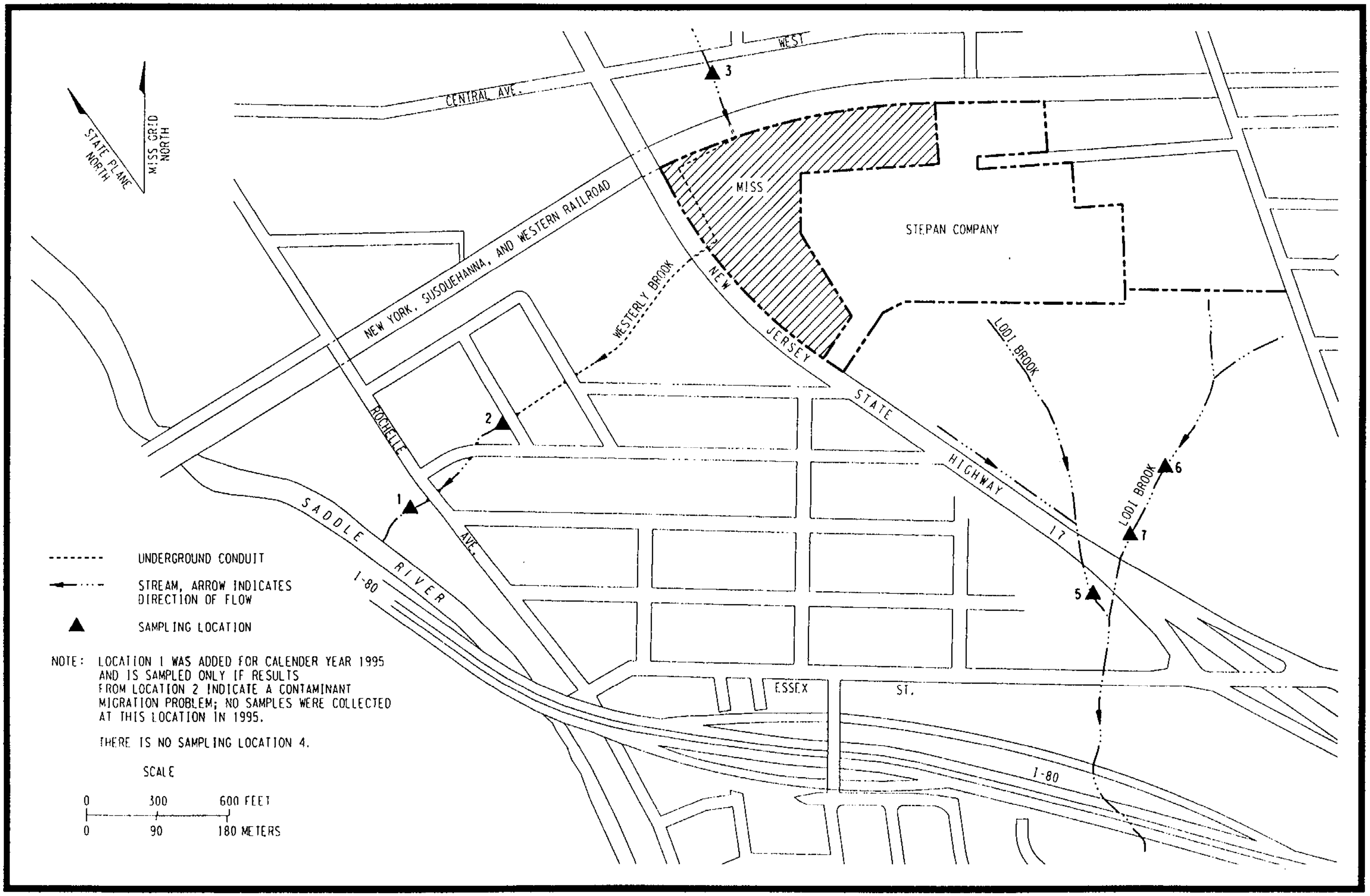
Figure 2
Maywood Interim Storage Site Environmental Surveillance
Approximate Radon -222 Flux Monitoring Locations




138 R84F010.DGN

**Figure 3**
**Maywood Interim Storage Site Environmental Surveillance Locations**
**Sediment**

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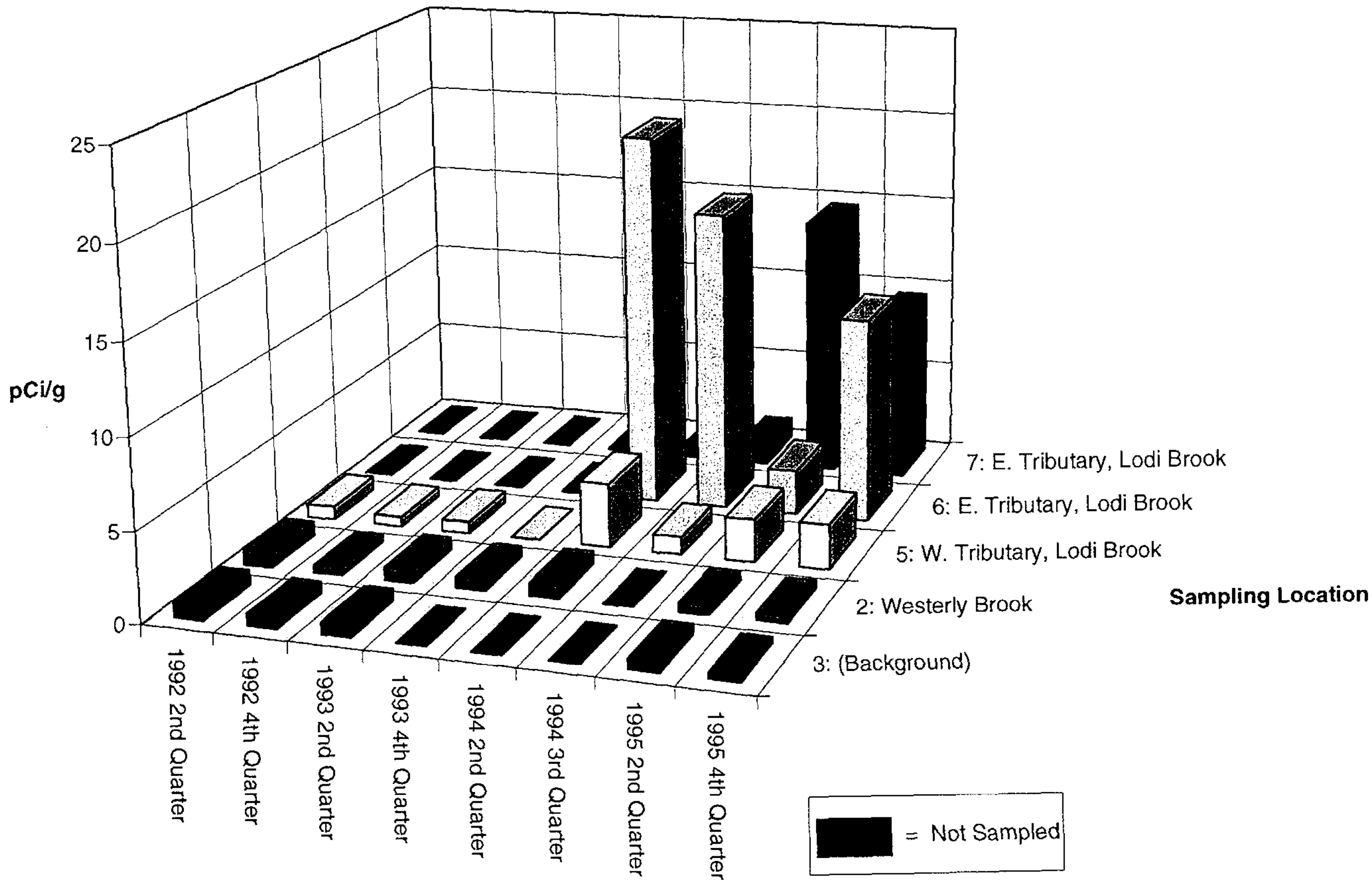
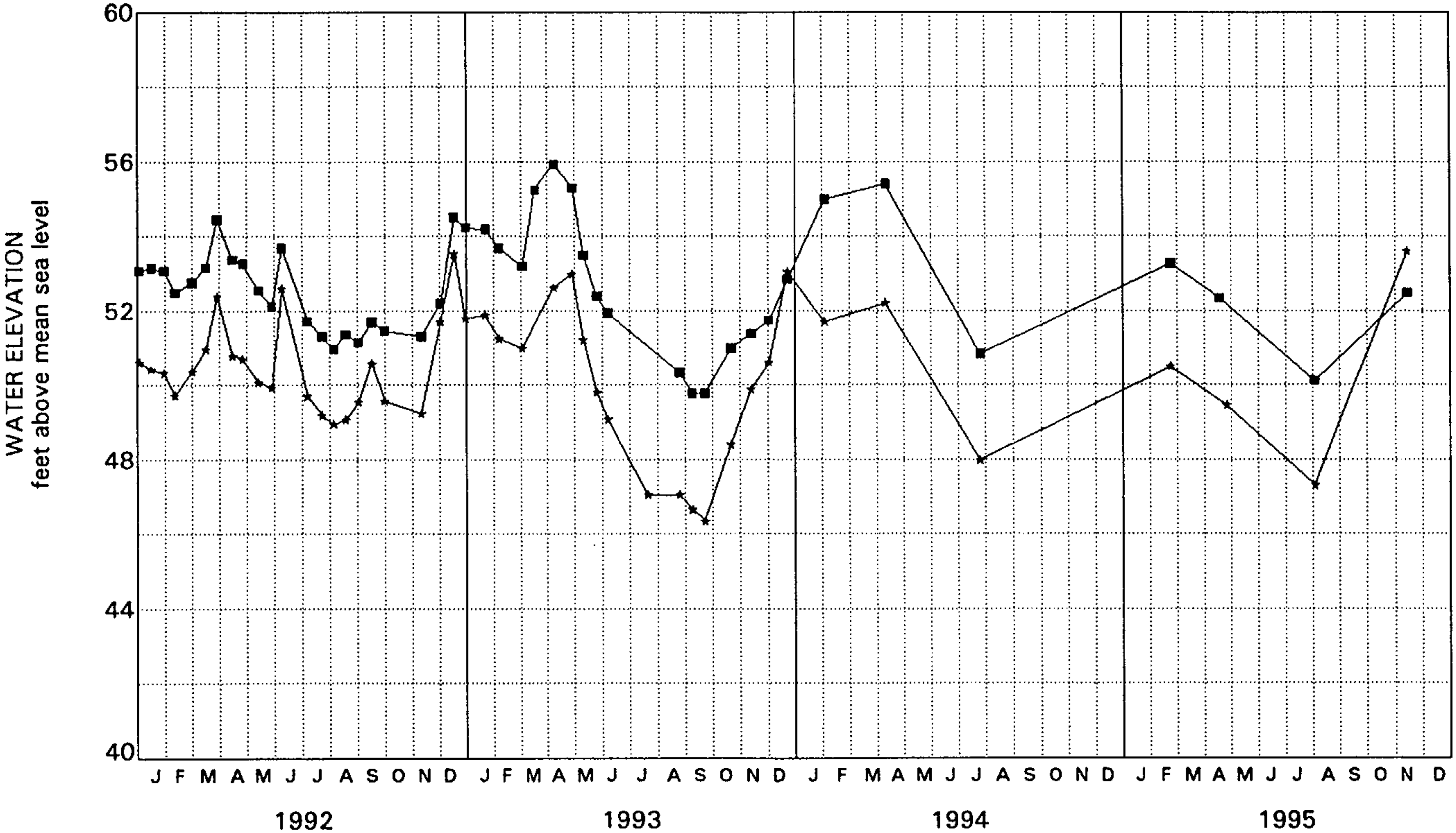



**Figure 4. Historical and Current Results for Thorium-232 in Streambed Sediments Maywood Interim Storage Site**

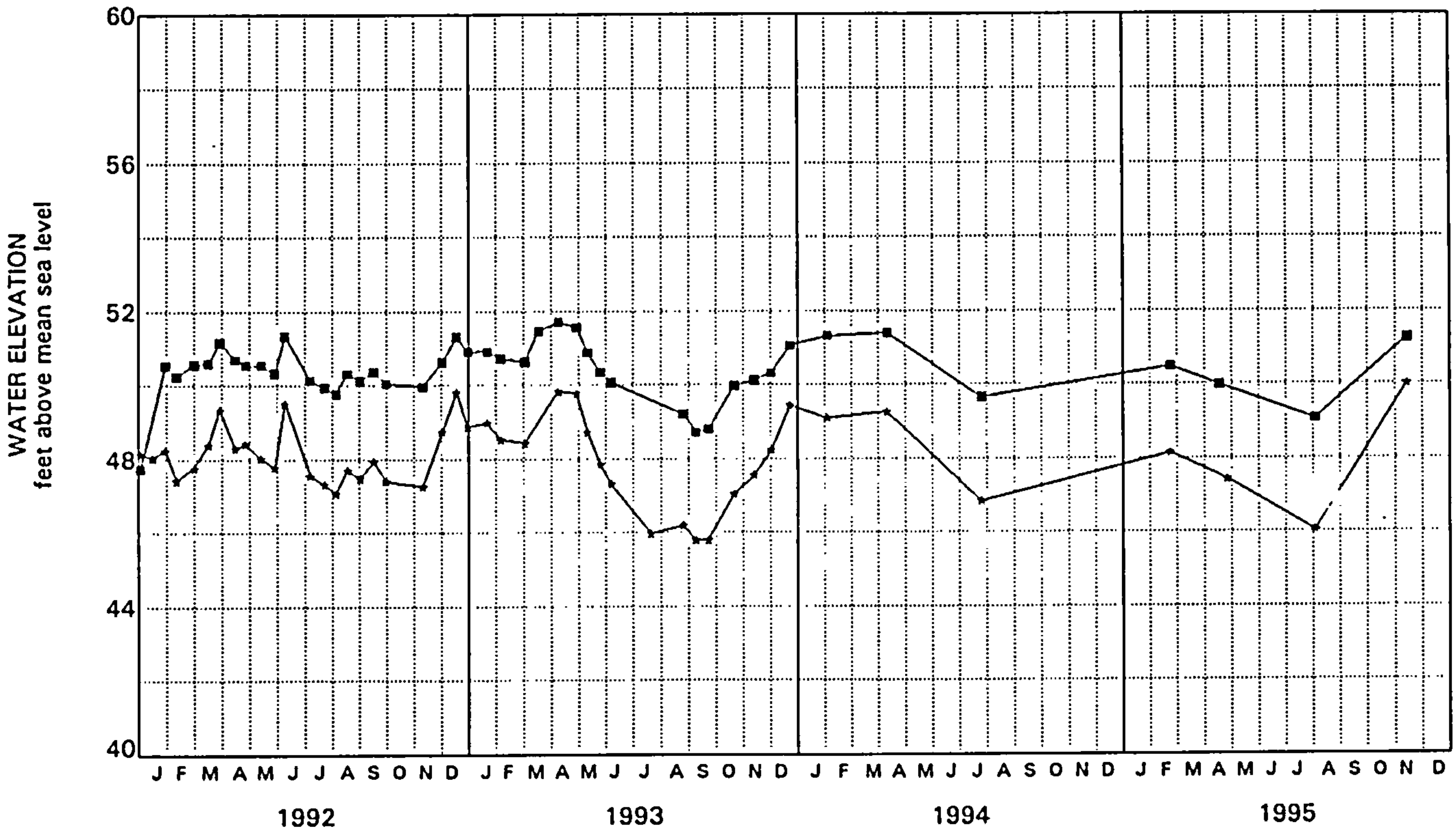



LEGEND:

| | Well ID | Ground Elev (ft amsl) |
|---|---|---|
| ■ | MISS-2A | 60.40 |
| ★ | MISS-3A | 56.40 |

**Figure 5**
**Four-Year Hydrograph for Maywood Interim Storage Site - Unconsolidated Sediments**

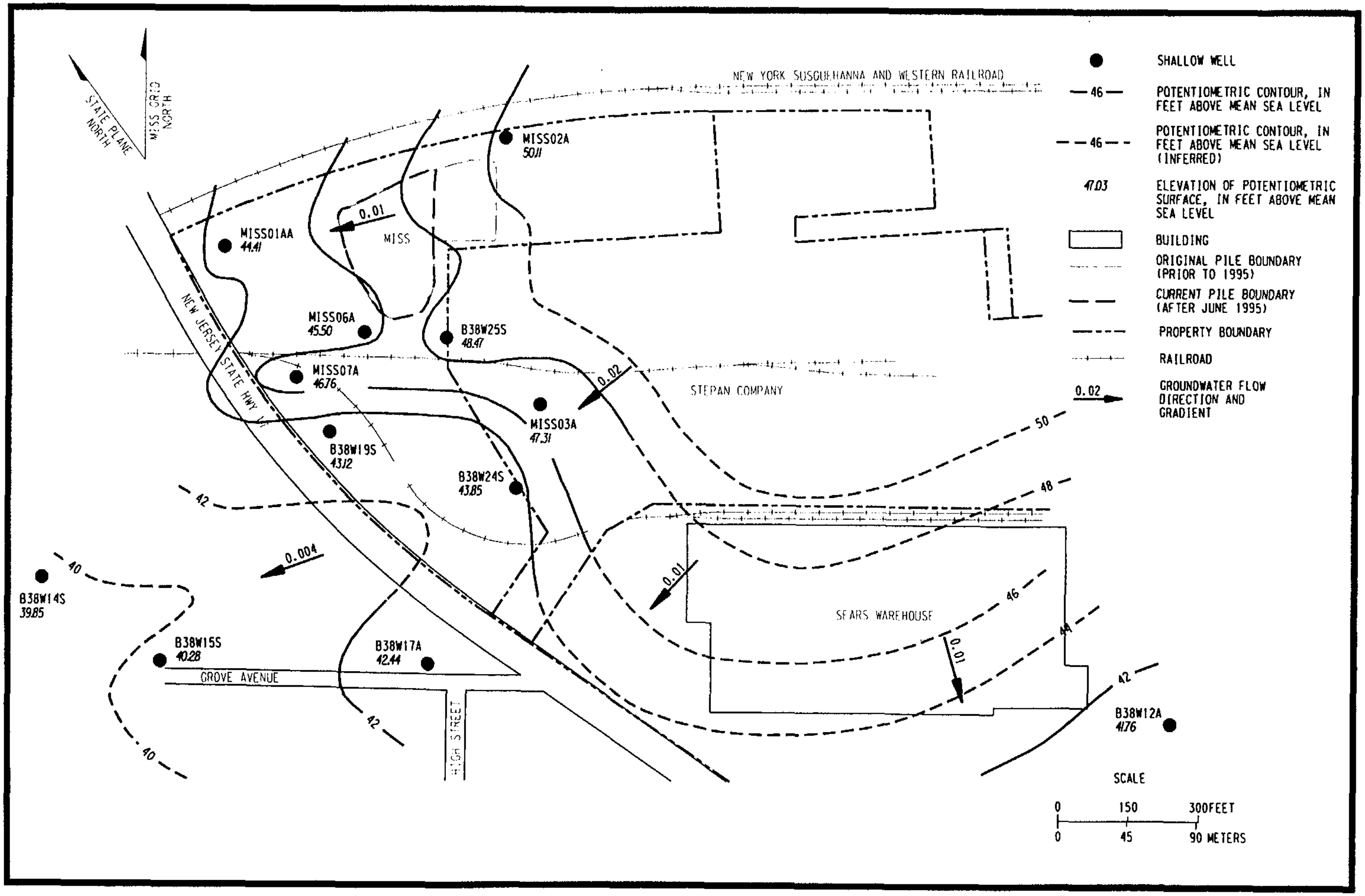
Template = HYDRO4L printed: 05-29-96




| | Well ID | Ground Elev (ft amsl) |
|---|---|---|
| LEGEND: ■ | MISS-2B | 60.50 |
| ★ | MISS-3B | 56.40 |

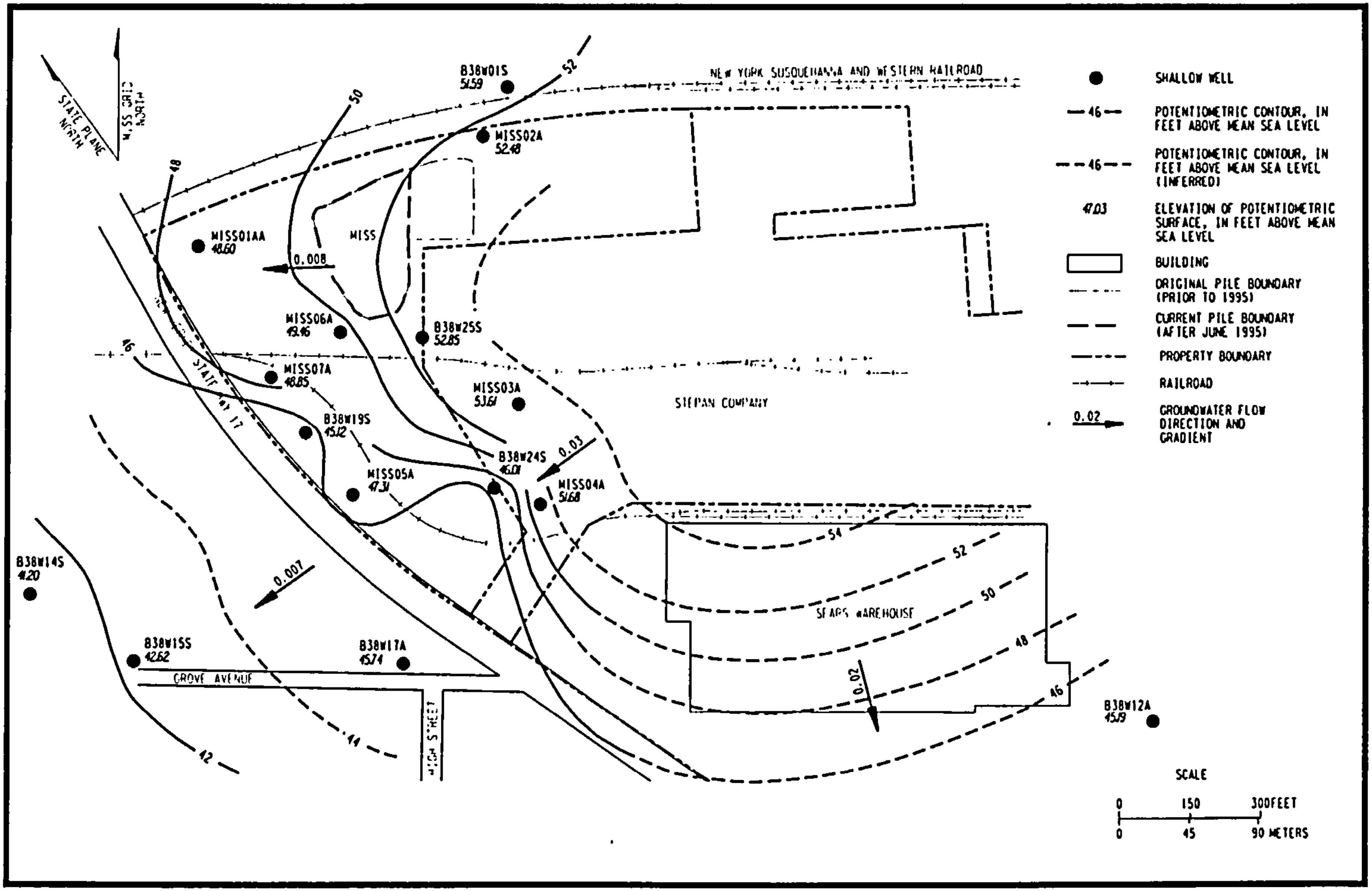
**Figure 6**
**Four-Year Hydrograph for Maywood Interim Storage Site - Bedrock**

Template = HYDRO4L printed: 05-29-96



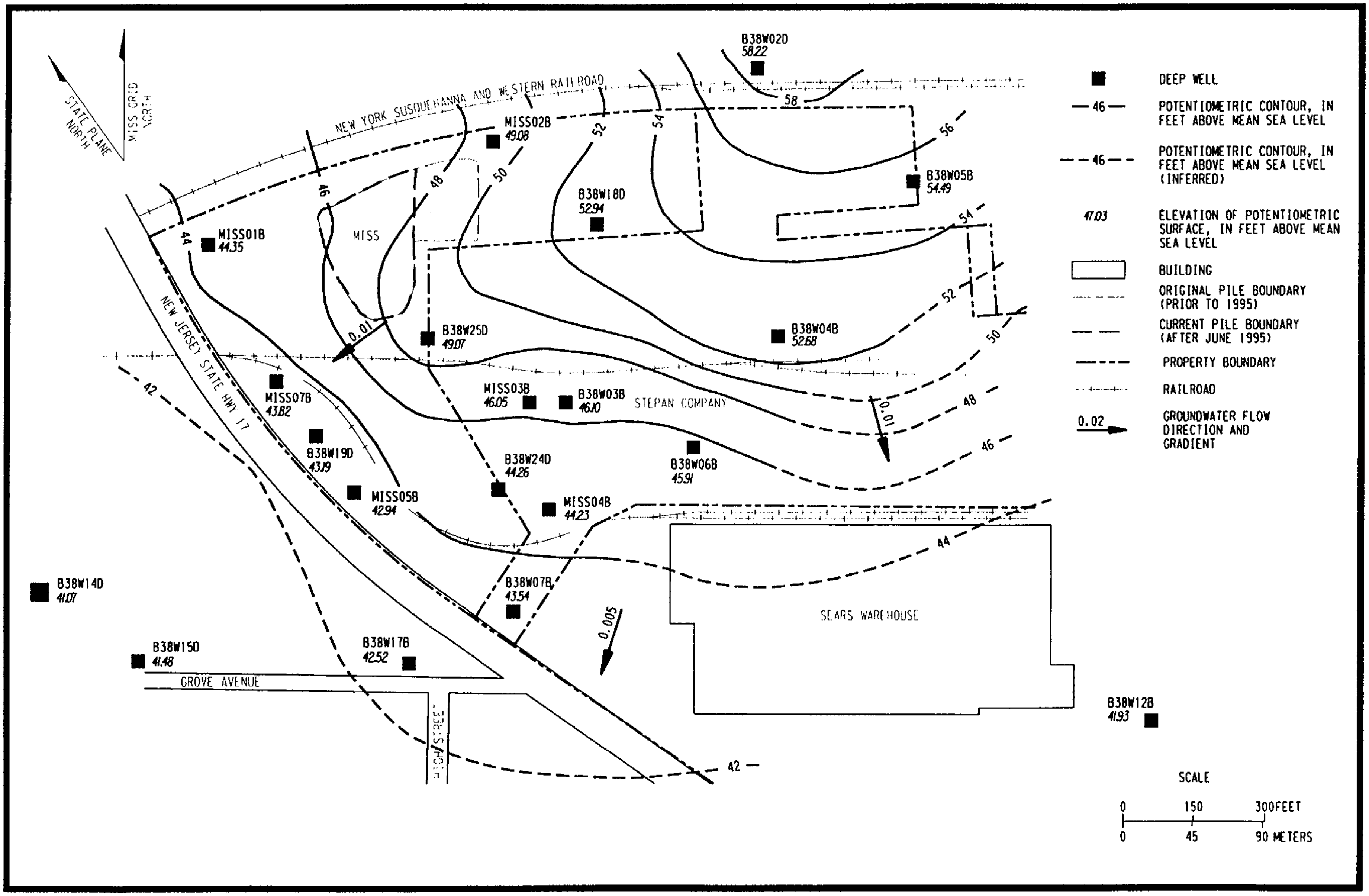

138 R84F013.DGN

Figure 7
Maywood Interim Storage Site
Potentiometric Surface Map ( August 3, 1995) - Unconsolidated Sediments



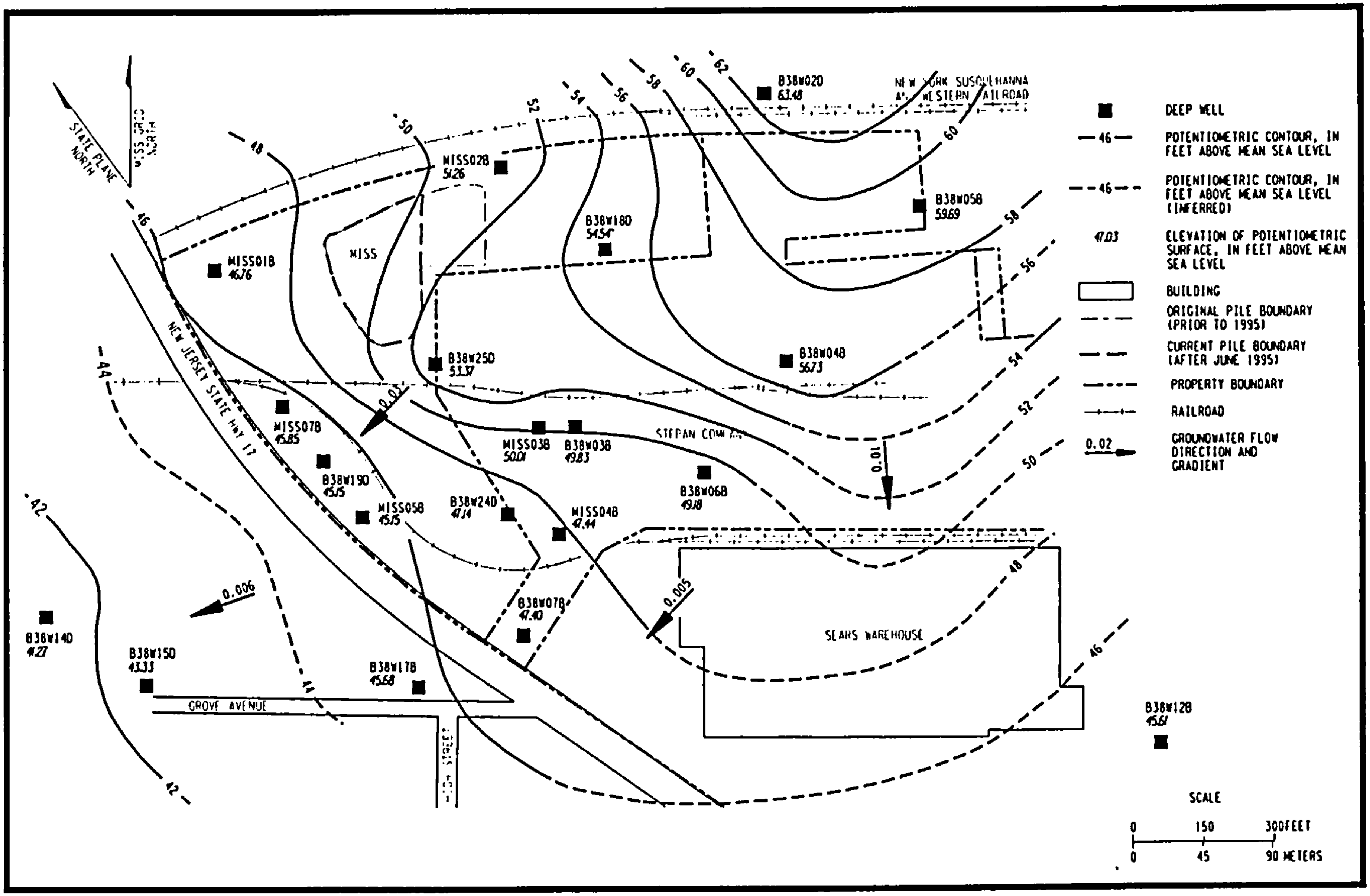

138 R64F012.DGN

Figure 8
Maywood Interim Storage Site
Potentiometric Surface Map ( November 14, 1995) - Unconsolidated Sediments




138 R84F015.DGN

**Figure 9**
**Maywood Interim Storage Site**
**Potentiometric Surface Map ( August 3, 1995) - Bedrock**




138 R84F014.DGN

Figure 10
Maywood Interim Storage Site
Potentiometric Surface Map ( November 14, 1995) - Bedrock

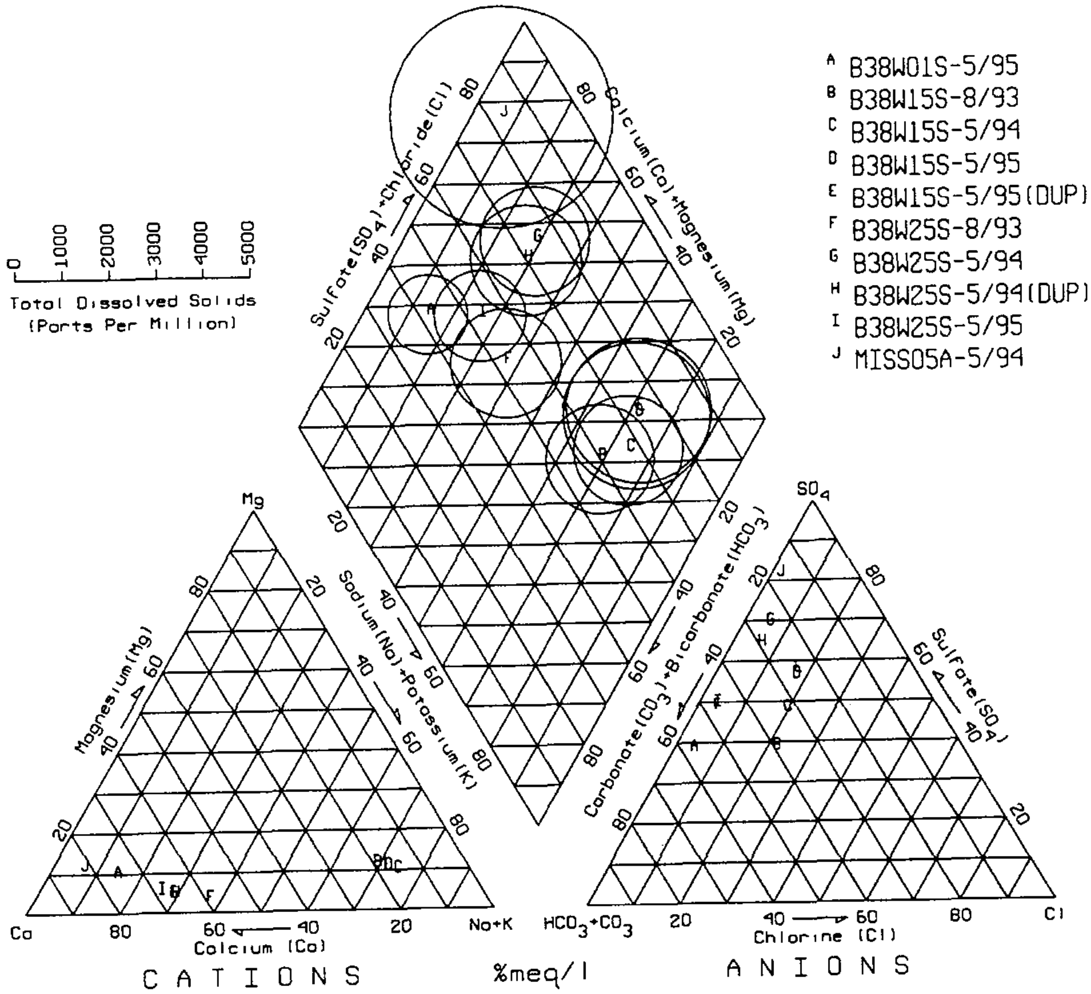



**Figure 11**
**Trilinear Piper Diagram For Groundwater Quality - Unconsolidated Sediments**
**Maywood Interim Storage Site**

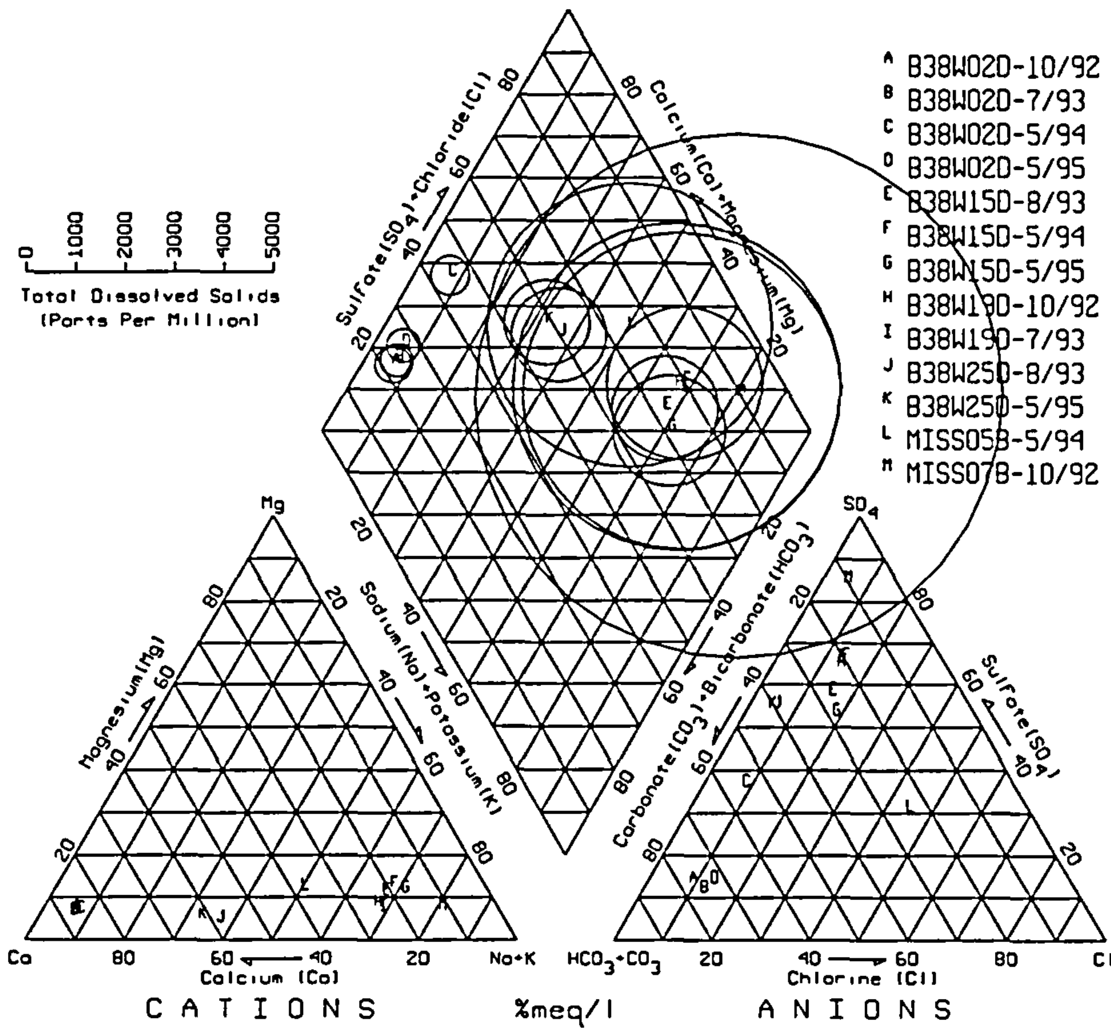



**Figure 12**
**Trilinear Piper Diagram For Groundwater Quality - Bedrock**
**Maywood Interim Storage Site**

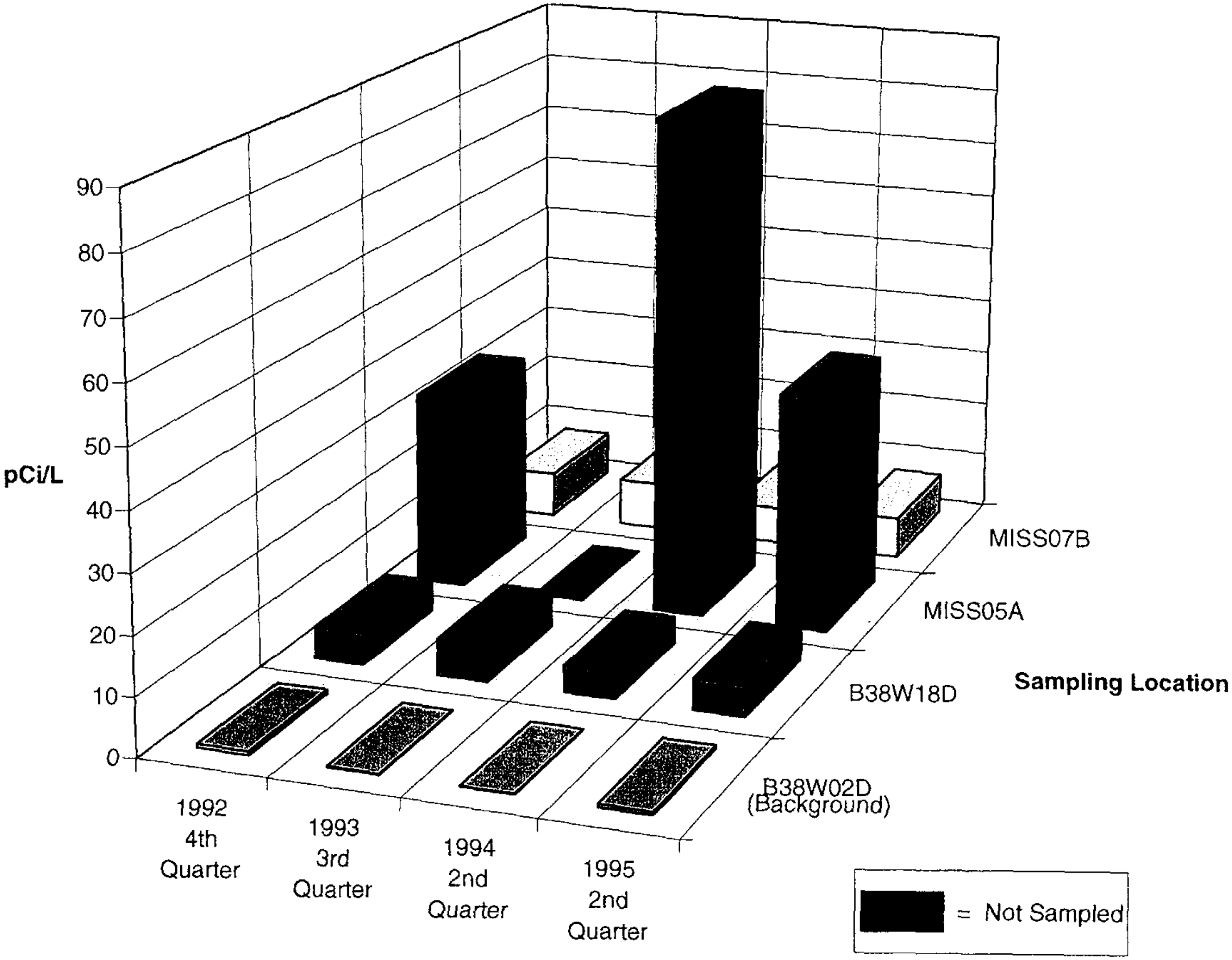



**Figure 13. Historical and Current Results for Uranium in Groundwater Maywood Interim Storage Site**

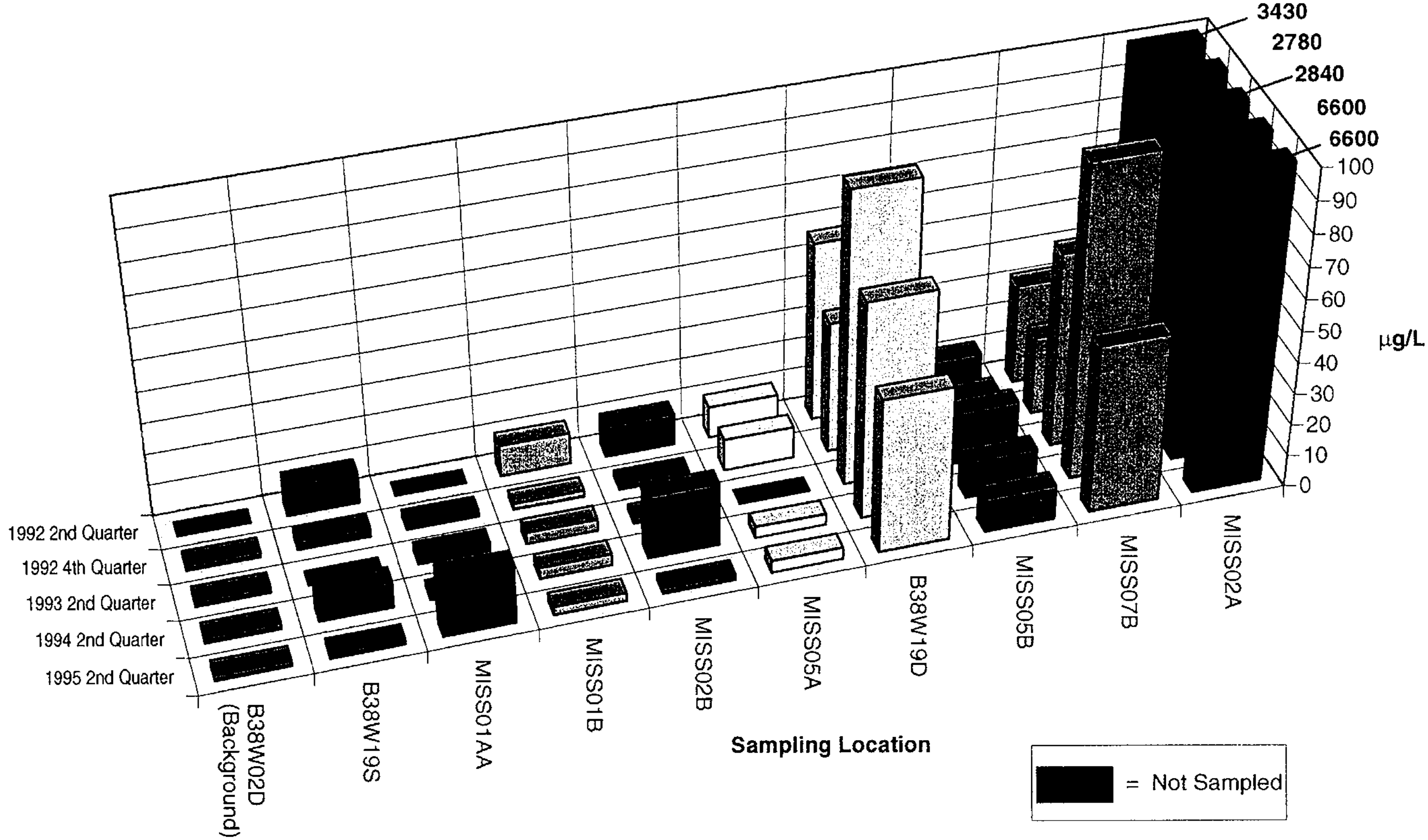



**Figure 14. Historical and Current Results for Arsenic in Groundwater Maywood Interim Storage Site**

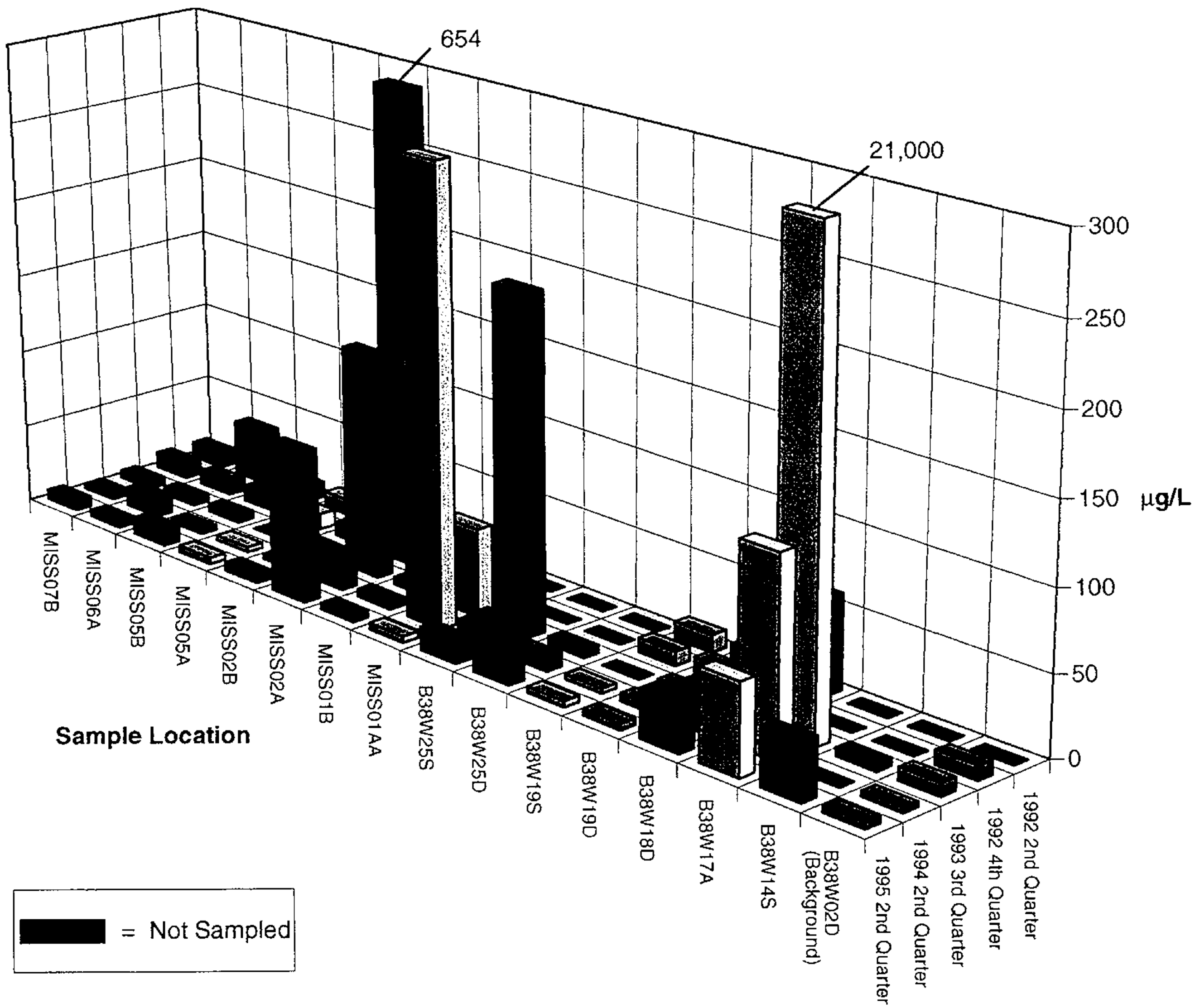



**Figure 15. Historical and Current Results for Chromium in Groundwater Maywood Interim Storage Site**

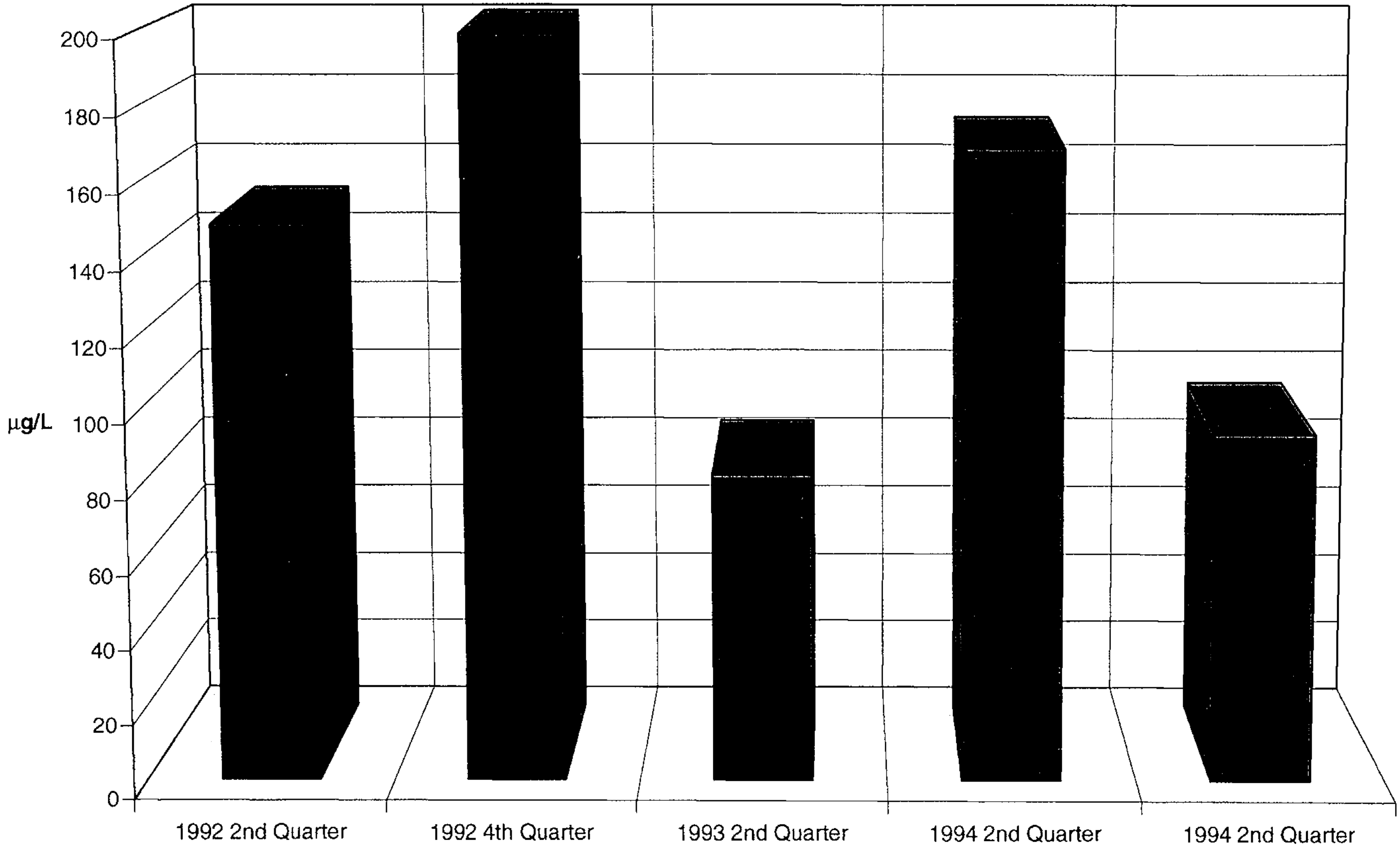



**Figure 16. Historical and Current Results for Benzene in Well MISS05B**
**Maywood Interim Storage Site**

**Environmental Surveillance Results for 1995**
**Maywood Interim Storage Site**

## List of Tables

**Environmental Surveillance Results for 1995**
**Maywood Interim Storage Site**

**List of Tables (continued)**

# Table 1
# 1995 Sampling Summary
# Maywood Interim Storage Site



| Well ID / Sampling Location | Radioactive Q1[c] | Radioactive Q2 | Radioactive Q3 | Radioactive Q4 | Metals Q1 | Metals Q2 | Metals Q3 | Metals Q4 | VOCs[a] Q1 | VOCs[a] Q2 | VOCs[a] Q3 | VOCs[a] Q4 | Water Quality Q1 | Water Quality Q2 | Water Quality Q3 | Water Quality Q4 | TPH[b] Q1 | TPH[b] Q2 | TPH[b] Q3 | TPH[b] Q4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Groundwater** | | | | | | | | | | | | | | | | | | | | |
| MISS01AA | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| MISS01B | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| MISS02A | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| MISS02B | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| MISS05A | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| MISS05B | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| MISS06A | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| MISS07B | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W01S | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | |
| B38W02D | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | |
| B38W14D | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W14S | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W15D | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | |
| B38W15S | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | |
| B38W17A | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W17B | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W18D | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W19D | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W19S | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W24D | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W24S | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | ✓ | | |
| B38W25D | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | |
| B38W25S | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | | | ✓ | | |
| **Sediment** | | | | | | | | | | | | | | | | | | | | |
| SWSD002[d] | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | | | |
| SWSD003 | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | | | |
| SWSD005 | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | | | |
| SWSD006 | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | | | |
| SWSD007 | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | | | |
| **External Gamma Radiation** | | | | | | | | | | | | | | | | | | | | |
| 4 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 5 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 10 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |

# Table 1
## *1995 Sampling Summary*
## Maywood Interim Storage Site



| Well ID / | Radioactive | | | | Metals | | | | VOCs[a] | | | | Water Quality | | | | TPH[b] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Location | Q1[c] | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| **External Gamma Radiation (continued)** | | | | | | | | | | | | | | | | | | | | |
| 12 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 19 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 20 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 21 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 22 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 23 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 24 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 25 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 26 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| **Radon-220 and Radon-222** | | | | | | | | | | | | | | | | | | | | |
| 4 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 5 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 10 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 12 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 19 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 20 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 21 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 22 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 23 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 24 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 25 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 26 | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| 30 | | | ✓ | | | | | | | | | | | | | | | | | |
| 31 | | | ✓ | | | | | | | | | | | | | | | | | |

a. Volatile organic compound
b. Total petroleum hydrocarbons
c. Q1 = first quarter 1995
   Q2 = second quarter 1995
   Q3 = third quarter 1995
   Q4 = fourth quarter 1995
d. Text and figures refer to sediment sampling locations by the last nonzero digit of the formal identifier presented in the table (e.g., SWSD002 is Location 2)

# Table 2
## 1995 Sampling Locations and Analytical Methods
## Maywood Interim Storage Site
## - External Gamma Radiation and Air (Radon Gas) -

| Category | Analytical Parameter | Analytical Level | Analytical Technique | Analytical Method[a] | Sampling Locations |
|---|---|---|---|---|---|
| **Laboratory Measurements** | | | | | |
| Radiation | External gamma radiation | V | Thermoluminescence - TETLD[b] | N/A | 4, 5, 10, 12, 19, 20, 21, 22, 23, 24, 25, 26, 30, 31 (30 and 31 are radon gas only) (Figure 1) |
| Radiological | Radon-220 / Radon-222 | V | Radtrack® | N/A | |
| | Radon-222 | V | Radtrack®-modified | N/A | |
| Radiological | Radon-222 flux | V | LAACC[c] /γ-spec | N/A | Storage Pile (Figure 2) |

57

# Table 2
## 1995 Sampling Locations and Analytical Methods
## Maywood Interim Storage Site
## - Groundwater -

| Category | Analytical Parameter | Analytical Level | Analytical Technique | Analytical Method | Sampling Locations (Figure 1) |
|---|---|---|---|---|---|
| **Field Measurements** | | | | | |
| Chemical | Dissolved oxygen | II | Electrometric | EPA[d] 360.1 | MISS01AA, MISS01B, MISS02A, MISS02B MISS05A, MISS05B, MISS06A, MISS07B, B38W01S, B38W02D, B38W14S, B38W14D, B38W15S, B38W15D, B38W17A, B38W17B, B38W18D, B38W19S, B38W19D, B38W24S, B38W24D, B38W25S, B38W25D |
| | Eh | II | Electrometric | N/A | |
| | Turbidity | II | Turbidimetric | EPA 180.1 | |
| | Temperature | II | Electrometric | EPA 170.1 | |
| | Specific conductivity | II | Electrometric | EPA 120.1 | |
| | pH | II | Electrometric | EPA 150.1 | |
| **Laboratory Measurements** | | | | | |
| Radiological | Total uranium | V | KPA[e] | ASTM[f]D-5174 | MISS01AA, MISS01B, MISS02A, MISS02B B38W01S, B38W02D, B38W14S, B38W14D, B38W15S, B38W15D, B38W17A, B38W17B, B38W18D, B38W19S, B38W19D, B38W24S, B38W24D, B38W25S, B38W25D |
| | Thorium-230 / Thorium-232 | V | Alpha spec | EML[g]Th-01 | |
| | Radium-226 | V | Alpha spec | EPA 903.1 | |
| Chemical | Volatile organic compounds | III | GC/MS[h] | EPA 8240B | |
| | ICPAES Metals | III | ICPAES[i] | EPA 6010A | |
| | Antimony | III | GFAA[j] | EPA 7041 | |
| | Arsenic | III | GFAA | EPA 7060A | |
| | Lead | III | GFAA | EPA 7421 | |
| | Selenium | III | GFAA | EPA 7740 | |
| | Thallium | III | GFAA | EPA 7841 | |
| | Sulfate | III | Turbidimetric | EPA 9038 | B38W01S, B38W02D, B38W15S B38W15D, B38W25S, B38W25D |
| | Phosphate - P | III | Colorimetric | EPA 365.2 | |
| | Nitrate-N | III | Colorimetric | EPA 353.2 | |
| | Chloride | III | Colorimetric | EPA 325.2 | |
| | Alkalinity | III | Titrimetric | EPA 310.1 | |
| | Carbonate | III | Titrimetric | EPA 310.1 | |
| | Bicarbonate | III | Titrimetric | EPA 310.1 | |
| | Total dissolved solids | III | Gravimetric | EPA 160.1 | |

# Table 2
## 1995 Sampling Locations and Analytical Methods
## Maywood Interim Storage Site
### - Sediment -

| Category | Analytical Parameter | Analytical Level | Analytical Technique | Analytical Method | Sampling Locations[k] (Figure 3) |
|---|---|---|---|---|---|
| **Laboratory Measurements** | | | | | |
| Radiological | Total uranium | V | KPA | ASTM D-5174 | SWSD002, SWSD003, SWSD005, SWSD006, SWSD007 |
| | Thorium-232 | V | Alpha Spec | EML Th-01 | |
| | Radium-226 | V | Alpha Spec | EPA 903.0 | |
| | Radium-228 | V | Gamma Spec | LANL ER[l] -130 | |
| Chemical | ICPAES Metals | III | ICPAES | EPA 6010A | SWSD002, SWSD003, SWSD005, SWSD006, SWSD007 |
| | Antimony | III | GFAA | EPA 7041 | |
| | Arsenic | III | GFAA | EPA 7060A | |
| | Lead | III | GFAA | EPA 7421 | |
| | Selenium | III | GFAA | EPA 7740 | |
| | Thallium | III | GFAA | EPA 7841 | |

a. Analytical methods for radioactive constituents have been adapted from the referenced method as well as other methods
b. Tissue-equivalent thermoluminescent dosimeter
c. Large area activated charcoal canister
d. Environmental Protection Agency
e. Kinetic phosphorescence analysis
f. American Society for Testing and Materials
g. Environmental Measurements Laboratory
h. Gas chromatography/mass spectrometry
i. Inductively coupled plasma atomic emission spectrophotometry
j. Graphite furnace atomic absorption
k. Text and figures refer to sediment sampling locations by the last nonzero digit of the formal identifier presented in the table (e.g., SWSD002 is Location 2)
l. Los Alamos National Laboratory Environmental Restoration

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**Table 3**
**1995 External Gamma Radiation Dose Rates**
**Maywood Interim Storage Site**

| Monitoring Location[b] | | TETLD[a] Readings (mrem/yr) | TETLD Corrected[c] (mrem/yr) |
|---|---|---|---|
| MISS | 4 | 158.4 | 80.1 |
| Perimeter | | 168.0 | 90.3 |
| | 5 | 281.0 | 210.8 |
| | | 250.6 | 178.4 |
| | 10 | 244.2 | 171.6 |
| | | 254.8 | 182.9 |
| | 12 | 154.2 | 75.6 |
| | | 152.2 | 73.5 |
| | 20 | 107.4 | 25.7 |
| | | 108.8 | 27.2 |
| | 21 | 668.4 | 623.9 |
| | | 647.2 | 601.3 |
| | 22 | 1,744.4 | 1,771.1 |
| | | 1,595.8 | 1,612.7 |
| | 23 | 626.0 | 578.7 |
| | | 592.6 | 543.1 |
| MISS | 24 | 390.8 | 327.9 |
| Perimeter | | 482.0 | 425.1 |
| | 25 | 787.6 | 751.0 |
| | | 815.6 | 780.8 |
| Background | 19 | 78.0 | -5.6 |
| | | 81.2 | -2.2 |
| Background | 26 | 87.6 | 4.6 |
| | | 86.2 | 3.1 |

TETLD Exposed Days.................. 368
**Calculated values:**
Average Background[d]..................... 83.3
Corrected Background / year[e]........ 88.8
1 mrem = 0.01mSv

a. TETLD = Tissue-equivalent thermoluminescent dosimeter. There are two TETLDs per station, each containing five chips. Reported values are an average chip reading per TETLD.
b. Monitoring locations are shown on Figure 1.
c. TETLD readings are corrected for shelter/absorption factor (s/a = 1.075), normalized to a one-year exposure, and corrected for corrected background/year.
Corrected exposure = (reading * 1.075 * days per year/exposed days) - (corrected background/year)
Example (Location 4): (158.4*1.075*365/368) - (82.9) = 80.1 mrem/yr
d. Average background is the average of reported values at locations 19 and 26.
e. Corrected background/year = (days per year/exposed days)*(average background)*1.075
Example: 365/368* 83.3 * 1.075 = 88.8 mrem/yr

**Table 4**
**1995 Radon-220 and Radon-222 Concentrations**
**Maywood Interim Storage Site**

| Monitoring Location[b] | | Average Concentration (pCi/L) 01/26/95 to 07/31/95[a] Radon-220[c] | Radon-222 | 07/31/95 to 01/29/96[a] Radon-220[c] | Radon-222 |
|---|---|---|---|---|---|
| MISS perimeter | 4 | 1.52 | 0.2* | 1.07 | 0.2 * |
| QC duplicate[d] | 4 | 1.38 | 0.2* | 1.26 | 0.2 * |
| | 5 | 4.08 | 0.2* | 3.54 | 0.2 |
| | 10 | 1.33 | 0.2* | 0.83 | 0.2 * |
| | 12 | 1.11 | 0.2* | 0.98 | 0.2 * |
| | 20 | 1.87 | 0.2* | 0.65 | 0.3 |
| | 21 | 2.12 | 0.2* | 1.78 | 0.2 * |
| | 22 | 11.46 | 1.0 | 8.06 | 0.6 |
| | 23 | 2.77 | 0.6 | 3.04 | 0.3 |
| | 24 | 2.75 | 0.2* | 2.55 | 0.2 * |
| | 25 | 1.84 | 0.2* | 2.21 | 0.3 |
| | 30[e] | -- | -- | 7.43 | 1.2 |
| | 31[e] | -- | -- | 5.69 | 0.3 |
| Background | 19 | 0.04 | 0.2* | -0.01 | 0.2 * |
| | 26 | 0.09 | 0.2* | -0.01 | 0.2 * |

a. Detectors were installed and removed on the dates listed, with the following exceptions:
Location 19 was monitored 01/26/95 to 08/02/95 and 08/02/95 to 01/29/96.
Location 26 was monitored 01/30/95 to 08/02/95 and 08/02/95 to 01/29/96.

b. Monitoring locations are shown in Figure 1.

c. 1995 radon-220 gas concentrations were calculated as described in FUSRAP committed calculation 191-CV-028 (BNI 1995d) using data from RadTrack® (no diffusion barriers) and RadTrack®-modified (with a membrane barrier to radon-220) detectors.

d. A quality control (QC) duplicate is collected at the same time and location and is analyzed by the same method for use in evaluation of precision in sampling and analysis.

e. Monitoring locations 30 and 31 were established 08/04/95. Detectors were removed 01/29/96.

Note: The DOE limits for radon-220 and radon-222 are 3.0 pCi/L and 3.0 pCi/L.
( * ) Indicates detection limit is reported. Actual result is less than this value.
1 pCi = 0.037 becquerel

## Table 5
## 1995 Radon-222 Flux Monitoring Results
## Maywood Interim Storage Site

| Sample ID | Radon-222 Flux ($pCi/m^2/s$) March 1995 | Radon-222 Flux ($pCi/m^2/s$) October 1995 |
|---|---|---|
| 138-RF-01 | 0.06 ± 0.01 | 0.06 ± 0.01 |
| 138-RF-02 | 0.06 ± 0.01 | 0.05 ± 0.01 |
| 138-RF-03 | 0.06 ± 0.01 | 0.05 ± 0.01 |
| 138-RF-04 | 0.06 ± 0.01 | 0.05 ± 0.01 |
| 138-RF-05 | 0.06 ± 0.01 | 0.07 ± 0.01 |
| 138-RF-06 | 0.05 ± 0.01 | 0.05 ± 0.01 |
| 138-RF-07 | 0.06 ± 0.01 | 0.06 ± 0.01 |
| 138-RF-08 | 0.05 ± 0.01 | 0.06 ± 0.01 |
| 138-RF-09 | 0.05 ± 0.01 | 0.06 ± 0.01 |
| 138-RF-10 | 0.06 ± 0.01 | 0.05 ± 0.01 |
| 138-RF-11 | 0.06 ± 0.01 | 0.05 ± 0.01 |
| 138-RF-12 | 0.05 ± 0.01 | 0.06 ± 0.01 |
| 138-RF-13 | 0.06 ± 0.01 | 0.06 ± 0.01 |
| 138-RF-14 | 0.06 ± 0.01 | 0.06 ± 0.01 |
| 138-RF-15 | 0.06 ± 0.01 | 0.07 ± 0.01 |
| 138-RF-16 | 0.06 ± 0.01 | 0.06 ± 0.01 |
| 138-RF-17 | 0.06 ± 0.01 | -- [a] |
| 138-RF-18 | 0.06 ± 0.01 | -- |
| 138-RF-19 | 0.06 ± 0.01 | -- |
| 138-RF-20 | 0.06 ± 0.01 | -- |
| 138-RF-21 | 0.06 ± 0.01 | -- |
| 138-RF-22 | 0.06 ± 0.01 | -- |
| 138-RF-23 | 0.06 ± 0.01 | -- |
| 138-RF-24 | 0.06 ± 0.01 | -- |
| 138-RF-25 | 0.07 ± 0.01 | -- |
| 138-RF-26 | 0.06 ± 0.01 | -- |
| QC duplicates [b] | | |
| 138-RF-10 | 0.05 ± 0.01 | 0.07 ± 0.01 |
| 138-RF-16 | | 0.05 ± 0.01 |
| 138-RF-20 | 0.05 ± 0.01 | |

Note: The EPA standard for radon-222 flux is 20 $pCi/m^2/s$.

a. (--) = No sample collected. Due to removal of the eastern portion of the pile, the pile surface area was reduced.

b. Every tenth canister is counted twice in the laboratory as a quality control (QC) duplicate in order to evaluate analytical precision.

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# Table 6
## 1995 Sediment Analytical Results - Radioactive Constituents
## Maywood Interim Storage Site



| Sampling Location [a] | Date Collected | Analyte | Result [b] (pCi/g) | BNI Flag [c] | MDA [d] (pCi/g) | Result Above Background [e] (pCi/g) | Cleanup Criteria [f] (pCi/g) |
|---|---|---|---|---|---|---|---|
| SWSD002 | 05/08/95 | Radium-226 | 0.48 ± 0.17 | | 0.09 | 0.05 ± 0.18 | 5 |
| | 11/13/95 | Radium-226 | 0.30 ± 0.13 | | 0.09 | -0.13 ± 0.14 | 5 |
| | 11/13/95 | Radium-228 | 1.60 ± 0.60 | | 0.42 | 1.54 ± 0.61 | 5 |
| | 05/08/95 | Thorium-232 | 0.50 ± 0.21 | | 0.08 | -0.02 ± 0.22 | 5 |
| | 11/13/95 | Thorium-232 | 0.39 ± 0.18 | U | 0.05 | -0.13 ± 0.19 | 5 |
| | 05/08/95 | Total uranium | 0.74 ± 0.07 | U | 0.07 | -0.89 ± 0.10 | 100 |
| | 11/13/95 | Total uranium | 1.10 ± 0.01 | U | 0.07 | -0.53 ± 0.07 | 100 |
| SWSD005 | 05/08/95 | Radium-226 | 1.50 ± 0.34 | | 0.09 | 1.07 ± 0.35 | 5 |
| | 11/13/95 | Radium-226 | 1.28 ± 0.38 | | 0.16 | 0.85 ± 0.38 | 5 |
| | 11/13/95 | Radium-228 | 1.60 ± 0.80 | | 0.58 | 1.54 ± 0.81 | 5 |
| | 05/08/95 | Thorium-232 | 2.40 ± 0.63 | | 0.08 | 1.88 ± 0.63 | 5 |
| | 11/13/95 | Thorium-232 | 2.53 ± 0.63 | | 0.06 | 2.01 ± 0.63 | 5 |
| | 05/08/95 | Total uranium | 1.42 ± 0.14 | U | 0.07 | -0.21 ± 0.16 | 100 |
| | 11/13/95 | Total uranium | 1.66 ± 0.02 | U | 0.07 | 0.03 ± 0.07 | 100 |
| SWSD005 | 05/08/95 | Radium-226 | 1.70 ± 0.40 | | 0.12 | 1.27 ± 0.40 | 5 |
| QC duplicate [g] | 11/13/95 | Radium-226 | 2.79 ± 0.49 | | 0.09 | 2.36 ± 0.49 | 5 |
| | 11/13/95 | Radium-228 | 13.60 ± 1.40 | | 0.69 | 13.54 ± 1.40 | 5 |
| | 05/08/95 | Thorium-232 | 2.20 ± 0.59 | | 0.05 | 1.68 ± 0.59 | 5 |
| | 11/13/95 | Thorium-232 | 12.62 ± 2.50 | | 0.10 | 12.10 ± 2.50 | 5 |
| | 05/08/95 | Total uranium | 1.22 ± 0.12 | U | 0.07 | -0.41 ± 0.14 | 100 |
| | 11/13/95 | Total uranium | 3.22 ± 0.04 | | 0.07 | 1.59 ± 0.08 | 100 |
| SWSD006 | 05/08/95 | Radium-226 | 1.30 ± 0.32 | | 0.12 | 0.87 ± 0.33 | 5 |
| | 11/13/95 | Radium-226 | 4.45 ± 0.68 | | 0.15 | 4.02 ± 0.68 | 5 |
| | 11/13/95 | Radium-228 | 9.60 ± 1.10 | | 0.53 | 9.54 ± 1.10 | 5 |
| | 05/08/95 | Thorium-232 | 2.50 ± 0.65 | | 0.04 | 1.98 ± 0.65 | 5 |
| | 11/13/95 | Thorium-232 | 11.47 ± 2.02 | | 0.04 | 10.95 ± 2.02 | 5 |
| | 05/08/95 | Total uranium | 1.35 ± 0.14 | U | 0.07 | -0.28 ± 0.15 | 100 |
| | 11/13/95 | Total uranium | 7.18 ± 0.26 | | 0.07 | 5.55 ± 0.27 | 100 |
| SWSD007 | 05/08/95 | Radium-226 | 5.40 ± 0.76 | | 0.12 | 4.97 ± 0.76 | 5 |
| | 11/13/95 | Radium-226 | 3.32 ± 0.54 | | 0.12 | 2.89 ± 0.54 | 5 |
| | 11/13/95 | Radium-228 | 11.70 ± 1.20 | | 0.56 | 11.64 ± 1.20 | 5 |
| | 05/08/95 | Thorium-232 | 14.60 ± 2.90 | | 0.07 | 14.08 ± 2.90 | 5 |
| | 11/13/95 | Thorium-232 | 9.49 ± 1.69 | | 0.04 | 8.97 ± 1.69 | 5 |
| | 05/08/95 | Total uranium | 6.16 ± 0.62 | | 0.07 | 4.53 ± 0.62 | 100 |
| | 11/13/95 | Total uranium | 6.11 ± 0.24 | | 0.07 | 4.48 ± 0.25 | 100 |

# Table 6
## 1995 Sediment Analytical Results - Radioactive Constituents
## Maywood Interim Storage Site

| Sampling Location[a] | Date Collected | Analyte | Result[b] (pCi/g) | BNI Flag[c] | MDA[d] (pCi/g) | Result Above Background[e] (pCi/g) | Cleanup Criteria[f] (pCi/g) |
|---|---|---|---|---|---|---|---|
| SWSD003 | 05/08/95 | Radium-226 | 0.55 ± 0.18 | | 0.08 | 0.12 ± 0.19 | 5 |
| Background | 11/13/95 | Radium-226 | 0.29 ± 0.15 | | 0.05 | -0.14 ± 0.16 | 5 |
| | 11/13/95 | Radium-228 | 0.90 ± 0.60 | | 0.50 | 0.84 ± 0.61 | 5 |
| | 05/08/95 | Thorium-232 | 0.56 ± 0.23 | | 0.10 | 0.04 ± 0.24 | 5 |
| | 11/13/95 | Thorium-232 | 0.32 ± 0.15 | U | 0.04 | -0.20 ± 0.17 | 5 |
| | 05/08/95 | Total uranium | 1.29 ± 0.13 | U | 0.07 | -0.34 ± 0.15 | 100 |
| | 11/13/95 | Total uranium | 1.27 ± 0.12 | U | 0.07 | -0.36 ± 0.13 | 100 |

a. Text and figures refer to sampling locations by the last non-zero digit of the formal identifier presented in the table (e.g., SWSD002 is location 2).

b. Results reported with (±) radiological error quoted at 2-sigma (95 percent confidence level).

c. Bechtel National, Inc. data qualifier flags:
U = The analyte was not detected. Some results for thorium-232 and total uranium are 'U' flagged due to the presence of these analytes in the associated laboratory blank. If sample results are less than 5 times the blank contamination, the result is nondetect.

d. Minimum detectable activity

e. Historical (1992-1995) average background for sediment is 0.43±0.06, 0.06±0.1, 0.52±0.07, and 1.63±0.07 for radium-226, radium-228, thorium-232, and total uranium, respectively. Associated error term for result above background was calculated: $(\text{error}^2_{result} + \text{error}^2_{background})^{1/2}$

f. DOE soil cleanup criteria, averaged over topmost 6 in. of soil. Because there are no standards for radioactive constituents in sediment, these soil values are used to provide a basis for comparison of sediment results.

g. A quality control (QC) duplicate is collected at the same time and location and is analyzed by the same method for use in evaluation of precision in sampling and analysis. The large differences between the analytical results for thorium-232 and radium-228 in the sample and its duplicate indicates poor precision; however, the source of the poor precision has not been identified. Historical data suggests that the duplicate results are not representative of conditions at that location.

# Table 7
## 1995 Sediment Analytical Results - Detected Metals [a]
## Maywood Interim Storage Site



| Sampling Location [b] | Date Collected | Analyte | Result (mg/kg) | Data Qualifiers [c] BNI | Data Qualifiers [c] Lab | Detection Limit (mg/kg) | State Regulations [d] (mg/kg) |
|---|---|---|---|---|---|---|---|
| SWSD002 | 05/08/95 | Aluminum | 4,460 | | = | 2.5 | NE |
| | 05/08/95 | Antimony | 0.64 | J | = | 0.2 | 14 |
| | 05/08/95 | Arsenic | 7.1 | J | = | 0.49 | 20 |
| | 05/08/95 | Barium | 49.7 | | = | 0.25 | 700 |
| | 05/08/95 | Beryllium | 0.4 | | = | 0.1 | 1 |
| | 05/08/95 | Calcium | 17,400 | J | = | 2.3 | NE |
| | 05/08/95 | Chromium | 17.2 | J | = | 0.57 | NE |
| | 05/08/95 | Cobalt | 6.7 | | = | 0.45 | NE |
| | 05/08/95 | Copper | 73.4 | J | = | 0.42 | 600 |
| | 05/08/95 | Iron | 14,200 | | = | 1.7 | NE |
| | 05/08/95 | Lead | 140 | J | = | 4.2 | 100 |
| | 05/08/95 | Magnesium | 10,200 | | = | 6.6 | NE |
| | 05/08/95 | Manganese | 355 | J | = | 0.52 | NE |
| | 05/08/95 | Molybdenum | 23.8 | | = | 0.97 | NE |
| | 05/08/95 | Nickel | 18.3 | | = | 1.4 | 250 |
| | 05/08/95 | Potassium | 320 | | = | 144 | NE |
| | 05/08/95 | Sodium | 231 | | = | 5.7 | NE |
| | 05/08/95 | Vanadium | 14.2 | | = | 0.91 | 370 |
| | 05/08/95 | Zinc | 524 | J | = | 0.34 | 1,500 |
| SWSD005 | 05/08/95 | Aluminum | 8,410 | | = | 6.1 | NE |
| | 05/08/95 | Antimony | 1.2 | J | = | 0.51 | 14 |
| | 05/08/95 | Arsenic | 7.4 | J | = | 0.61 | 20 |
| | 05/08/95 | Barium | 361 | | = | 0.61 | 700 |
| | 05/08/95 | Beryllium | 0.51 | | = | 0.24 | 1 |
| | 05/08/95 | Cadmium | 1.8 | J | = | 1.2 | 1 |
| | 05/08/95 | Calcium | 11,100 | J | = | 5.6 | NE |
| | 05/08/95 | Chromium | 64.7 | J | = | 1.4 | NE |
| | 05/08/95 | Cobalt | 9.2 | | = | 1.1 | NE |
| | 05/08/95 | Copper | 265 | J | = | 1.1 | 600 |
| | 05/08/95 | Iron | 25,200 | | = | 4.2 | NE |
| | 05/08/95 | Lead | 191 | J | = | 10.6 | 100 |
| | 05/08/95 | Magnesium | 3,960 | | = | 16.4 | NE |
| | 05/08/95 | Manganese | 2,370 | J | = | 1.3 | NE |
| | 05/08/95 | Molybdenum | 41.2 | | = | 2.4 | NE |
| | 05/08/95 | Nickel | 25.6 | | = | 3.5 | 250 |
| | 05/08/95 | Potassium | 562 | | = | 361 | NE |
| | 05/08/95 | Silver | 3.1 | | = | 1.2 | 110 |

# Table 7
## 1995 Sediment Analytical Results - Detected Metals [a]
## Maywood Interim Storage Site

| Sampling Location [b] | Date Collected | Analyte | Result (mg/kg) | Data Qualifiers [c] BNI | Data Qualifiers [c] Lab | Detection Limit (mg/kg) | State Regulations [d] (mg/kg) |
|---|---|---|---|---|---|---|---|
| SWSD005 continued | 05/08/95 | Sodium | 460 | | = | 14.3 | NE |
| | 05/08/95 | Vanadium | 25.4 | | = | 2.3 | 370 |
| | 05/08/95 | Zinc | 362 | J | = | 0.85 | 1,500 |
| SWSD005 QC duplicate [e] | 05/08/95 | Aluminum | 9,430 | | = | 6.8 | NE |
| | 05/08/95 | Antimony | 1.4 | J | = | 0.56 | 14 |
| | 05/08/95 | Arsenic | 8.2 | J | = | 0.68 | 20 |
| | 05/08/95 | Barium | 382 | | = | 0.68 | 700 |
| | 05/08/95 | Beryllium | 0.49 | | = | 0.26 | 1 |
| | 05/08/95 | Cadmium | 1.6 | J | = | 1.3 | 1 |
| | 05/08/95 | Calcium | 12,600 | J | = | 6.2 | NE |
| | 05/08/95 | Chromium | 62.2 | J | = | 1.6 | NE |
| | 05/08/95 | Cobalt | 9.4 | | = | 1.2 | NE |
| | 05/08/95 | Copper | 288 | J | = | 1.2 | 600 |
| | 05/08/95 | Iron | 26,000 | | = | 4.7 | NE |
| | 05/08/95 | Lead | 184 | J | = | 11.7 | 100 |
| | 05/08/95 | Magnesium | 4,230 | | = | 18.1 | NE |
| | 05/08/95 | Manganese | 2,250 | J | = | 1.4 | NE |
| | 05/08/95 | Molybdenum | 43.7 | | = | 2.7 | NE |
| | 05/08/95 | Nickel | 25 | | = | 3.9 | 250 |
| | 05/08/95 | Potassium | 664 | | = | 398 | NE |
| | 05/08/95 | Silver | 4.2 | | = | 1.3 | 110 |
| | 05/08/95 | Sodium | 512 | | = | 15.8 | NE |
| | 05/08/95 | Vanadium | 27.2 | | = | 2.5 | 370 |
| | 05/08/95 | Zinc | 390 | J | = | 0.94 | 1,500 |
| SWSD006 | 05/08/95 | Aluminum | 3,990 | | = | 3.9 | NE |
| | 05/08/95 | Antimony | 0.92 | J | = | 0.33 | 14 |
| | 05/08/95 | Arsenic | 6.5 | J | = | 0.39 | 20 |
| | 05/08/95 | Barium | 169 | | = | 0.39 | 700 |
| | 05/08/95 | Beryllium | 0.24 | | = | 0.15 | 1 |
| | 05/08/95 | Cadmium | 1.2 | J | = | 0.77 | 1 |
| | 05/08/95 | Calcium | 6,970 | J | = | 3.6 | NE |
| | 05/08/95 | Chromium | 129 | J | = | 0.92 | NE |
| | 05/08/95 | Cobalt | 3 | | = | 0.72 | NE |
| | 05/08/95 | Copper | 44.4 | J | = | 0.68 | 600 |
| | 05/08/95 | Iron | 8,270 | | = | 2.7 | NE |
| | 05/08/95 | Lead | 140 | J | = | 6.8 | 100 |
| | 05/08/95 | Magnesium | 1,390 | | = | 10.5 | NE |

**Table 7**
**1995 Sediment Analytical Results - Detected Metals [a]**
**Maywood Interim Storage Site**

| Sampling Location [b] | Date Collected | Analyte | Result (mg/kg) | Data Qualifiers [c] | | Detection Limit (mg/kg) | State Regulations [d] (mg/kg) |
|---|---|---|---|---|---|---|---|
| | | | | BNI | Lab | | |
| SWSD006 continued | 05/08/95 | Manganese | 204 | J | = | 0.83 | NE |
| | 05/08/95 | Molybdenum | 18.6 | | = | 1.6 | NE |
| | 05/08/95 | Nickel | 10.2 | | = | 2.3 | 250 |
| | 05/08/95 | Selenium | 0.37 | | = | 0.26 | 63 |
| | 05/08/95 | Sodium | 269 | | = | 9.2 | NE |
| | 05/08/95 | Vanadium | 17.2 | | = | 1.5 | 370 |
| | 05/08/95 | Zinc | 209 | J | = | 0.55 | 1,500 |
| SWSD007 | 05/08/95 | Aluminum | 11,300 | | = | 6.9 | NE |
| | 05/08/95 | Antimony | 2.6 | J | = | 0.57 | 14 |
| | 05/08/95 | Arsenic | 15.5 | J | = | 0.69 | 20 |
| | 05/08/95 | Barium | 574 | | = | 0.69 | 700 |
| | 05/08/95 | Beryllium | 0.95 | | = | 0.27 | 1 |
| | 05/08/95 | Boron | 25.5 | | = | 4.6 | NE |
| | 05/08/95 | Cadmium | 2.8 | J | = | 1.3 | 1 |
| | 05/08/95 | Calcium | 23,500 | J | = | 6.4 | NE |
| | 05/08/95 | Chromium | 265 | J | = | 1.6 | NE |
| | 05/08/95 | Cobalt | 8.4 | | = | 1.3 | NE |
| | 05/08/95 | Copper | 136 | J | = | 1.2 | 600 |
| | 05/08/95 | Iron | 22,800 | | = | 4.8 | NE |
| | 05/08/95 | Lead | 416 | J | = | 12 | 100 |
| | 05/08/95 | Magnesium | 3,110 | | = | 18.4 | NE |
| | 05/08/95 | Manganese | 620 | J | = | 1.5 | NE |
| | 05/08/95 | Molybdenum | 47.4 | | = | 2.7 | NE |
| | 05/08/95 | Nickel | 28.2 | | = | 3.9 | 250 |
| | 05/08/95 | Potassium | 686 | | = | 406 | NE |
| | 05/08/95 | Selenium | 1.1 | | = | 0.46 | 63 |
| | 05/08/95 | Sodium | 813 | | = | 16.1 | NE |
| | 05/08/95 | Vanadium | 41.8 | | = | 2.6 | 370 |
| | 05/08/95 | Zinc | 618 | J | = | 0.96 | 1,500 |
| SWSD003 Background | 05/08/95 | Aluminum | 4,810 | | = | 4 | NE |
| | 05/08/95 | Antimony | 1.9 | J | = | 0.33 | 14 |
| | 05/08/95 | Arsenic | 8.5 | J | = | 0.8 | 20 |
| | 05/08/95 | Barium | 105 | | = | 0.4 | 700 |
| | 05/08/95 | Beryllium | 0.32 | | = | 0.16 | 1 |
| | 05/08/95 | Cadmium | 1.5 | J | = | 0.78 | 1 |
| | 05/08/95 | Calcium | 5,960 | J | = | 3.7 | NE |
| | 05/08/95 | Chromium | 30.2 | J | = | 0.93 | NE |

# Table 7
## 1995 Sediment Analytical Results - Detected Metals [a]
## Maywood Interim Storage Site

| Sampling Location [b] | Date Collected | Analyte | Result (mg/kg) | Data Qualifiers [c] BNI | Lab | Detection Limit (mg/kg) | State Regulations [d] (mg/kg) |
|---|---|---|---|---|---|---|---|
| SWSD003 | 05/08/95 | Cobalt | 5.4 | | = | 0.73 | NE |
| Background | 05/08/95 | Copper | 74.9 | J | = | 0.69 | 600 |
| continued | 05/08/95 | Iron | 12,700 | | = | 2.7 | NE |
| | 05/08/95 | Lead | 311 | J | = | 6.9 | 100 |
| | 05/08/95 | Magnesium | 2,630 | | = | 10.7 | NE |
| | 05/08/95 | Manganese | 114 | J | = | 0.84 | NE |
| | 05/08/95 | Molybdenum | 23 | | = | 1.6 | NE |
| | 05/08/95 | Nickel | 20.3 | | = | 2.3 | 250 |
| | 05/08/95 | Sodium | 376 | | = | 9.3 | NE |
| | 05/08/95 | Vanadium | 22.4 | | = | 1.5 | 370 |
| | 05/08/95 | Zinc | 342 | J | = | 0.55 | 1,500 |

a. *Only the analytes that were detected are reported. See Table 13 for a comprehensive* listing of requested analyses and associated detection limits.

b. Text and figures refer to sampling locations by the last non-zero digit of the formal identifier presented in the table (e.g., SWSD002 is location 2).

c. Bechtel National, Inc. and laboratory data qualifier flags:
J = Reported as an estimated value. Data quality evaluation indicates that the analytical result is an estimate of the actual value.
(=) = Analytical result reported.

d. New Jersey Proposed Cleanup Standards for Contaminated Sites; Residential Soil Cleanup Standard; (24 NJR 373 January 1992). NE = Not established.

e. *A quality control (QC) duplicate is collected at the same time and location and is analyzed by* the same method for use in evaluation of precision in sampling and analysis.

**Table 8**
**1995 Field Parameter Summary**
**Maywood Interim Storage Site**

| Sampling Location | Date | pH | Temp (°C) | Spec. Cond.[a] (mS/cm) | DO[b] (mg/L) | Turbidity (NTU)[c] | Eh (mV)[d] | Purge Volume[e] | Discharge (GPM)[f] |
|---|---|---|---|---|---|---|---|---|---|
| MISS01AA | 05/18/95 | 7.07 | 15.2 | 3.01 | -[g] | 11 | 25 | 1.08 | 0.01 |
| MISS01B | 05/10/95 | 7.17 | 12.7 | 0.878 | 0.14 | 15 | -51 | 1.0 | 0.10 |
| MISS02A | 05/10/95 | 7.08 | 11.7 | 5.40 | 1.11 | 12 | 137 | 2.95 | 0.06 |
| MISS02B | 05/09/95 | 6.89 | 12.9 | 5.99 | 0.22 | 24 | -124 | 1.0 | 0.12 |
| MISS05A | 05/12/95 | 6.69 | 12.2 | 2.77 | 2.60 | 46 | 46 | 6.25 | 0.04 |
| MISS05B | 05/09/95 | 6.96 | 11.9 | 3.88 | 0.60 | 0 | -152 | 1.0 | 0.14 |
| MISS06A | 05/16/95 | 7.03 | 17.8 | 2.20 | - | 1 | 27 | 2.53 | 0.02 |
| MISS07B | 05/11/95 | 7.19 | 11.9 | 5.88 | 0.35 | 38 | -64 | 1.0 | 0.11 |
| B38W01S | 05/21/95 | 6.62 | 12.5 | 2.89 | - | 55 | - | 1.04 | 0.04 |
| B38W02D | 05/20/95 | 6.70 | 13.2 | 0.604 | - | 11 | - | 1.0 | 0.06 |
| B38W14S | 05/20/95 | 7.10 | 12.9 | 0.902 | - | 9 | - | 1.21 | 0.06 |
| B38W14D | 05/20/95 | 7.04 | 14.2 | 1.128 | - | 24 | - | 1.0 | 0.06 |
| B38W15S | 05/19/95 | 7.27 | 12.6 | 2.67 | - | 12 | - | 1.09 | 0.04 |
| B38W15D | 05/19/95 | 7.48 | 13.4 | 1.918 | - | 11 | - | 1.0 | 0.08 |

# Table 8
## 1995 Field Parameter Summary
## Maywood Interim Storage Site

| Sampling Location | Date | pH | Temp (°C) | Spec. Cond.[a] (mS/cm) | DO[b] (mg/L) | Turbidity (NTU)[c] | Eh (mV)[d] | Purge Volume[e] | Discharge (GPM)[f] |
|---|---|---|---|---|---|---|---|---|---|
| B38W17A | 05/20/95 | 6.69 | 15.1 | 0.808 | -[g] | 42 | - | 3.12 | 0.02 |
| B38W17B | 05/20/95 | 6.97 | 12.9 | 3.54 | - | 3 | - | 1.16 | 0.12 |
| B38W18D | 05/15/95 | 5.8 | 14.5 | 0.854 | 0.48 | 4 | 45 | 1.01 | 0.12 |
| B38W19S | 05/17/95 | 6.97 | 14.0 | 3.38 | - | 8 | 174 | 2.03 | 0.01 |
| B38W19D | 05/10/95 | 6.80 | 12.0 | 4.25 | 0.65 | 4 | -103 | 1.41 | 0.16 |
| B38W24S[h] | 05/17/95 | - | - | - | - | - | - | 3.12 | 0.10 |
| B38W24D | 05/17/95 | 6.27 | 15.4 | 1.030 | - | 11 | -57 | 1.10 | 0.08 |
| B38W25S | 05/15/95 | 6.86 | 11.7 | 1.284 | 0.76 | 24 | -57 | 5.85 | 0.06 |
| B38W25D | 05/12/95 | 6.79 | 12.0 | 1.106 | 0.60 | 2 | -99 | 1.40 | 0.12 |

a. Specific Conductance, measured in milliSiemens/centimeter (mS/cm)
b. Dissolved Oxygen
c. Nephelometric turbidity units
d. Oxidation/reduction potential, measured in milliVolts (mV)
e. Purge volumes = gallons purged/one purge volume
f. Gallons per minute
g. ( - ) Parameter not measured; dissolved oxygen and Eh probes were inoperable
h. YSI 3800 water quality system inoperable while purging well B38W24S

# Table 9
## 1995 Groundwater Quality Analytical Results
## Maywood Interim Storage Site



| Sampling Location | Date Collected | Analyte [a] | Result (mg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (mg/L) | Related Regulations [c] Federal [d] (mg/L) | Related Regulations [c] State [c] (mg/L) |
|---|---|---|---|---|---|---|---|---|
| B38W01S | 05/21/95 | Alkalinity | 235 | | = | 2 | NE | NE |
| | 05/21/95 | Bicarbonate | 235 | | = | 2 | NE | NE |
| | 05/21/95 | Carbonate | 2 | | U | 2 | NE | NE |
| | 05/21/95 | Chloride | 9.6 | | = | 0.25 | 250 | 250 |
| | 05/21/95 | Nitrate / nitrite | 0.19 | | = | 0.02 | 10 | 10 |
| | 05/21/95 | Phosphate | 0.15 | | = | 0.05 | NE | NE |
| | 05/21/95 | Sulfate | 121 | | = | 10 | 250 | 250 |
| | 05/21/95 | Total dissolved solids | 1,980 | | = | 5 | 500 | 500 |
| B38W15D | 05/19/95 | Alkalinity | 279 | | = | 2 | NE | NE |
| | 05/19/95 | Bicarbonate | 279 | | = | 2 | NE | NE |
| | 05/19/95 | Carbonate | 2 | | U | 2 | NE | NE |
| | 05/19/95 | Chloride | 103 | | = | 6.2 | 250 | 250 |
| | 05/19/95 | Nitrate / nitrite | 1.2 | | = | 0.1 | 10 | 10 |
| | 05/19/95 | Phosphate | 0.05 | | U | 0.05 | NE | NE |
| | 05/19/95 | Sulfate | 400 | | = | 125 | 250 | 250 |
| | 05/19/95 | Total dissolved solids | 1,020 | | = | 5 | 500 | 500 |
| B38W15S | 05/19/95 | Alkalinity | 342 | | = | 2 | NE | NE |
| | 05/19/95 | Bicarbonate | 342 | | = | 2 | NE | NE |
| | 05/19/95 | Carbonate | 2 | | U | 2 | NE | NE |
| | 05/19/95 | Chloride | 129 | | = | 6.2 | 250 | 250 |
| | 05/19/95 | Nitrate / nitrite | 0.05 | | = | 0.02 | 10 | 10 |
| | 05/19/95 | Phosphate | 0.16 | | = | 0.05 | NE | NE |
| | 05/19/95 | Sulfate | 563 | | = | 125 | 250 | 250 |
| | 05/19/95 | Total dissolved solids | 1,390 | | = | 5 | 500 | 500 |
| B38W15S QC Duplicate [e] | 05/19/95 | Alkalinity | 335 | | = | 2 | NE | NE |
| | 05/19/95 | Bicarbonate | 335 | | = | 2 | NE | NE |
| | 05/19/95 | Carbonate | 2 | | U | 2 | NE | NE |
| | 05/19/95 | Chloride | 130 | | = | 6.2 | 250 | 250 |
| | 05/19/95 | Nitrate / nitrite | 0.05 | | = | 0.02 | 10 | 10 |
| | 05/19/95 | Phosphate | 0.16 | | = | 0.05 | NE | NE |
| | 05/19/95 | Sulfate | 593 | | = | 83.3 | 250 | 250 |
| | 05/19/95 | Total dissolved solids | 1,410 | | = | 5 | 500 | 500 |
| B38W25D | 05/12/95 | Alkalinity | 289 | | = | 2 | NE | NE |
| | 05/12/95 | Bicarbonate | 289 | | = | 2 | NE | NE |
| | 05/12/95 | Carbonate | 2 | | U | 2 | NE | NE |
| | 05/12/95 | Chloride | 18.5 | | = | 1.2 | 250 | 250 |
| | 05/12/95 | Nitrate / nitrite | 0.07 | | = | 0.02 | 10 | 10 |

# Table 9
## 1995 Groundwater Quality Analytical Results
## Maywood Interim Storage Site



| Sampling Location | Date Collected | Analyte[a] | Result (mg/L) | Data Qualifiers[b] BNI | Data Qualifiers[b] Lab | Detection Limit (mg/L) | Related Regulations[c] Federal[d] (mg/L) | Related Regulations[c] State[e] (mg/L) |
|---|---|---|---|---|---|---|---|---|
| B38W25D | 05/12/95 | Phosphate | 2.1 | | = | 0.25 | NE | NE |
| continued | 05/12/95 | Sulfate | 301 | | = | 25 | 250 | 250 |
| | 05/12/95 | Total dissolved solids | 762 | | = | 5 | 500 | 500 |
| B38W25S | 05/15/95 | Alkalinity | 344 | | = | 2 | NE | NE |
| | 05/15/95 | Bicarbonate | 344 | | = | 2 | NE | NE |
| | 05/15/95 | Carbonate | 2 | | U | 2 | NE | NE |
| | 05/15/95 | Chloride | 16 | | = | 0.5 | 250 | 250 |
| | 05/15/95 | Nitrate / nitrite | 0.17 | | = | 0.02 | 10 | 10 |
| | 05/15/95 | Phosphate | 2.1 | | = | 0.25 | NE | NE |
| | 05/15/95 | Sulfate | 283 | | = | 50 | 250 | 250 |
| | 05/15/95 | Total dissolved solids | 836 | J | = | 5 | 500 | 500 |
| B38W25S | 05/15/95 | Alkalinity | 329 | | = | 2 | NE | NE |
| QC Duplicate[f] | 05/15/95 | Bicarbonate | 329 | | = | 2 | NE | NE |
| | 05/15/95 | Carbonate | 2 | | U | 2 | NE | NE |
| | 05/15/95 | Chloride | 16.9 | | = | 1.2 | 250 | 250 |
| | 05/15/95 | Nitrate / nitrite | 0.24 | | = | 0.02 | 10 | 10 |
| | 05/15/95 | Phosphate | 2 | | = | 0.25 | NE | NE |
| | 05/15/95 | Total dissolved solids | 1,020 | J | = | 5 | 500 | 500 |
| B38W02D | 05/20/95 | Alkalinity | 209 | | = | 2 | NE | NE |
| | 05/20/95 | Bicarbonate | 209 | | = | 2 | NE | NE |
| | 05/20/95 | Carbonate | 2 | | U | 2 | NE | NE |
| | 05/20/95 | Chloride | 21.7 | | = | 1.2 | 250 | 250 |
| | 05/20/95 | Nitrate / nitrite | 1.8 | | = | 0.1 | 10 | 10 |
| | 05/20/95 | Phosphate | 0.061 | | = | 0.05 | NE | NE |
| | 05/20/95 | Sulfate | 30.8 | | = | 10 | 250 | 250 |
| | 05/20/95 | Total dissolved solids | 363 | | = | 5 | 500 | 500 |

a. Analytical results for calcium, magnesium, potassium, and sodium (utilized in the construction of Figures 11 and 12) can be found in Table 10.

b. Bechtel National, Inc. and laboratory data qualifier flags:
J = Reported as an estimated value.
U = Analyte was not detected. Detection limit reported.
(=) = Actual value reported.

c. Regulations presented pertain to drinking water quality and are listed for comparison only. No drinking water supply is obtained from groundwater at MISS. NE = Not established.

d. Safe Drinking Water Act maximum contaminant levels from EPA Drinking Water Regulations and Health Advisories (May 1994).

e. New Jersey Class IIA Groundwater Quality Standard.

f. A quality control (QC) duplicate is collected at the same time and location and is analyzed by the same method for use in evaluation of precision in sampling and analysis.

# Table 10
## 1995 Groundwater Analytical Results - Detected Metals [a]
## Maywood Interim Storage Site

| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| B38W01S | 05/21/95 | Aluminum | 225 | | = | 18 | NE | 200 |
| | 05/21/95 | Barium | 13.1 | | = | 1.8 | 2,000 | 2,000 |
| | 05/21/95 | Beryllium | 3.1 | | = | 0.7 | 4 | 0.008 / 20 [f] |
| | 05/21/95 | Boron | 444 | | = | 11.9 | NE | NE |
| | 05/21/95 | Calcium | 371,000 | | = | 16.6 | NE | NE |
| | 05/21/95 | Cobalt | 4.7 | | = | 3.3 | NE | NE |
| | 05/21/95 | Iron | 22,100 | | = | 12.4 | NE | 300 |
| | 05/21/95 | Magnesium | 27,600 | | = | 48.1 | NE | NE |
| | 05/21/95 | Manganese | 2,340 | | = | 3.8 | NE | 50 |
| | 05/21/95 | Potassium | 44,600 | | = | 1,060 | NE | NE |
| | 05/21/95 | Sodium | 53,700 | | = | 42.1 | NE | 50,000 |
| B38W14D | 05/20/95 | Aluminum | 38.1 | | = | 18 | NE | 200 |
| | 05/20/95 | Barium | 73.6 | | = | 1.8 | 2,000 | 2,000 |
| | 05/20/95 | Boron | 108 | | = | 11.9 | NE | NE |
| | 05/20/95 | Calcium | 77,400 | | = | 16.6 | NE | NE |
| | 05/20/95 | Copper | 5.7 | | = | 3.1 | 1,300 | 1,000 |
| | 05/20/95 | Iron | 32 | | = | 12.4 | NE | 300 |
| | 05/20/95 | Lead | 2.8 | J | = | 1.5 | NE | 50 |
| | 05/20/95 | Magnesium | 19,500 | | = | 48.1 | NE | NE |
| | 05/20/95 | Manganese | 5.3 | | = | 3.8 | NE | 50 |
| | 05/20/95 | Molybdenum | 16.6 | | = | 7.1 | NE | NE |
| | 05/20/95 | Potassium | 3,750 | | = | 1,060 | NE | NE |
| | 05/20/95 | Sodium | 22,100 | | = | 42.1 | NE | 50,000 |
| B38W14S | 05/20/95 | Aluminum | 48 | | = | 18 | NE | 200 |
| | 05/20/95 | Barium | 61.6 | | = | 1.8 | 2,000 | 2,000 |
| | 05/20/95 | Boron | 142 | | = | 11.9 | NE | NE |
| | 05/20/95 | Calcium | 70,800 | | = | 16.6 | NE | NE |
| | 05/20/95 | Chromium | 35.9 | | = | 4.2 | 100 | 10 |
| | 05/20/95 | Copper | 4.1 | | = | 3.1 | 1,300 | 1,000 |
| | 05/20/95 | Iron | 324 | | = | 12.4 | NE | 300 |
| | 05/20/95 | Lead | 2.9 | J | = | 1.5 | NE | 50 |
| | 05/20/95 | Magnesium | 20,000 | | = | 48.1 | NE | NE |
| | 05/20/95 | Manganese | 7.9 | | = | 3.8 | NE | 50 |
| | 05/20/95 | Molybdenum | 18.1 | | = | 7.1 | NE | NE |
| | 05/20/95 | Potassium | 2,850 | | = | 1,060 | NE | NE |
| | 05/20/95 | Sodium | 13,500 | | = | 42.1 | NE | 50,000 |
| | 05/20/95 | Zinc | 40.1 | | = | 2.5 | NE | 5,000 |
| B38W15D | 05/19/95 | Barium | 22.3 | | = | 1.8 | 2,000 | 2,000 |
| | 05/19/95 | Boron | 338 | | = | 11.9 | NE | NE |
| | 05/19/95 | Calcium | 58,700 | J | = | 16.6 | NE | NE |

**Table 10**
**1995 Groundwater Analytical Results - Detected Metals [a]**
**Maywood Interim Storage Site**

| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| B38W15D | 05/19/95 | Magnesium | 22,700 | J | = | 48.1 | NE | NE |
| continued | 05/19/95 | Manganese | 638 | J | = | 3.8 | NE | 50 |
| | 05/19/95 | Potassium | 43,300 | J | = | 1,060 | NE | NE |
| | 05/19/95 | Sodium | 245,000 | | = | 42.1 | NE | 50,000 |
| B38W15S | 05/19/95 | Aluminum | 247 | | = | 18 | NE | 200 |
| | 05/19/95 | Arsenic | 4.9 | | = | 1.8 | 50 | 0.02 / 8 [g] |
| | 05/19/95 | Barium | 50.9 | | = | 1.8 | 2,000 | 2,000 |
| | 05/19/95 | Boron | 608 | | = | 11.9 | NE | NE |
| | 05/19/95 | Calcium | 80,500 | J | = | 16.6 | NE | NE |
| | 05/19/95 | Copper | 9.3 | | = | 3.1 | 1,300 | 1,000 |
| | 05/19/95 | Iron | 1,720 | | = | 12.4 | NE | 300 |
| | 05/19/95 | Lead | 2 | | = | 1.5 | NE | 50 |
| | 05/19/95 | Magnesium | 27,700 | J | = | 48.1 | NE | NE |
| | 05/19/95 | Manganese | 2,170 | J | = | 3.8 | NE | 50 |
| | 05/19/95 | Potassium | 168,000 | J | = | 1,060 | NE | NE |
| | 05/19/95 | Sodium | 269,000 | | = | 42.1 | NE | 50,000 |
| B38W15S | 05/19/95 | Aluminum | 170 | | = | 18 | NE | 200 |
| QC duplicate [h] | 05/19/95 | Arsenic | 4.8 | | = | 1.8 | 50 | 0.02 / 8 |
| | 05/19/95 | Barium | 46.1 | | = | 1.8 | 2,000 | 2,000 |
| | 05/19/95 | Boron | 566 | | = | 11.9 | NE | NE |
| | 05/19/95 | Calcium | 75,100 | J | = | 16.6 | NE | NE |
| | 05/19/95 | Copper | 6.4 | | = | 3.1 | 1,300 | 1,000 |
| | 05/19/95 | Iron | 1,450 | | = | 12.4 | NE | 300 |
| | 05/19/95 | Lead | 2.4 | | = | 1.5 | NE | 50 |
| | 05/19/95 | Magnesium | 25,300 | J | = | 48.1 | NE | NE |
| | 05/19/95 | Manganese | 1,970 | J | = | 3.8 | NE | 50 |
| | 05/19/95 | Potassium | 154,000 | J | = | 1,060 | NE | NE |
| | 05/19/95 | Sodium | 248,000 | | = | 42.1 | NE | 50,000 |
| B38W17A | 05/20/95 | Aluminum | 29.6 | | = | 18 | NE | 200 |
| | 05/20/95 | Barium | 36.4 | | = | 1.8 | 2,000 | 2,000 |
| | 05/20/95 | Boron | 156 | | = | 11.9 | NE | NE |
| | 05/20/95 | Calcium | 57,300 | | = | 16.6 | NE | NE |
| | 05/20/95 | Chromium | 56.6 | | = | 4.2 | 100 | 10 |
| | 05/20/95 | Iron | 688 | | = | 12.4 | NE | 300 |
| | 05/20/95 | Lead | 2.8 | J | = | 1.5 | NE | 50 |
| | 05/20/95 | Magnesium | 5,610 | | = | 48.1 | NE | NE |
| | 05/20/95 | Manganese | 55.9 | | = | 3.8 | NE | 50 |
| | 05/20/95 | Molybdenum | 18.9 | | = | 7.1 | NE | NE |
| | 05/20/95 | Nickel | 167 | | = | 10.3 | 100 | 100 |
| | 05/20/95 | Potassium | 13,900 | | = | 1,060 | NE | NE |
| | 05/20/95 | Sodium | 28,000 | | = | 42.1 | NE | 50,000 |

# Table 10
## 1995 Groundwater Analytical Results - Detected Metals [a]
## Maywood Interim Storage Site

| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| B38W17B | 05/20/95 | Aluminum | 34.6 | | = | 18 | NE | 200 |
| | 05/20/95 | Barium | 71.8 | | = | 1.8 | 2,000 | 2,000 |
| | 05/20/95 | Boron | 382 | | = | 11.9 | NE | NE |
| | 05/20/95 | Calcium | 223,000 | | = | 16.6 | NE | NE |
| | 05/20/95 | Cobalt | 4.6 | | = | 3.3 | NE | NE |
| | 05/20/95 | Iron | 6,570 | | = | 12.4 | NE | 300 |
| | 05/20/95 | Magnesium | 22,800 | | = | 48.1 | NE | NE |
| | 05/20/95 | Manganese | 4,020 | | = | 3.8 | NE | 50 |
| | 05/20/95 | Potassium | 73,200 | | = | 1,060 | NE | NE |
| | 05/20/95 | Sodium | 232,000 | | = | 42.1 | NE | 50,000 |
| | 05/20/95 | Vanadium | 7.6 | | = | 6.7 | NE | NE |
| B38W18D | 05/15/95 | Barium | 22.7 | | = | 1.8 | 2,000 | 2,000 |
| | 05/15/95 | Beryllium | 1.1 | | = | 0.7 | 4 | 0.008 / 20 |
| | 05/15/95 | Boron | 425 | | = | 11.9 | NE | NE |
| | 05/15/95 | Calcium | 154,000 | | = | 16.6 | NE | NE |
| | 05/15/95 | Chromium | 29.9 | | = | 4.2 | 100 | 10 |
| | 05/15/95 | Cobalt | 18.5 | | = | 3.3 | NE | NE |
| | 05/15/95 | Iron | 14,400 | | = | 12.4 | NE | 300 |
| | 05/15/95 | Magnesium | 14,100 | | = | 48.1 | NE | NE |
| | 05/15/95 | Manganese | 4,010 | | = | 3.8 | NE | 50 |
| | 05/15/95 | Nickel | 26.3 | | = | 10.3 | 100 | 100 |
| | 05/15/95 | Potassium | 6,370 | | = | 1,060 | NE | NE |
| | 05/15/95 | Sodium | 27,000 | | = | 5,000 | NE | 50,000 |
| | 05/15/95 | Zinc | 152 | J | = | 2.5 | NE | 5,000 |
| B38W19D | 05/10/95 | Arsenic | 48.8 | J | = | 1.8 | 50 | 0.02 / 8 |
| | 05/10/95 | Barium | 22.4 | | = | 1.8 | 2,000 | 2,000 |
| | 05/10/95 | Boron | 885 | | = | 11.9 | NE | NE |
| | 05/10/95 | Calcium | 180,000 | | = | 16.6 | NE | NE |
| | 05/10/95 | Iron | 2,630 | J | = | 12.4 | NE | 300 |
| | 05/10/95 | Magnesium | 31,200 | | = | 48.1 | NE | NE |
| | 05/10/95 | Manganese | 2,030 | | = | 3.8 | NE | 50 |
| | 05/10/95 | Potassium | 329,000 | | = | 1,060 | NE | NE |
| | 05/10/95 | Sodium | 306,000 | | = | 42.1 | NE | 50,000 |
| B38W19S | 05/17/95 | Barium | 47.5 | | = | 1.8 | 2,000 | 2,000 |
| | 05/17/95 | Boron | 1,240 | | = | 11.9 | NE | NE |
| | 05/17/95 | Calcium | 657,000 | | = | 16.6 | NE | NE |
| | 05/17/95 | Copper | 4.8 | | = | 3.1 | 1,300 | 1,000 |
| | 05/17/95 | Iron | 1,300 | | = | 12.4 | NE | 300 |
| | 05/17/95 | Magnesium | 69,000 | | = | 48.1 | NE | NE |
| | 05/17/95 | Manganese | 301 | | = | 3.8 | NE | 50 |

# Table 10
## 1995 Groundwater Analytical Results - Detected Metals [a]
## Maywood Interim Storage Site

| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| B38W19S | 05/17/95 | Molybdenum | 20.4 | | = | 7.1 | NE | NE |
| continued | 05/17/95 | Potassium | 40,400 | | = | 1,060 | NE | NE |
| | 05/17/95 | Sodium | 23,700 | J | = | 42.1 | NE | 50,000 |
| | 05/17/95 | Vanadium | 6.7 | | = | 6.7 | NE | NE |
| B38W24D | 05/17/95 | Barium | 24.6 | | = | 1.8 | 2,000 | 2,000 |
| | 05/17/95 | Calcium | 69,700 | | = | 16.6 | NE | NE |
| | 05/17/95 | Iron | 17,500 | | = | 12.4 | NE | 300 |
| | 05/17/95 | Magnesium | 8,290 | | = | 48.1 | NE | NE |
| | 05/17/95 | Manganese | 3,980 | | = | 3.8 | NE | 50 |
| | 05/17/95 | Potassium | 7,530 | | = | 1,060 | NE | NE |
| | 05/17/95 | Sodium | 39,700 | J | = | 42.1 | NE | 50,000 |
| B38W24S | 05/17/95 | Barium | 45.6 | | = | 1.8 | 2,000 | 2,000 |
| | 05/17/95 | Beryllium | 0.77 | | = | 0.7 | 4 | 0.008 / 20 |
| | 05/17/95 | Boron | 132 | | = | 11.9 | NE | NE |
| | 05/17/95 | Calcium | 57,000 | | = | 16.6 | NE | NE |
| | 05/17/95 | Cobalt | 6 | | = | 3.3 | NE | NE |
| | 05/17/95 | Iron | 46,500 | | = | 12.4 | NE | 300 |
| | 05/17/95 | Lead | 1.8 | | = | 1.5 | NE | 50 |
| | 05/17/95 | Magnesium | 8,430 | | = | 48.1 | NE | NE |
| | 05/17/95 | Manganese | 5,420 | | = | 3.8 | NE | 50 |
| | 05/17/95 | Potassium | 7,050 | | = | 1,060 | NE | NE |
| | 05/17/95 | Sodium | 18,800 | J | = | 42.1 | NE | 50,000 |
| B38W25D | 05/12/95 | Aluminum | 48.6 | | = | 18 | NE | 200 |
| | 05/12/95 | Antimony | 2.9 | | = | 1.5 | 6 | 2 / 10 [i] |
| | 05/12/95 | Barium | 62.7 | | = | 1.8 | 2,000 | 2,000 |
| | 05/12/95 | Boron | 236 | J | = | 11.9 | NE | NE |
| | 05/12/95 | Calcium | 144,000 | | = | 16.6 | NE | NE |
| | 05/12/95 | Chromium | 36.5 | J | = | 4.2 | 100 | 10 |
| | 05/12/95 | Cobalt | 4.4 | | = | 3.3 | NE | NE |
| | 05/12/95 | Iron | 6,760 | | = | 12.4 | NE | 300 |
| | 05/12/95 | Magnesium | 6,940 | | = | 48.1 | NE | NE |
| | 05/12/95 | Manganese | 1,740 | J | = | 3.8 | NE | 50 |
| | 05/12/95 | Nickel | 27.7 | | = | 10.3 | 100 | 100 |
| | 05/12/95 | Potassium | 73,900 | J | = | 1,060 | NE | NE |
| | 05/12/95 | Sodium | 43,700 | J | = | 42.1 | NE | 50,000 |
| B38W25S | 05/15/95 | Antimony | 1.5 | | = | 1.5 | 6 | 2 / 10 |
| | 05/15/95 | Barium | 68.5 | | = | 1.8 | 2,000 | 2,000 |
| | 05/15/95 | Boron | 227 | | = | 11.9 | NE | NE |
| | 05/15/95 | Calcium | 208,000 | | = | 16.6 | NE | NE |
| | 05/15/95 | Chromium | 14.6 | | = | 4.2 | 100 | 10 |

# Table 10
## 1995 Groundwater Analytical Results - Detected Metals [a]
## Maywood Interim Storage Site

| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| B38W25S | 05/15/95 | Cobalt | 3.6 | | = | 3.3 | NE | NE |
| continued | 05/15/95 | Iron | 14,600 | | = | 12.4 | NE | 300 |
| | 05/15/95 | Magnesium | 9,110 | | = | 48.1 | NE | NE |
| | 05/15/95 | Manganese | 1,540 | | = | 3.8 | NE | 50 |
| | 05/15/95 | Nickel | 22.5 | | = | 10.3 | 100 | 100 |
| | 05/15/95 | Potassium | 88,400 | | = | 1,060 | NE | NE |
| | 05/15/95 | Sodium | 37,200 | | = | 5,000 | NE | 50,000 |
| B38W25S | 05/15/95 | Arsenic | 2.5 | | = | 1.8 | 50 | 0.02 / 8 |
| QC duplicate | 05/15/95 | Barium | 43.1 | | = | 1.8 | 2,000 | 2,000 |
| | 05/15/95 | Boron | 171 | | = | 11.9 | NE | NE |
| | 05/15/95 | Calcium | 199,000 | | = | 16.6 | NE | NE |
| | 05/15/95 | Chromium | 12.7 | | = | 4.2 | 100 | 10 |
| | 05/15/95 | Iron | 12,000 | | = | 12.4 | NE | 300 |
| | 05/15/95 | Magnesium | 7,630 | | = | 48.1 | NE | NE |
| | 05/15/95 | Manganese | 1,410 | | = | 3.8 | NE | 50 |
| | 05/15/95 | Nickel | 30 | | = | 10.3 | 100 | 100 |
| | 05/15/95 | Potassium | 88,800 | | = | 1,060 | NE | NE |
| | 05/15/95 | Sodium | 37,000 | | = | 5,000 | NE | 50,000 |
| MISS01AA | 05/18/95 | Arsenic | 18.7 | | = | 1.8 | 50 | 0.02 / 8 |
| | 05/18/95 | Barium | 10.6 | | = | 1.8 | 2,000 | 2,000 |
| | 05/18/95 | Boron | 222 | | = | 11.9 | NE | NE |
| | 05/18/95 | Calcium | 714,000 | | = | 16.6 | NE | NE |
| | 05/18/95 | Iron | 360 | | = | 12.4 | NE | 300 |
| | 05/18/95 | Lead | 2 | | = | 1.5 | NE | 50 |
| | 05/18/95 | Magnesium | 22,000 | | = | 48.1 | NE | NE |
| | 05/18/95 | Manganese | 8.6 | | = | 3.8 | NE | 50 |
| | 05/18/95 | Molybdenum | 10 | | = | 7.1 | NE | NE |
| | 05/18/95 | Potassium | 1,550 | | = | 1,060 | NE | NE |
| | 05/18/95 | Sodium | 5,990 | J | = | 42.1 | NE | 50,000 |
| MISS01B | 05/10/95 | Arsenic | 2.7 | J | = | 1.8 | 50 | 0.02 / 8 |
| | 05/10/95 | Barium | 66.9 | | = | 1.8 | 2,000 | 2,000 |
| | 05/10/95 | Cadmium | 3.9 | | = | 3.5 | 5 | 2 |
| | 05/10/95 | Calcium | 84,500 | | = | 16.6 | NE | NE |
| | 05/10/95 | Copper | 4.6 | | = | 3.1 | 1,300 | 1,000 |
| | 05/10/95 | Iron | 1,030 | J | = | 12.4 | NE | 300 |
| | 05/10/95 | Magnesium | 17,600 | | = | 48.1 | NE | NE |
| | 05/10/95 | Manganese | 271 | | = | 3.8 | NE | 50 |
| | 05/10/95 | Potassium | 6,950 | | = | 1,060 | NE | NE |
| | 05/10/95 | Zinc | 34.6 | | = | 2.5 | NE | 5,000 |
| | 05/10/95 | Sodium | 48,100 | | = | 42.1 | NE | 50,000 |

## Table 10
## 1995 Groundwater Analytical Results - Detected Metals [a]
## Maywood Interim Storage Site



| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| MISS02A | 05/10/95 | Aluminum | 896 | | = | 18 | NE | 200 |
| | 05/10/95 | Antimony | 2.4 | | = | 1.5 | 6 | 2 / 10 |
| | 05/10/95 | Arsenic | 6,000 | J | = | 360 | 50 | 0.02 / 8 |
| | 05/10/95 | Barium | 12 | | = | 1.8 | 2,000 | 2,000 |
| | 05/10/95 | Boron | 1,190 | | = | 11.9 | NE | NE |
| | 05/10/95 | Calcium | 54,500 | | = | 16.6 | NE | NE |
| | 05/10/95 | Chromium | 94.5 | | = | 4.2 | 100 | 10 |
| | 05/10/95 | Copper | 173 | | = | 3.1 | 1,300 | 1,000 |
| | 05/10/95 | Iron | 892 | J | = | 12.4 | NE | 300 |
| | 05/10/95 | Lead | 3.6 | | = | 1.5 | NE | 50 |
| | 05/10/95 | Magnesium | 3,410 | | = | 48.1 | NE | NE |
| | 05/10/95 | Manganese | 50.6 | | = | 3.8 | NE | 50 |
| | 05/10/95 | Nickel | 11.4 | | = | 10.3 | 100 | 100 |
| | 05/10/95 | Potassium | 4,340 | | = | 1,060 | NE | NE |
| | 05/10/95 | Selenium | 1.5 | | = | 1.2 | 50 | 50 |
| | 05/10/95 | Sodium | 986,000 | | = | 42.1 | NE | 50,000 |
| | 05/10/95 | Vanadium | 10.1 | | = | 6.7 | NE | NE |
| | 05/10/95 | Zinc | 19.3 | | = | 2.5 | NE | 5,000 |
| MISS02B | 05/09/95 | Aluminum | 89.9 | | = | 18 | NE | 200 |
| | 05/09/95 | Antimony | 4.8 | J | = | 1.5 | 6 | 2 / 10 |
| | 05/09/95 | Barium | 18.1 | | = | 1.8 | 2,000 | 2,000 |
| | 05/09/95 | Boron | 1,220 | | = | 11.9 | NE | NE |
| | 05/09/95 | Calcium | 248,000 | | = | 16.6 | NE | NE |
| | 05/09/95 | Chromium | 5.3 | | = | 4.2 | 100 | 10 |
| | 05/09/95 | Cobalt | 5.4 | | = | 3.3 | NE | NE |
| | 05/09/95 | Copper | 6 | | = | 3.1 | 1,300 | 1,000 |
| | 05/09/95 | Iron | 8,690 | | = | 12.4 | NE | 300 |
| | 05/09/95 | Magnesium | 33,600 | | = | 48.1 | NE | NE |
| | 05/09/95 | Manganese | 4,210 | | = | 3.8 | NE | 50 |
| | 05/09/95 | Potassium | 40,300 | | = | 1,060 | NE | NE |
| | 05/09/95 | Sodium | 932,000 | J | = | 42.1 | NE | 50,000 |
| | 05/09/95 | Vanadium | 6.8 | | = | 6.7 | NE | NE |
| | 05/09/95 | Zinc | 22 | | = | 2.5 | NE | 5,000 |
| MISS05A | 05/12/95 | Aluminum | 77.2 | | = | 18 | NE | 200 |
| | 05/12/95 | Antimony | 1.8 | | = | 1.5 | 6 | 2 / 10 |
| | 05/12/95 | Arsenic | 3.8 | | = | 1.8 | 50 | 0.02 / 8 |
| | 05/12/95 | Barium | 37.8 | | = | 1.8 | 2,000 | 2,000 |
| | 05/12/95 | Boron | 588 | J | = | 11.9 | NE | NE |
| | 05/12/95 | Calcium | 683,000 | | = | 16.6 | NE | NE |
| | 05/12/95 | Cobalt | 9.1 | | = | 3.3 | NE | NE |

**Table 10**
**1995 Groundwater Analytical Results - Detected Metals [a]**
**Maywood Interim Storage Site**

| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| MISS05A | 05/12/95 | Iron | 15,800 | | = | 12.4 | NE | 300 |
| continued | 05/12/95 | Magnesium | 79,200 | | = | 48.1 | NE | NE |
| | 05/12/95 | Manganese | 1,330 | J | = | 3.8 | NE | 50 |
| | 05/12/95 | Potassium | 84,600 | J | = | 1,060 | NE | NE |
| | 05/12/95 | Sodium | 24,200 | J | = | 42.1 | NE | 50,000 |
| | 05/12/95 | Zinc | 34.4 | | = | 2.5 | NE | 5,000 |
| MISS05B | 05/11/95 | Aluminum | 66.4 | | = | 18 | NE | 200 |
| | 05/11/95 | Arsenic | 10.9 | J | = | 1.8 | 50 | 0.02 / 8 |
| | 05/11/95 | Barium | 128 | | = | 1.8 | 2,000 | 2,000 |
| | 05/11/95 | Boron | 665 | J | = | 11.9 | NE | NE |
| | 05/11/95 | Calcium | 295,000 | | = | 16.6 | NE | NE |
| | 05/11/95 | Chromium | 10.9 | | = | 4.2 | 100 | 10 |
| | 05/11/95 | Copper | 4.9 | | = | 3.1 | 1,300 | 1,000 |
| | 05/11/95 | Iron | 3,180 | J | = | 12.4 | NE | 300 |
| | 05/11/95 | Magnesium | 52,200 | J | = | 48.1 | NE | NE |
| | 05/11/95 | Manganese | 2,180 | | = | 3.8 | NE | 50 |
| | 05/11/95 | Potassium | 231,000 | | = | 1,060 | NE | NE |
| | 05/11/95 | Sodium | 303,000 | | = | 42.1 | NE | 50,000 |
| | 05/11/95 | Zinc | 98 | J | = | 2.5 | NE | 5,000 |
| MISS06A | 05/16/95 | Barium | 122 | | = | 1.8 | 2,000 | 2,000 |
| | 05/16/95 | Boron | 2,080 | | = | 11.9 | NE | NE |
| | 05/16/95 | Calcium | 292,000 | | = | 16.6 | NE | NE |
| | 05/16/95 | Copper | 31.3 | | = | 3.1 | 1,300 | 1,000 |
| | 05/16/95 | Iron | 333 | | = | 12.4 | NE | 300 |
| | 05/16/95 | Magnesium | 19,200 | | = | 48.1 | NE | NE |
| | 05/16/95 | Manganese | 1,540 | | = | 3.8 | NE | 50 |
| | 05/16/95 | Potassium | 97,000 | | = | 1,060 | NE | NE |
| | 05/16/95 | Selenium | 4.9 | | = | 1.2 | 50 | 50 |
| | 05/16/95 | Sodium | 62,600 | | = | 42.1 | NE | 50,000 |
| | 05/16/95 | Zinc | 865 | | = | 2.5 | NE | 5,000 |
| MISS07B | 05/11/95 | Aluminum | 49.3 | | = | 18 | NE | 200 |
| | 05/11/95 | Arsenic | 53.4 | J | = | 1.8 | 50 | 0.02 / 8 |
| | 05/11/95 | Barium | 32.9 | | = | 1.8 | 2,000 | 2,000 |
| | 05/11/95 | Boron | 1,210 | J | = | 11.9 | NE | NE |
| | 05/11/95 | Calcium | 169,000 | | = | 16.6 | NE | NE |
| | 05/11/95 | Chromium | 6.4 | | = | 4.2 | 100 | 10 |
| | 05/11/95 | Cobalt | 5.4 | | = | 3.3 | NE | NE |
| | 05/11/95 | Copper | 7.3 | | = | 3.1 | 1,300 | 1,000 |
| | 05/11/95 | Iron | 7,270 | J | = | 12.4 | NE | 300 |
| | 05/11/95 | Magnesium | 60,000 | J | = | 48.1 | NE | NE |
| | 05/11/95 | Manganese | 2,520 | | = | 3.8 | NE | 50 |

Table 10

1995 Groundwater Analytical Results - Detected Metals [a]

Maywood Interim Storage Site



| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| MISS07B | 05/11/95 | Potassium | 20,400 | | = | 1,060 | NE | NE |
| continued | 05/11/95 | Sodium | 934,000 | | = | 42.1 | NE | 50,000 |
| | 05/11/95 | Vanadium | 28.7 | | = | 6.7 | NE | NE |
| B38W02D | 05/20/95 | Aluminum | 78.6 | | = | 18 | NE | 200 |
| Background | 05/20/95 | Barium | 298 | | = | 1.8 | 2,000 | 2,000 |
| | 05/20/95 | Boron | 125 | | = | 11.9 | NE | NE |
| | 05/20/95 | Calcium | 73,700 | | = | 16.6 | NE | NE |
| | 05/20/95 | Iron | 72 | | = | 12.4 | NE | 300 |
| | 05/20/95 | Magnesium | 3,020 | | = | 48.1 | NE | NE |
| | 05/20/95 | Manganese | 1,240 | | = | 3.8 | NE | 50 |
| | 05/20/95 | Molybdenum | 9.7 | | = | 7.1 | NE | NE |
| | 05/20/95 | Sodium | 6,050 | | = | 42.1 | NE | 50,000 |

a. Only the analytes that were detected are reported. See Table 13 for a comprehensive listing of requested analyses and associated detection limits.

b. Bechtel National, Inc. and laboratory data qualifier flags:
J = Reported as an estimated value. Data quality evaluation indicates that the analytical result is an estimate of the actual value.
(=) = Analytical result reported.

c. Regulations presented pertain to drinking water quality and are listed for comparison only. No drinking water supply is obtained from groundwater at MISS. NE = Not established.

d. Safe Drinking Water Act maximum contaminant levels from EPA Drinking Water Regulations and Health Advisories (May 1994).

e. New Jersey Class IIA Groundwater Quality Standard.

f. For beryllium, the New Jersey Groundwater Quality Standard is 0.008 µg/L, but the practical quantitation limit (PQL) is 20 µg/L.

g. For arsenic, the New Jersey Groundwater Quality Standard is 0.02 µg/L, but the PQL is 8 µg/L.

h. A quality control (QC) duplicate is collected at the same time and location and is analyzed by the same method for use in evaluation of precision in sampling and analysis.

i. For antimony, the New Jersey Groundwater Quality Standard is 2 µg/L, but the PQL is 20 µg/L.

# Table 11
## 1995 Groundwater Analytical Results - Radioactive Constituents
## Maywood Interim Storage Site



| Sampling Location | Date Collected | Analyte | Result [a] (pCi/L) | BNI Flag [b] | MDA[c] (pCi/L) | Result Above Background [d] (pCi/L) | DCG [e] (pCi/L) |
|---|---|---|---|---|---|---|---|
| B38W01S | 05/21/95 | Radium-226 | 0.08 ± 0.10 | UJ | 0.20 | -0.22 ± 0.14 | 100 |
| | 05/21/95 | Thorium-230 | 0.06 ± 0.12 | UJ | 0.26 | 0.00 ± 0.17 | 300 |
| | 05/21/95 | Thorium-232 | 0.02 ± 0.09 | UJ | 0.26 | -0.04 ± 0.11 | 50 |
| | 05/21/95 | Total uranium | 0.18 ± 0.02 | U | 0.02 | -0.08 ± 0.03 | 600 |
| B38W14D | 05/20/95 | Radium-226 | 0.09 ± 0.10 | UJ | 0.14 | -0.21 ± 0.14 | 100 |
| | 05/20/95 | Thorium-230 | 0.15 ± 0.17 | UJ | 0.22 | 0.09 ± 0.21 | 300 |
| | 05/20/95 | Thorium-232 | 0.11 ± 0.00 | UJ | 0.11 | 0.05 ± 0.07 | 50 |
| | 05/20/95 | Total uranium | 0.74 ± 0.08 | | 0.02 | 0.48 ± 0.08 | 600 |
| B38W14S | 05/20/95 | Radium-226 | 0.10 ± 0.10 | UJ | 0.11 | -0.20 ± 0.14 | 100 |
| | 05/20/95 | Thorium-230 | 0.31 ± 0.27 | J | 0.14 | 0.25 ± 0.30 | 300 |
| | 05/20/95 | Thorium-232 | -0.02 ± 0.03 | UJ | 0.28 | -0.08 ± 0.08 | 50 |
| | 05/20/95 | Total uranium | 1.15 ± 0.12 | | 0.02 | 0.89 ± 0.12 | 600 |
| B38W15D | 05/19/95 | Radium-226 | 0.04 ± 0.07 | UJ | 0.11 | -0.26 ± 0.12 | 100 |
| | 05/19/95 | Thorium-230 | 0.22 ± 0.18 | U | 0.10 | 0.16 ± 0.22 | 300 |
| | 05/19/95 | Thorium-232 | 0.07 ± 0.10 | UJ | 0.10 | 0.01 ± 0.12 | 50 |
| | 05/19/95 | Total uranium | 3.66 ± 0.38 | | 0.02 | 3.40 ± 0.38 | 600 |
| B38W15S | 05/19/95 | Radium-226 | 0.27 ± 0.17 | | 0.14 | -0.03 ± 0.20 | 100 |
| | 05/19/95 | Thorium-230 | 0.50 ± 0.31 | U | 0.11 | 0.44 ± 0.33 | 300 |
| | 05/19/95 | Thorium-232 | 0.11 ± 0.00 | UJ | 0.11 | 0.05 ± 0.07 | 50 |
| | 05/19/95 | Total uranium | 0.74 ± 0.08 | | 0.02 | 0.48 ± 0.08 | 600 |
| B38W15S | 05/19/95 | Radium-226 | 0.28 ± 0.17 | | 0.16 | -0.02 ± 0.20 | 100 |
| QC duplicate [f] | 05/19/95 | Thorium-230 | 0.15 ± 0.17 | UJ | 0.26 | 0.09 ± 0.21 | 300 |
| | 05/19/95 | Thorium-232 | -0.01 ± 0.01 | UJ | 0.20 | -0.07 ± 0.07 | 50 |
| | 05/19/95 | Total uranium | 0.81 ± 0.08 | | 0.02 | 0.55 ± 0.08 | 600 |
| B38W17A | 05/20/95 | Radium-226 | 0.05 ± 0.08 | UJ | 0.07 | -0.25 ± 0.13 | 100 |
| | 05/20/95 | Thorium-230 | 0.47 ± 0.31 | U | 0.24 | 0.41 ± 0.33 | 300 |
| | 05/20/95 | Thorium-232 | 0.02 ± 0.09 | UJ | 0.26 | -0.04 ± 0.11 | 50 |
| | 05/20/95 | Total uranium | 0.13 ± 0.01 | U | 0.02 | -0.13 ± 0.02 | 600 |
| B38W17B | 05/20/95 | Radium-226 | 0.28 ± 0.17 | | 0.13 | -0.02 ± 0.20 | 100 |
| | 05/20/95 | Thorium-230 | 0.37 ± 0.29 | U | 0.26 | 0.31 ± 0.31 | 300 |
| | 05/20/95 | Thorium-232 | -0.01 ± 0.02 | UJ | 0.22 | -0.07 ± 0.07 | 50 |
| | 05/20/95 | Total uranium | 0.23 ± 0.03 | U | 0.02 | -0.03 ± 0.03 | 600 |

**Table 11**
**1995 Groundwater Analytical Results - Radioactive Constituents**
**Maywood Interim Storage Site**

| Sampling Location | Date Collected | Analyte | Result [a] (pCi/L) | BNI Flag [b] | MDA[c] (pCi/L) | Result Above Background [d] (pCi/L) | DCG [e] (pCi/L) |
|---|---|---|---|---|---|---|---|
| B38W18D | 05/15/95 | Radium-226 | 0.03 ± 0.05 | UJ | 0.10 | -0.27 ± 0.11 | 100 |
| | 05/15/95 | Thorium-230 | 0.31 ± 0.26 | U | 0.25 | 0.25 ± 0.29 | 300 |
| | 05/15/95 | Thorium-232 | 0.13 ± 0.00 | UJ | 0.13 | 0.07 ± 0.07 | 50 |
| | 05/15/95 | Total uranium | 3.66 ± 0.38 | | 0.02 | 3.40 ± 0.38 | 600 |
| B38W19D | 05/10/95 | Radium-226 | 0.09 ± 0.10 | UJ | 0.16 | -0.21 ± 0.14 | 100 |
| | 05/10/95 | Thorium-230 | 0.37 ± 0.23 | U | 0.09 | 0.31 ± 0.26 | 300 |
| | 05/10/95 | Thorium-232 | 0.09 ± 0.00 | UJ | 0.09 | 0.03 ± 0.07 | 50 |
| | 05/10/95 | Total uranium | 0.20 ± 0.02 | | 0.02 | -0.06 ± 0.03 | 600 |
| B38W19S | 05/17/95 | Radium-226 | 0.11 ± 0.09 | | 0.05 | -0.19 ± 0.13 | 100 |
| | 05/17/95 | Thorium-230 | 0.35 ± 0.25 | U | 0.18 | 0.29 ± 0.28 | 300 |
| | 05/17/95 | Thorium-232 | -0.01 ± 0.02 | UJ | 0.21 | -0.07 ± 0.07 | 50 |
| | 05/17/95 | Total uranium | 0.95 ± 0.10 | | 0.02 | 0.69 ± 0.10 | 600 |
| B38W24D | 05/17/95 | Radium-226 | 0.08 ± 0.08 | | 0.06 | -0.22 ± 0.13 | 100 |
| | 05/17/95 | Thorium-230 | 0.29 ± 0.24 | U | 0.24 | 0.23 ± 0.27 | 300 |
| | 05/17/95 | Thorium-232 | -0.01 ± 0.01 | UJ | 0.20 | -0.07 ± 0.07 | 50 |
| | 05/17/95 | Total uranium | 0.02 ± | UJ | 0.02 | -0.24 ± 0.02 | 600 |
| B38W24S | 05/17/95 | Radium-226 | 0.06 ± 0.07 | UJ | 0.09 | -0.24 ± 0.12 | 100 |
| | 05/17/95 | Thorium-230 | 0.18 ± 0.18 | UJ | 0.24 | 0.12 ± 0.22 | 300 |
| | 05/17/95 | Thorium-232 | -0.01 ± 0.01 | UJ | 0.18 | -0.07 ± 0.07 | 50 |
| | 05/17/95 | Total uranium | 0.04 ± 0.01 | U | 0.02 | -0.22 ± 0.02 | 600 |
| B38W25D | 05/12/95 | Radium-226 | 0.21 ± 0.15 | | 0.16 | -0.09 ± 0.18 | 100 |
| | 05/12/95 | Thorium-230 | 0.31 ± 0.24 | U | 0.25 | 0.25 ± 0.27 | 300 |
| | 05/12/95 | Thorium-232 | -0.01 ± 0.01 | UJ | 0.19 | -0.07 ± 0.07 | 50 |
| | 05/12/95 | Total uranium | 0.05 ± 0.01 | | 0.02 | -0.21 ± 0.02 | 600 |
| B38W25S | 05/15/95 | Radium-226 | 0.15 ± 0.12 | | 0.06 | -0.15 ± 0.16 | 100 |
| | 05/15/95 | Thorium-230 | 0.14 ± 0.16 | UJ | 0.21 | 0.08 ± 0.20 | 300 |
| | 05/15/95 | Thorium-232 | -0.02 ± 0.02 | UJ | 0.24 | -0.08 ± 0.07 | 50 |
| | 05/15/95 | Total uranium | 0.06 ± 0.01 | | 0.02 | -0.20 ± 0.02 | 600 |
| B38W25S | 05/15/95 | Radium-226 | 0.16 ± 0.12 | | 0.09 | -0.14 ± 0.16 | 100 |
| QC duplicate [f] | 05/15/95 | Thorium-230 | 0.11 ± 0.13 | UJ | 0.10 | 0.05 ± 0.18 | 300 |
| | 05/15/95 | Thorium-232 | 0.06 ± 0.11 | UJ | 0.20 | 0.00 ± 0.13 | 50 |
| | 05/15/95 | Total uranium | 0.05 ± 0.01 | | 0.02 | -0.21 ± 0.02 | 600 |

## Table 11
## 1995 Groundwater Analytical Results - Radioactive Constituents
## Maywood Interim Storage Site

| Sampling Location | Date Collected | Analyte | Result [a] (pCi/L) | BNI Flag [b] | MDA[c] (pCi/L) | Result Above Background [d] (pCi/L) | DCG [e] (pCi/L) |
|---|---|---|---|---|---|---|---|
| MISS01AA | 05/18/95 | Radium-226 | 0.16 ± 0.19 | UJ | 0.35 | -0.14 ± 0.21 | 100 |
| | 05/18/95 | Thorium-230 | 0.08 ± 0.11 | UJ | 0.10 | 0.02 ± 0.16 | 300 |
| | 05/18/95 | Thorium-232 | 0.04 ± 0.08 | UJ | 0.10 | -0.02 ± 0.11 | 50 |
| | 05/18/95 | Total uranium | 0.53 ± 0.05 | | 0.02 | 0.27 ± 0.06 | 600 |
| MISS01B | 05/10/95 | Radium-226 | 0.20 ± 0.13 | | 0.06 | -0.10 ± 0.16 | 100 |
| | 05/10/95 | Thorium-230 | 0.26 ± 0.23 | U | 0.25 | 0.20 ± 0.26 | 300 |
| | 05/10/95 | Thorium-232 | -0.01 ± 0.02 | UJ | 0.21 | -0.07 ± 0.07 | 50 |
| | 05/10/95 | Total uranium | 0.88 ± 0.09 | | 0.02 | 0.62 ± 0.09 | 600 |
| MISS02A | 05/10/95 | Radium-226 | -0.10 ± 0.37 | R | 1.45 | -0.40 ± 0.38 | 100 |
| | 05/10/95 | Thorium-230 | 0.38 ± 0.36 | UJ | 0.42 | 0.32 ± 0.38 | 300 |
| | 05/10/95 | Thorium-232 | -0.01 ± 0.02 | UJ | 0.32 | -0.07 ± 0.07 | 50 |
| | 05/10/95 | Total uranium | 0.62 ± 0.06 | | 0.02 | 0.36 ± 0.06 | 600 |
| MISS02B | 05/09/95 | Radium-226 | 0.10 ± 0.09 | | 0.06 | -0.20 ± 0.13 | 100 |
| | 05/09/95 | Thorium-230 | 0.08 ± 0.12 | UJ | 0.19 | 0.02 ± 0.17 | 300 |
| | 05/09/95 | Thorium-232 | 0.07 ± 0.12 | UJ | 0.22 | 0.01 ± 0.14 | 50 |
| | 05/09/95 | Total uranium | 0.20 ± 0.02 | | 0.02 | -0.06 ± 0.03 | 600 |
| MISS05A | 05/12/95 | Radium-226 | 0.20 ± 0.18 | UJ | 0.22 | -0.10 ± 0.21 | 100 |
| | 05/12/95 | Thorium-230 | 0.43 ± 0.28 | U | 0.22 | 0.37 ± 0.30 | 300 |
| | 05/12/95 | Thorium-232 | 0.23 ± 0.20 | | 0.18 | 0.17 ± 0.21 | 50 |
| | 05/12/95 | Total uranium | 27.89 ± 3.25 | | 0.02 | 27.63 ± 3.25 | 600 |
| MISS05B | 05/11/95 | Radium-226 | 0.06 ± 0.07 | UJ | 0.09 | -0.24 ± 0.12 | 100 |
| | 05/11/95 | Thorium-230 | 0.28 ± 0.22 | U | 0.20 | 0.22 ± 0.25 | 300 |
| | 05/11/95 | Thorium-232 | 0.07 ± 0.11 | UJ | 0.17 | 0.01 ± 0.13 | 50 |
| | 05/11/95 | Total uranium | 0.07 ± 0.01 | | 0.02 | -0.19 ± 0.02 | 600 |
| MISS06A | 05/16/95 | Radium-226 | 0.05 ± 0.08 | UJ | 0.19 | -0.25 ± 0.13 | 100 |
| | 05/16/95 | Thorium-230 | 0.23 ± 0.22 | U | 0.22 | 0.17 ± 0.25 | 300 |
| | 05/16/95 | Thorium-232 | -0.02 ± 0.02 | UJ | 0.25 | -0.08 ± 0.07 | 50 |
| | 05/16/95 | Total uranium | 0.02 ± 0.00 | UJ | 0.02 | -0.24 ± 0.02 | 600 |
| MISS07B | 05/11/95 | Radium-226 | 0.09 ± 0.13 | UJ | 0.24 | -0.21 ± 0.16 | 100 |
| | 05/11/95 | Thorium-230 | 0.34 ± 0.22 | U | 0.09 | 0.28 ± 0.25 | 300 |
| | 05/11/95 | Thorium-232 | 0.09 ± 0.00 | UJ | 0.09 | 0.03 ± 0.07 | 50 |
| | 05/11/95 | Total uranium | 4.87 ± 0.50 | | 0.02 | 4.61 ± 0.50 | 600 |

**Table 11**
**1995 Groundwater Analytical Results - Radioactive Constituents**
**Maywood Interim Storage Site**

| Sampling Location | Date Collected | Analyte | Result [a] (pCi/L) | BNI Flag [b] | MDA[c] (pCi/L) | Result Above Background [d] (pCi/L) | DCG [e] (pCi/L) |
|---|---|---|---|---|---|---|---|
| B38W02D | 05/20/95 | Radium-226 | 0.23 ± 0.18 | | 0.20 | -0.07 ± 0.21 | 100 |
| Background | 05/20/95 | Thorium-230 | 0.16 ± 0.18 | UJ | 0.24 | 0.10 ± 0.22 | 300 |
| | 05/20/95 | Thorium-232 | -0.01 ± 0.01 | UJ | 0.20 | -0.07 ± 0.07 | 50 |
| | 05/20/95 | Total uranium | 0.37 ± 0.04 | | 0.02 | 0.11 ± 0.05 | 600 |

a. Results reported with (±) radiological error quoted at 2-sigma (95 percent confidence level). Negative laboratory results occur when the average background activity of the laboratory counting instrument exceeds the measured sample activity.

b. Bechtel National, Inc. data qualifier flags:
   U = The analyte was not detected. Some results for thorium-230 and total uranium are 'U' flagged due the to the presence of these analytes in the associated laboratory blank. If sample results are less than 5 times the blank contamination, the result is nondetect.
   J = Reported as an estimated value.
   UJ = Analyte was undetected; estimated value reported. The result is below the MDA or less than the associated error term.
   R = Rejected based on quality control considerations; analyte may or may not be present in the sample.

c. Minimum detectable activity

d. Historical (1993-1995) average background (pCi/L) for groundwater is 0.3±0.1, 0.06±0.07, 0.26±0.02 for radium-226, thorium-232, and total uranium, respectively. Background (1995 only) for thorium-230 is 0.06±0.12 pCi/L. Associated error term for result above background was calculated: $(error^2_{result} + error^2_{background})^{1/2}$

e. DOE derived concentration guide for water.

f. A quality control (QC) duplicate is collected at the same time and location and is analyzed by the same method for use in evaluation of precision in sampling and analysis.

## Table 12
## 1995 Groundwater Analytical Results - Detected Volatile Organic Compounds [a]
## Maywood Interim Storage Site



| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| B38W01S [f] | | | | | | | | |
| B38W14D | 05/20/95 | 1,1,1-Trichloroethane | 6 | | = | 5 | 200 | 30 |
| | 05/20/95 | 1,1-Dichloroethane | 4 | | J | 5 | NE | 70 |
| | 05/20/95 | 1,1-Dichloroethene | 7 | | = | 5 | 7 | 1 / 2 [g] |
| | 05/20/95 | 1,2-Dichloroethene (total) | 93 | | = | 5 | NE | NE |
| | 05/20/95 | 1,2-Dichloropropane | 1 | | J | 5 | 5 | 0.5 / 1 [h] |
| | 05/20/95 | Acetone | 4 | J | J | 10 | NE | 700 |
| | 05/20/95 | Tetrachloroethene | 1,100 | | = | 50 | 5 | 0.4 /1 [i] |
| | 05/20/95 | Trichloroethene | 250 | | = | 50 | 5 | 1 |
| B38W14S | 05/20/95 | 1,1,1-Trichloroethane | 7 | | = | 5 | 200 | 30 |
| | 05/20/95 | 1,1-Dichloroethane | 2 | | J | 5 | NE | 70 |
| | 05/20/95 | 1,1-Dichloroethene | 7 | | = | 5 | 7 | 1 / 2 |
| | 05/20/95 | 1,2-Dichloroethene (total) | 53 | | = | 5 | NE | NE |
| | 05/20/95 | Chloroform | 3 | | J | 5 | NE | 6 |
| | 05/20/95 | Tetrachloroethene | 640 | | = | 25 | 5 | 0.4 /1 |
| | 05/20/95 | Trichloroethene | 140 | | = | 5 | 5 | 1 |
| B38W15D | 05/19/95 | 1,1,1-Trichloroethane | 7 | | = | 5 | 200 | 30 |
| | 05/19/95 | 1,1-Dichloroethane | 6 | | = | 5 | NE | 70 |
| | 05/19/95 | 1,1-Dichloroethene | 9 | | = | 5 | 7 | 1 / 2 |
| | 05/19/95 | 1,2-Dichloroethene (total) | 160 | | = | 5 | NE | NE |
| | 05/19/95 | Tetrachloroethene | 1,500 | | = | 50 | 5 | 0.4 /1 |
| | 05/19/95 | Trichloroethene | 270 | | = | 50 | 5 | 1 |
| B38W15S | 05/19/95 | 1,1-Dichloroethane | 4 | | J | 5 | NE | 70 |
| | 05/19/95 | 1,2-Dichloroethene (total) | 6 | | = | 5 | NE | NE |
| | 05/19/95 | Acetone | 6 | J | J | 10 | NE | 700 |
| | 05/19/95 | Vinyl chloride | 4 | | J | 10 | 2 | 0.8 / 5 [j] |
| B38W15S | 05/19/95 | 1,1-Dichloroethane | 4 | | J | 5 | NE | 70 |
| QC duplicate [k] | 05/19/95 | 1,2-Dichloroethene (total) | 10 | | = | 5 | NE | NE |
| | 05/19/95 | Vinyl chloride | 5 | | J | 10 | 2 | 0.8 / 5 |
| B38W17A [f] | | | | | | | | |
| B38W17B | 05/20/95 | 1,2-Dichloroethene (total) | 2 | J | J | 5 | NE | NE |
| | 05/20/95 | Acetone | 8 | J | J | 10 | NE | 700 |
| | 05/20/95 | Vinyl chloride | 2 | J | J | 10 | 2 | 0.8 / 5 |
| B38W18D | 05/15/95 | Acetone | 6 | | J | 10 | NE | 700 |
| B38W19D | 05/10/95 | Benzene | 1 | | J | 5 | 5 | 0.2 / 1 [l] |
| B38W19S [f] | | | | | | | | |
| B38W24D | 05/17/95 | Acetone | 7 | J | J | 10 | NE | 700 |
| B38W24S | 05/17/95 | Acetone | 6 | J | J | 10 | NE | 700 |
| B38W25D [f] | | | | | | | | |
| B38W25S [f] | | | | | | | | |
| B38W25S | 05/15/95 | Acetone | 12 | | = | 10 | NE | 700 |
| QC duplicate | 05/15/95 | Methylene chloride | 1 | | J | 5 | NE | 2 / 2 [m] |

## Table 12

## 1995 Groundwater Analytical Results - Detected Volatile Organic Compounds [a]

## Maywood Interim Storage Site



| Sampling Location | Date Collected | Analyte | Result (µg/L) | Data Qualifiers [b] BNI | Data Qualifiers [b] Lab | Detection Limit (µg/L) | Related Regulations [c] Federal [d] (µg/L) | Related Regulations [c] State [e] (µg/L) |
|---|---|---|---|---|---|---|---|---|
| MISS01AA [f] | | | | | | | | |
| MISS01B | 05/10/95 | 1,2-Dichloroethene (total) | 3 | | J | 5 | NE | NE |
| | 05/10/95 | Tetrachloroethene | 20 | | = | 5 | 5 | 0.4 /1 |
| | 05/10/95 | Trichloroethene | 2 | | J | 5 | 5 | 1 |
| MISS02A [f] | | | | | | | | |
| MISS02B | 05/09/95 | Acetone | 4 | J | J | 10 | NE | 700 |
| | 05/09/95 | Benzene | 1 | | J | 5 | 5 | 0.2 / 1 |
| MISS05A [f] | | | | | | | | |
| MISS05B | 05/11/95 | 4-Methyl-2-pentanone | 2 | J | J | 10 | NE | 400 |
| | 05/11/95 | Benzene | 89 | J | = | 5 | 5 | 0.2 / 1 |
| MISS06A [f] | | | | | | | | |
| MISS07B | 05/11/95 | 1,1-Dichloroethene | 2 | | J | 5 | 7 | 1 / 2 |
| | 05/11/95 | 1,2-Dichloroethene (total) | 8 | | = | 5 | NE | NE |
| | 05/11/95 | Tetrachloroethene | 45 | | = | 5 | 5 | 0.4 /1 |
| | 05/11/95 | Trichloroethene | 3 | | J | 5 | 5 | 1 |
| B38W02D [f] Background | | | | | | | | |

a. Only the analytes that were detected are reported. See Table 13 for a comprehensive listing of requested analyses and associated detection limits.
b. Bechtel National, Inc. and laboratory data qualifier flags:
J = Reported as an estimated value.
(=) = Actual value reported.
c. Regulations presented pertain to drinking water quality and are listed for comparison only. No drinking water supply is obtained from groundwater at MISS. NE = Not established.
d. Safe Drinking Water Act maximum contaminant levels from EPA Drinking Water Regulations and Health Advisories (May 1994).
e. New Jersey Class IIA Groundwater Quality Standard.
f. No volatile organic compounds were detected during 1995 sampling of this monitoring well.
g. For 1,1-dichloroethene, the New Jersey Groundwater Quality Standard is 1µg/L, but the practical quantitation limit (PQL) is 2 µg/L.
h. For 1,2-dichloropropane, the New Jersey Groundwater Quality Standard is 0.5 µg/L, but the PQL is 1 µg/L.
i. For tetrachloroethene, the New Jersey Groundwater Quality Standard is 0.4 µg/L, but the PQL is 1 µg/L.
j. For vinyl chloride, the New Jersey Groundwater Quality Standard is 0.8 µg/L, but the PQL is 5 µg/L.
k. A quality control (QC) duplicate is collected at the same time and location and is analyzed by the same method for use in evaluation of precision in sampling and analysis.
l. For benzene, the New Jersey Groundwater Quality Standard is 0.2 µg/L, but the PQL is 1 µg/L.
m. For methylene chloride, the New Jersey Groundwater Quality Standard is 2 µg/L, and the PQL is 2 µg/L.

## Table 13
## 1995 Comprehensive List of Analytes and Detection Limits for Metals and Volatile Organic Compounds Analyses
## Maywood Interim Storage Site

| Metals | Detection Limit [a] Groundwater (µg/L) | Detection Limit [a] Sediment (µg/g) |
|---|---|---|
| Aluminum | 18 | -- [b] |
| Antimony | 1.5 | -- |
| Arsenic | 1.8 | -- |
| Barium | -- | -- |
| Beryllium | 0.7 | -- |
| Boron | 11.9 | 4.5 |
| Cadmium | 3.5 | 0.48 |
| Calcium | -- | -- |
| Chromium | 4.2 | -- |
| Cobalt | 3.3 | -- |
| Copper | 3.1 | -- |
| Iron | 12.4 | -- |
| Lead | 1.5 | -- |
| Magnesium | -- | -- |
| Manganese | -- | -- |
| Molybdenum | 7.1 | -- |
| Nickel | 10.3 | -- |
| Potassium | 1,060 | 235 |
| Selenium | 1.2 | 0.45 |
| Silver | 3.5 | 1.3 |
| Sodium | -- | -- |
| Thallium | 2.3 | 0.88 |
| Vanadium | 6.7 | -- |
| Zinc | 2.5 | -- |

a. The detection limit listed for each analyte is the maximum detection limit taken from all non-detect results (i.e., results that were U qualified by either BNI or the laboratory) for the same analyte.
b. (--) = The specific analyte was detected at all sampling locations. Reported values and detection limits are listed in Tables 7, 10, and 12.

| Groundwater Volatile Organic Compounds | Detection Limit (µg/L) [a] |
|---|---|
| 1,1,1-Trichloroethane | 5 |
| 1,1,2,2-Tetrachloroethane | 5 |
| 1,1,2-Trichloroethane | 5 |
| 1,1-Dichloroethane | 5 |
| 1,1-Dichloroethene | 5 |
| 1,2-Dichloroethane | 5 |
| 1,2-Dichloroethene (total) | 5 |
| 1,2-Dichloropropane | 5 |
| 2-Butanone | 10 |
| 2-Chloroethylvinyl ether | 10 |
| 2-Hexanone | 10 |
| 4-Methyl-2-pentanone | 10 |
| Acetone | 10 |
| Acrolein | 50 |
| Acrylonitrile | 10 |
| Benzene | 5 |
| Bromodichloromethane | 5 |
| Bromoform | 5 |
| Bromomethane | 10 |
| Carbon disulfide | 5 |
| Carbon tetrachloride | 5 |
| Chlorobenzene | 5 |
| Chlorodibromomethane | 5 |
| Chloroethane | 10 |
| Chloroform | 5 |
| Chloromethane | 10 |
| Cis-1,3-dichloropropene | 5 |
| Ethylbenzene | 5 |
| Methylene chloride | 5 |
| Styrene | 5 |
| Tetrachloroethene | 5 |
| Toluene | 5 |
| Trans-1,3-dichloropropene | 5 |
| Trichloroethene | 5 |
| Vinyl acetate | 10 |
| Vinyl chloride | 10 |
| Xylenes (total) | 5 |

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