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1993

EPA Superfund
Record of Decision:

LODI MUNICIPAL WELL
EPA ID: NJD980769301
OU 01
LODI, NJ
09/27/1993

RECORD OF DECISION FACT SHEET EPA REGION II

Site:

Site name: Lodi Municipal Well Superfund Site

Site location: Borough of Lodi, Bergen County, New Jersey

HRS score: 33.39

Record of Decision:

Date signed: September 27, 1993

Selected remedy: No Action

Capital cost: N/A

O & M cost: N/A

Present-worth cost: N/A

Lead:

Remedial EPA lead

Primary Contact: Silvina Fonseca, (212) 264-7604

Secondary Contact: Robert McKnight, (212) 264-7509
Main PRPs: None

Waste:

Waste type: VOCs and radionuclides

Waste origin: Regionally and naturally occurring

Estimated waste quantity: N/A

Contaminated medium: Groundwater

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

DATE: SEP 24 1993

SUBJECT: Record of Decision for the
Lodi Municipal Well Site

FROM: George Pavlou, Acting Director
Emergency and Remedial Response Division (2ERRD)

TO: William J. Muszynski, P.E.
Acting Regional Administrator (2RA)

Attached for your approval is the Record of Decision (ROD) for the Lodi Municipal Well site, located in the Borough of Lodi, Bergen County, New Jersey. A no action response has been selected and no further activities are planned for the site.

The Lodi Municipal Well site was placed on the National Priorities List primarily due to radiological contamination. After performing extensive field investigations, we have determined that the radiological contamination is naturally occurring. As described below, EPA is not authorized to respond to such naturally occurring conditions.

Section 104 of CERCLA provides limitations on response actions and directs that no remedial action be taken in response to a release or threat of release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found. A response can only be authorized if the presence of the naturally occurring substance constitutes a public health or environmental emergency and no other entity will respond in a timely manner. The radionuclides present at the Lodi Municipal Well site have been determined to be naturally occurring and, since the well is no longer being used for water supply purposes, an emergency does not exist.

Remedial action is not necessary to ensure protection of human health and the environment from non-radiological compounds at the Lodi Municipal Well site since the concentrations of those compounds in the ground water at the well do not pose an unacceptable risk. However, because ground water in the
area has been found to contain sporadic contamination that is regional in nature, EPA recommends that the ground water not be used for potable water supply purposes without appropriate treatment. The Borough of Lodi currently obtains potable water through private water supply companies. The Lodi Municipal Well is not utilized as a source of potable water.

The remedial investigation report and the Proposed Plan were released to the public for comment on July 15, 1993. A 30-day public comment period ended on August 14, 1993. In addition, a public meeting to discuss these documents and the preferred remedy was held on July 20, 1993. Most of the comments received during the public comment period related to the Maywood Chemical Company site and the community's desire to have ground water contamination resulting from that site remediated. Comments provided by local residents and officials on the Lodi Municipal Well site did not necessitate a modification of the proposed remedy.

The ROD was developed by EPA and has been reviewed by the appropriate offices within Region II. Their input and comments are reflected in this document. The State of New Jersey has not yet established a final position concerning the no action response for the Lodi Municipal Well site.

If you have questions or comments on this document, I would be happy to discuss them with you at your convenience.

Attachment

DECLARATION STATEMENT

RECORD OF DECISION

Lodi Municipal Well

Site Name and Location

Lodi Municipal Well, Bergen County, New Jersey

Statement of Basis and Purpose

This decision document presents the selected remedy for the Lodi Municipal Well site. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the administrative record for the site.

Description of the Remedy

A no action response has been selected for the Lodi Municipal Well site. The radionuclides found in the ground water at the well have been determined to be naturally occurring and, therefore, cannot be addressed under CERCLA. No further activities are planned for the site.

Declarations

Section 104 of CERCLA provides limitations on response actions and directs that no remedial action be taken in response to a release or threat of release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found. A response can only be authorized if the presence of the naturally occurring substance constitutes a public health or environmental emergency and no other entity will respond in a timely manner. The radionuclides present at the Lodi Municipal Well site have been determined to be naturally occurring and, since the well is no longer being used for water supply purposes, an emergency does not exist. Therefore, the U.S. Environmental Protection Agency (EPA) does not have the authority under CERCLA to address the radiological contamination at the site.

Remedial action is not necessary to ensure protection of human health and the environment from non-radiological compounds at the Lodi Municipal Well site since the concentrations of those compounds in the ground water at the well do not pose an unacceptable risk. However, because ground water in the
area has been found to contain sporadic contamination that is regional in nature, EPA recommends that the ground water not be used for potable water supply purposes without appropriate treatment.

The Borough of Lodi currently obtains potable water through private water supply companies. The Lodi Municipal Well is not utilized as a source of potable water.

EPA has determined that its response at this site is complete. Therefore, the site now qualifies for inclusion on the Construction Completion List.

DECISION SUMMARY

Lodi Municipal Well Site

SITE NAME, LOCATION AND DESCRIPTION

The Lodi Municipal Well is the Home Place Well, which is located in the Borough of Lodi, Bergen County, New Jersey. The Borough, which is approximately 3.5 square miles in size, is located east of the Passaic River, west of the Hackensack River, and south of New Jersey State Route 4. Interstate 80 forms the northeast boundary of the Borough (see Figure 1). In addition to the Home Place Well, ten other municipal wells exist in the Borough of Lodi. All eleven municipal wells were investigated to varying degrees to determine the nature and quality of ground water in the vicinity of the Home Place Well. However, the site is the Home Place Well, in which both radiological and chemical contamination were detected.

The wells are installed in the Passaic Formation (previously called the Brunswick Formation) at depths varying between 300 and 600 feet. The Passaic Formation is one of nine formations that make up the Newark Supergroup in New Jersey. Together, these formations make up the Newark Basin structure. The Lodi municipal well field is located on the northeast flank of the basin where beds dip gently toward the northwest border fault.

The Passaic Formation extends to a depth of approximately 3,000 feet in the vicinity of the site. It consists predominantly of red siltstones, sandstones and conglomerates, with beds of gray and black mudstone in the lower portion. Literature indicates that uranium mineralization occurs within the Stockton and Lockatong Formations of the Newark Basin and may also be prevalent in lower portions of the Passaic Formation.

The Passaic Formation is an important aquifer. Domestic, industrial and municipal supply wells of depths to 600 feet tap this unit. Well yields range from 15 gallons per minute (gpm) to more than 500 gpm. Regional ground water flow is from the northeast to the southwest along the regional strike of bedding.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

From the early 1900s to the beginning of the 1980s, the Lodi Water Department supplied potable water for the majority of the Borough's residential and commercial water needs from a series of municipal wells which tapped the bedrock aquifer. The first of these, the Arnot Street Well, was installed in 1923; the eleventh and last, the Home Place Well, was installed in 1965. Besides the Arnot Street Well and Home Place Well, other existing and former Lodi municipal wells are located at Columbia Avenue, Garfield Avenue, Corabelle Avenue, Kimmig Avenue (four wells; Kimmig Avenue Number 4, Kimmig Avenue Number 5, Kimmig Avenue Number 6, and Kimmig Avenue Number 7), Lawrence Avenue, and Terrace Avenue. The Corabelle Avenue and Kimmig Avenue Number 6 wells were abandoned shortly after construction because of inadequate water production, leaving nine wells at seven locations. In addition to the eleven municipal wells, production, and monitoring wells are located throughout the Borough of Lodi and in surrounding communities. However, as indicated above, the Home Place Well is of particular concern because of the presence of both radiological and chemical contamination.

During April 1981 and October 1981, water samples were obtained from several wells and analyzed for volatile organic compounds (VOCs) by the New Jersey Department of Environmental Protection and Energy (NJDEPE). Elevated VOCs exceeding the NJDEPE standards for potable water were detected in the Arnot Street and Garfield Avenue Wells resulting in the closure of these wells. In December 1982, NJDEPE instructed the Borough of Lodi to implement a treatment system for the contaminated wells by the end of 1984 if the Arnot Street and Garfield Avenue wells were to be brought back into service, and if the Kimmig Avenue Number 4 Well was to continue operating. The Borough responded that treatment alternatives would be evaluated. Meanwhile, contaminant levels in the Arnot Street Well declined, allowing the well to be placed back into service in January 1983.

As part of an investigation of the Maywood Chemical Company Superfund site (located approximately two miles north of the Borough of Lodi), NJDEPE sampled the Home Place, Garfield Avenue, Kimmig Avenue, and Lawrence Avenue wells in 1983 to evaluate their possible contamination by radionuclides that may have migrated from the Maywood Chemical Company site (a discussion of the nature of radionuclides is provided below). Except for the Home Place Well, where elevated radiological activity was detected, no radiological contaminants were detected above federal

water quality standards. Consequently, the Home Place Well was closed in December 1983.

In October 1984, the site was proposed for inclusion on the National Priorities List (NPL) of Superfund sites. The site was added to the NPL in May 1985.

In June 1985, a tap water sample collected from a local business by the Lodi Water Department was found to contain VOCs including tetrachloroethylene (PCE), trichloroethylene (TCE), and carbon tetrachloride. Subsequent sampling by NJDEPE confirmed the presence of VOCs which led to the sampling of the seven operating Lodi wells. The elevated levels of VOCs, coupled with the adoption of more stringent standards for VOCs in drinking water, prompted the closure of all of the Lodi municipal wells in April 1986, except for the Terrace Avenue Well. However, on June 1, 1987, this well was also closed due to elevated levels of PCE. Water for the Borough is currently being supplied by the Hackensack Water Company and the Passaic Valley Water Commission.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The remedial investigation (RI) report and the Proposed Plan for the site were released to the public for comment on July 15, 1993. These documents were made available to the public in the administrative record file at the information repository at the Lodi Memorial Library, located at One Memorial Drive, Lodi, New Jersey, and at the EPA Docket Room in Region II, 26 Federal Plaza, New York, New York. The notice of availability for the above-referenced documents was published in The Record on July 15, 1993 and July 17, 1993. The public comment period associated with these documents was held from July 15, 1993 to August 14, 1993. On July 20, 1993, EPA conducted a public meeting at the Lodi Municipal Building, to inform local officials and interested citizens about the Superfund process, to present the conclusions of the RI, to elaborate further on the reasons for recommending the preferred remedy, and to respond to any questions from area residents and other attendees.

Responses to the comments received at the public meeting and in writing during the public comment period are included in the Responsiveness Summary, which is part of this Record of Decision (ROD).

This decision document presents the selected remedial action for the Lodi Municipal Well site, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1980, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The selection of the remedy for this site is based on the administrative record.

SCOPE AND ROLE OF REMEDY

This ROD focuses on EPA's selection of a remedy for the entire Lodi Municipal Well site. Based on the results of the RI report, public comments, and other information in the administrative record, a no action response has been selected for the Lodi Municipal Well site. No further activities are planned for the site.

SUMMARY OF SITE CHARACTERISTICS

RI SUMMARY

The RI for the Lodi Municipal Well site was conducted in two phases. The purpose of the first phase was to characterize the nature, extent, and origin of radioactive and chemical contamination of the Home Place Well that had been detected and reported by NJDEPE. This work was undertaken in the summer and fall of 1988, and the results were documented in December 1989. Organic and inorganic contaminants detected in ground water at the site were found at levels consistent with background conditions in the area. Ground water in the vicinity of the site flows in a southwesterly direction. The results of the investigation were inconclusive with regard to the determination of the nature of the radionuclide contamination. However, the results did confirm the presence of elevated levels of radionuclides in the Home Place Well. This led to the initiation of a supplemental investigation to determine the source of radionuclides in the Home Place Well; in particular, whether the radionuclides were naturally occurring within the bedrock aquifer or derived from contamination migrating from the Maywood Chemical Company site.

The following discussion of the nature of radionuclides is provided to facilitate the reader's understanding of the findings of the RI. A summary of the first phase and supplemental RI follows.

NATURE OF RADIONUCLIDES

A radionuclide is an element that radioactively "decays" into another element through natural processes. Radionuclides are present in trace amounts in all rocks and soils and consist primarily of elements of the uranium238 and thorium-232 decay series. When radionuclides decay, they emit energy in the form of radiation. The decaying radionuclide is often called the "parent", and the radionuclide that is produced by the transformation is referred to as the decay product, or the "daughter". The rate at which radionuclides decay is measured by the unit Curie (Ci), which is equal to 2.22 X 10[12] (2.22 trillion) radionuclide disintegrations per minute. A more convenient unit for expressing environmental radioactivity is the picoCurie (pCi), which is equal to 1 X 10[-12] (one trillionth) Ci. Because each radionuclide decays at a specific rate under natural conditions, the radionuclides in a decay series are distributed in relatively fixed proportions. This is referred to as equilibrium. If man has in some way altered the material (forexample, through commercial extraction of thorium or radium from ore), the proportions of radionuclides in the material will vary from equilibrium. This would indicate that the
material is not in its natural state. On the other hand, proportions which are in equilibrium are indicative of naturally occurring radio nuclides. Figure 2 illustrates the uranium-238 and thorium-232 radioactive decay series. This figure illustrates the extensive breakdown process associated with these elements.

FIRST PHASE RI

The first phase of the RI included the sampling of ground water and soil in the vicinity of the Home Place Well, as well as sampling of the Saddle River sediments and surface water. The samples were analyzed for chemical and radiological parameters. The findings of the initial RI are as follows:

. VOCs, including PCE, TCE, 1,1,1-trichloroethane (TCA), chloroform, and 1,2-dichloroethane, were detected in municipal and private wells above federal or state Maximum Contaminant Levels (MCLs) for drinking water. PCE, with an MCL of 1 part per billion (ppb), was found at concentrations ranging from 0.26 to 56 ppb. TCE, with an MCL of 1 ppb, was found at concentrations ranging from 0.38 to 3 ppb. Chloroform was detected at 0.45 to 2 ppb; 1,2dichloroethane, with an MCL of 2 ppb, was measured at 5 to 69 ppb. The typical concentrations of total VOCs detected ranged from 5 to 20 ppb (see Tables 1 - 3).

  VOCs were detected in thirteen wells sampled over an area covering about two square miles. The generally elevated VOC levels in the Lodi wells were found to be consistent with background levels found in the area. No definite pattern of VOC contamination was evident, nor could a plume of ground water contamination be delineated. Therefore, the presence of the VOCs appears to be a common problem in the area and attributable to unknown sources. In addition to VOCs, all ground water samples were analyzed for metals. The concentrations of metals, including mercury and selenium, were generally consistent with background levels, with no clear pattern as to their distribution. Mercury, detected at the Columbia Avenue Well at 2.6 ppb was the only metal compound that exceeded its respective MCL (2 ppb) (see Tables 1 and 2).

. Soil samples were collected from surficial fill near the Home Place Well and from a soil boring adjacent to the Home Place Well (see Tables 4 and 5). Samples analyzed from the surficial fill were found to have slightly elevated concentrations of semivolatile organic compounds such as naphthalene, 2-methylnaphthalene, and acenaphthene. However, since these compounds were not found in water samples from the Home Place Well, the semivolatile organic compounds do not appear to have any significant impact on the ground water. The only compound detected in the samples analyzed from the soil boring was bis(2-ethylhexyl) phthalate at low concentrations. VOCs were not detected in the surficial fill or soil boring samples. Radionuclide concentrations in the surficial fill and soil boring samples were consistent with background levels typical of soil in northern New Jersey: (uranium-238 was detected at concentrations of less than 2.3 picoCuries per gram (pCi/g) to 6.4 pCi/g; thorium-232 was detected at concentrations of 0.58 to 1.1 pCi/g; and radium-226 was detected at concentrations of 0.42 to 0.87 pCi/g).

- The bedrock aquifer in the vicinity of the site discharges to the Saddle River. A total of five surface water samples were obtained along the Saddle River (see Figure 3). Four samples were taken at individual river locations, and a duplicate sample was taken at the fourth location. The VOCs which were detected included methylene chloride, toluene, PCE, 1,2-dichloroethylene, vinyl chloride, chlorobenzene, carbon disulfide, and TCE. These compounds were found at levels below MCLs. The metals detected included aluminum, barium, cadmium, copper, magnesium, manganese, potassium, silver, sodium, and zinc. Generally, the concentrations of metals varied only slightly from the upgradient to the downgradient samples in the study area, with some compounds showing a slight increase in concentration, and some a slight decrease. No semivolatiles were found in the surface water samples (see Table 6). Radionuclides were detected at very low levels, indicative of background conditions, ranging from 0.3 pCi per liter (pCi/l) to 0.7 pCi/l.

- Sediment samples were taken at the same locations along the Saddle River as the surface water samples (see Figure 3). Chlorobenzene was the only VOC detected. It was detected at two locations at concentrations of 15 and 17 ppb. Metals detected in the sediments were aluminum, barium, beryllium, cadmium, calcium, copper, iron, lead, magnesium, manganese, nickel, potassium, vanadium, and zinc. As with the surface water samples, metals were detected at all upgradient or background sample locations and the concentrations detected varied only slightly from downgradient concentrations. Thirteen semivolatile compounds were detected, but only two compounds, fluoranthene and pyrene, were detected at all four sample locations. The pattern of semivolatile compounds in the river did not indicate a readily identifiable source or sources of contamination. For example, chrysene, benzo(a)anthracene, and benzo(k)fluoranthene were detected at three locations. Acenaphthene, dibenzofuran, fluorene, and anthracene were detected at two locations (see Table 7). Low levels of radiological activity, ranging from 0.2 pCi/g to 0.5 pCi/g, were detected in the river sediment. All radionuclides detected were well within normal background ranges. The uranium-238 parent and decay product radionuclides, uranium-238, uranium-234, thorium230 and radium-226, were in equilibrium at each location. Similarly, thorium-232, radium-228 and thorium-228 were also in equilibrium. This would indicate that the materials are naturally occurring. There was no apparent correlation between the concentrations of specific compounds in surface water or sediment and those in the ground water.

- Two discrete ground water samples obtained from the Home Place Well at a well depth of 485 to 495 feet were found to exceed the federal MCL of 5 pCi/l (Ra 226 and Ra 228, combined) for radionuclides in drinking water. Radiological levels in these samples were measured at 41 and 31 pCi/l (see Table 8).

SUPPLEMENTAL RI

One of the objectives of the initial RI was to evaluate whether the elevated radionuclide concentrations in the Home Place Well could have been due to the migration of contaminants from the Maywood Chemical Company site. However, the results of the initial RI proved inconclusive with respect to the elevated radionuclide concentrations. Therefore, a supplemental RI was conducted.

A two-pronged approach was developed in the supplemental RI to determine whether radionuclides in the Home Place Well were transported from the Maywood Chemical Company site or were naturally occurring. The approach involved: 1) a study of the rare-earth elements (REEs) (the abundant metallic elements of atomic number 57 through 71 on the periodic table of elements), and 2) a comparison of uranium, thorium, and radium isotopes. Ratios of REE concentrations act as geochemical tracers that can be used to identify relationships among samples. In this case, the REEs were used to determine if the radionuclides migrated from the Maywood Chemical Company site in ground water. Ratios of radioactive isotopes were examined to
determine equilibrium relationships among samples. Samples from a particular medium that have very different degrees of equilibrium would be expected to have different origins.

As previously described, the relative amounts, or ratios, of these elements would not be the same in the natural environment as they would be in material that had been processed. In the natural environment, the ratios of elements would be relatively constant, reflecting an equilibrium condition among the uranium, thorium and radium isotopes. These ratios would be substantially different for process-waste materials such as those which might

be found at a thorium-processing facility, such as the Maywood Chemical Company site. At such a facility, thorium in process waste material would be expected to be found at lower than naturally occurring levels, since the extraction process removes thorium from the ore at a much greater rate than would occur under the natural decay process. By comparing the characteristics of the Lodi geologic area to the relative levels of the elements in both naturally occurring and process-waste situations, a determination could be made of the nature of the radionuclide materials found at the Home Place Well. Samples were collected from four media: ground water, ground water filter residue (the suspended particulate material in ground water collected when filtered during sampling), bedrock, and Maywood process-waste material (see Figure 4). These samples were collected for analysis from three general areas: the Lodi site; upgradient, or background, locations; and the Maywood Chemical Company site. Besides the Home Place Well, ground water samples were taken from eight other wells. These wells included the Kimmig Avenue Number 4 and Garfield Avenue wells, which are located in between the Home Place Well and the Maywood Chemical Company site (see Figure 5); the Artesian Well in Rochelle Park, Paramus Number 2, and Westwood Well, which are located upgradient of the Home Place Well and the Maywood Chemical Company site (see Figure 6); and three monitoring wells (MISS-6A, MISS-6B and MISS-5B) at the Maywood Chemical Company site. In addition, samples were taken of the local rock outcrops (see Figure 7). Table 9 describes the type of sampling conducted at each location. The combined results support the following conclusions:

. Filtered ground water samples from the Lodi municipal wells (including Home Place), the Maywood monitoring wells, the Artesian Well, Paramus Number 2 Well, and Westwood Well, which are upgradient of Maywood and the Home Place Well, did not show thorium in concentrations above the analytical detection limit of 0.1 ppb. However, thorium was measured in unfiltered ground water samples in these wells at levels ranging from less than 0.1 ppb to 0.4 ppb. Table 10 shows thorium concentrations (and other elements) detected in the ground water samples. The detection of thorium in the unfiltered samples can be attributed to the thorium contained in suspended particles. These suspended particles were likely left behind on the filter from the filtered ground water samples.

. The concentrations of thorium in the Home Place Well rock samples (5.5 to 13.1 parts per million (ppm); average 8.8 ppm) were consistent with those found in the local rock outcrop samples (7.4 to 9.7 ppm; average 8.8 ppm), i.e., background samples, and were much higher than those found in the Maywood waste samples (0.2 to 3.3 ppm;average 1.4 ppm)(see Tables 11 and 12).

. The relative amounts, or ratios, of lanthanum/thorium (La/Th), phosphorous/thorium (Ph/Th), and zirconium/thorium (Zr/Th), were relatively consistent for the Home Place Well rock samples and local rock outcrop samples [(La/Th 3.4), (P/Th 53.8), and (Zr/Th 10.9)], but are substantially different from those found in the Maywood waste samples [(La/Th 1.1), (P/Th 3,820), and (Zr/Th 4.6)] (see Figures 8-10). This implies that the materials found in the Home Place Well samples are not derived from the Maywood wastes, but rather are naturally occurring in the area (see Figure 11).

. Discrete uranium-bearing minerals were found in the sidewall core samples from the Home Place Well. One sidewall core sample taken at a depth of 491.3 feet in the Home Place Well had a uranium concentration of 3,170 ppm (see Table 11). This provided physical evidence that the high concentrations of uranium found in the rock in the Home Place Well result from naturally occurring radionuclides within the bedrock and could not have resulted from deposition of contaminants from an upgradient source.

. Uranium concentrations were found to be three orders of magnitude higher in ground water collected from the Home Place Well (filtered: 124 to 552 ppb; unfiltered: 126 to 611 ppb) than in ground water collected from the Maywood monitoring wells (filtered: 0.1 to 2.2 ppb; unfiltered: 0.1 to 3 ppb). While the concentrations of uranium found in the Home Place Well were unusually high, ground water samples from the Newark Basin structure, in general, are known to have naturally high concentrations of uranium, ranging from 0.3 to 120 ppb (see Table 10 and Figure 12). Comparisons of uranium concentrations in filtered and unfiltered ground water samples suggest that uranium is considerably more likely to be dissolved in the ground water environment than would thorium or the rare-earth elements. This, in turn, means that uranium is more likely to migrate through ground water movement than would the thorium or rare-earth elements. However, the uranium concentrations found in the ground water at Maywood (filtered and unfiltered) are extremely low, which makes it an unlikely source of the contamination at the Home Place Well. Rather, the high concentrations of

uranium that occur naturally in the rock surrounding the Home Place Well are believed to be responsible for the high uranium levels in the ground water samples obtained from the well.

. The uranium series isotope analysis further supports the conclusion that the high concentrations of uranium found in the Home Place Well are naturally occurring. The ground water samples collected from the Maywood wells, both filtered and unfiltered, are enriched with uranium-234 relative to thorium-230 and uranium-238. Therefore, if accumulation of uranium contained in ground water from Maywood, e.g., via accumulation of colloidal or suspended material, were responsible for the high uranium concentrations in the Home Place Well, there would be excess uranium-234 in the sidewall core samples from the Home Place Well. However, this is not the case. The Home Place sidewall core samples have uranium-234/thorium-230 ratios (1.05 to 1.21) that are very close to equilibrium (see Table 13 and Figure 13).

  Most of the sidewall cores also have uranium-234/uranium 238 ratios near equilibrium (0.90 to 1.06). One sample, however, from a depth of 490.8 feet (the zone with the highest uranium concentration), is slightly deficient in uranium-234, with a uranium234/uranium-238 ratio of 0.69 (see Table 13). The extremely high concentrations found in the rocks of this zone suggest that uranium leaching from these rocks is most likely responsible for the high concentrations of uranium found in the ground water in the Home Place Well. Because uranium-234 is produced by alpha decay of uranium-238, which damages the crystal structure, it is more susceptible to leaching by ground water. Therefore, the slight deficiency of uranium-234 in rocks from this zone could be explained by preferential leaching.

In summary, the radionuclide contamination found in the Home Place Well is not originating from the Maywood Chemical Company site. The analytical results of the initial and supplemental RIs, and other supporting information, indicate that the elevated radiological levels in the Home Place Well are caused by naturally occurring radionuclides within the bedrock aquifer. No radiological waste materials were found to be present.

SUMMARY OF SITE RISKS

The results of the RI demonstrated that the chemical contaminants found at and near the site are sporadic and regional in nature and that the elevated radiological levels are a naturally occurring phenomenon. Therefore, EPA conducted only a limited characterization of site risks and only assessed human health risks. Ecological risks were not assessed because there are no known ecological receptors that will be in contact with the contaminated ground water.

Human Health Risk Assessment

For the human health risk assessment, a reasonable maximum human exposure was evaluated. A four-step process was utilized for assessing site related human health risks for a reasonable maximum exposure scenario: Hazard Identification--identified the contaminants of concern at the site based on several factors such as toxicity, frequency of occurrence, and concentration; Exposure Assessment--estimated the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures,
and the pathways (e.g., ingesting contaminated well water) by which humans are potentially exposed; Toxicity Assessment--determined the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response); and Risk Characterization--summarized and combined outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-a-million excess cancer risk) assessment of site-related risks.
For risk assessment purposes, individual contaminants are separated into two categories of health hazard depending on whether they exhibit carcinogenic or noncarcinogenic effects. For known or suspected carcinogens, federal guidelines for acceptable exposures are an individual lifetime excess carcinogenic risk in the range of 10[-4] to 10[-4], representing a probability of approximately one in ten thousand to one in one million that an individual could develop cancer due to exposure. The noncarcinogenic effects (e.g., systemic effects) posed by each contaminant are summarized as a "Hazard Index" (HI) for a particular exposure pathway. The HI compares the chronic exposure to a contaminant to a reference dose, the reference dose being a measure, with many built-in safety factors, of a contaminant's threshold for causing toxicity. Generally, only Hazard Indices greater than 1 are identified with potential adverse health effects.

The baseline risk assessment presented in the RI report was conducted in 1988 as part of the Phase I RI. These risk assessment results were also presented in the Proposed Plan for the site. Many of the assumptions presented in that risk assessment were overly conservative (i.e., not reflective of the reasonable maximum exposure case intended to be evaluated). For example, the compounds that were selected as contaminants of concern in the 1988 assessment represented the highest concentrations found throughout the study area, and were not necessarily representative of the contaminants found in the Home Place Well or any other municipal well. To better characterize the risks posed by the Lodi Municipal Well site, several of the assumptions and conclusions of the 1988 assessment were reevaluated in 1993 using current guidance. A discussion of the 1988 risk assessment, as well as a discussion of the reevaluation, is presented below.

Organic contaminants of concern selected in the 1988 assessment included chloroform, 1,2-dichloroethane, PCE, 1,1,1-TCA, and TCE; inorganic contaminants included mercury and selenium; and radionuclides included radium226, thorium-228, thorium-230, thorium-232, uranium-234, uranium-235, and uranium-238 (see Table 14). Chloroform, 1,2-dichloroethane, PCE, TCE and all radionuclides are suspected or known human and animal carcinogens.

The 1988 baseline risk assessment evaluated the health effects which could result from exposure to contamination as a result of ingestion of ground water, direct contact with ground water, and ingestion of plants grown in a garden irrigated with ground water. Because the wells were not in use, risks were only estimated based on a hypothetical future-use scenario (see Tables 15 to 20).

In the 1988 risk assessment, the maximum carcinogenic risk for nonradiological contaminants was calculated using a compilation of worst-case conditions found anywhere in the area investigated. The risk was calculated to be 3 X 10[-4] (three in ten thousand), which falls within the upper end of EPA's acceptable risk range. The primary contributors to this risk were PCE and 1,2-dichloroethane (see Table 21). It should be noted that 1,2dichloroethane was detected in only three out of 16 samples taken in the entire area of investigation and in only one of the five samples taken from the Home Place Well. Of these five samples, two discrete duplicate samples were taken at a depth of 485 to 495 feet; while 1,2-dichloroethane was detected in one sample at a concentration of 69 ppb, it was not detected in the other.

The estimated risks posed by the presence of radionuclides in the ground water in the Home Place Well, the only well in which elevated radionuclide concentrations were detected, exceeded EPA's acceptable risk range of 10[-4] to 10[-4]. The maximum carcinogenic risk attributable to radionuclides in the Home Place Well was estimated to be 3 X 10[-3] (three in a thousand). In this case, uranium-234 and uranium-238 present in the Home Place Well ground water samples are the primary contributors to the risk (see Table 22). As noted above, the radiological contamination present in the well was determined to be naturally occurring.

Based upon the 1988 risk assessment, the maximum noncarcinogenic risk estimate for all age groups exceeded EPA's reference HI of 1, and was calculated to be 26 (see Table 23). However, as in the carcinogenic risk estimation, this calculation used the maximum contaminant concentrations found within the area of investigation. The primary contributors to the risk estimated were mercury and selenium. Mercury, detected in 6 out of 14 samples, was only detected once above its MCL (2 ppb) at a concentration of 2.6 ppb, and was only detected in the Home Place Well at a concentration of 0.9 ppb. Selenium, which accounts for 92 percent of the HI of 26, was detected only once in 14 samples; it was detected at the Home Place Well at a concentration of 28.6 ppb, above its 1988 MCL of 10 ppb, but well below its current MCL of 50 ppb.

Selenium, with its lone detection of 28.6 ppb, was identified as a contaminant of concern in 1988 because it exceeded the then-current federal MCL. Given the fact that the MCL for selenium is now 50 ppb, the compound might not be a contaminant of concern worthy of inclusion were the risk assessment being compiled today. Under current guidance, selenium would likely have been excluded based upon its limited frequency of detection (only 1 of 14 samples). In addition, the 1988 risk assessment calculated and overall HI of 21 for selenium; 90 percent of that risk was attributed to the ingestion of crops irrigated with selenium-contaminated ground water. This was based upon highly unlikely assumptions that a person would consume nearly one-half pound of leafy vegetables per day from a garden irrigated with contaminated water, for three months out of each year, over a 70-year period (current guidance uses a 30-year exposure period). Due to the highly conservative nature of the assumptions used for the 1988 assessment, the noncarcinogenic risks associated with contaminants in the Home Place Well were recalculated in 1993 (see Table 24) to more closely reflect current EPA risk assessment guidance.

Selenium was the only contaminant considered to be a contaminant of concern; the crop ingestion pathway was not considered to be a relevant pathway. The recalculated noncarcinogenic risk posed by ingestion of ground water contaminated with selenium was found to be 0.068, far below EPA's HI reference of 1 (since selenium was only detected in the Home Place Well, if the HI were calculated for selenium throughout the study area, the result would be the same). The carcinogenic risks associated with the ingestion of ground water from the Home Place Well were also recalculated. 1,2-dichloroethane was the only carcinogenic compound considered to be a contaminant of concern. The recalculated carcinogenic risk was estimated to be 4.4 X 10[-4] (4.4 in ten thousand) (see Table 25), which is at the high end of EPA's risk range, but considered acceptable given the particular circumstances at this site.

In summary, many of the assumptions of the 1988 risk assessment were overly conservative (i.e., not reflective of the reasonable maximum exposure case intended to be evaluated). As such, they did not portray the actual risk that would accrue to users of ground water at the site. The critical pathway of concern at the site is ingestion of ground water. Ingestion of ground water from the Home Place Well poses an unacceptable risk due to the presence of naturally occurring radiological compounds, but does not pose an unacceptable risk from non-radiological compounds.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data.

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemistry-analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the risk assessment provides upper-bound estimates of the risks to populations near the site, and is highly unlikely to underestimate the actual risks related to the site. In this particular case, the risk estimates are considered to be highly conservative.

More specific information concerning public health risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the administrative record.

STATUTORY DETERMINATIONS

Section 104 of CERCLA provides limitations on response actions and directs that no remedial action be taken in response to a release or threat of release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found. A response can only be authorized if the presence of the naturally occurring substance constitutes a public health

or environmental emergency and no other entity will respond in a timely manner. The radionuclides present at the Lodi Municipal Well site have been determined to be naturally occurring and, since the well is no longer being used for water supply purposes, an emergency does not exist. Therefore, EPA does not have the authority under CERCLA to address the radiological contamination at the site.

Remedial action is not necessary to ensure protection of human health and the environment from non-radiological compounds at the Lodi Municipal Well site since the concentrations of those compounds in the ground water at the well do not pose an unacceptable risk given the circumstances at the site. However, because ground water in the area has been found to contain sporadic contamination that is regional in nature, EPA recommends that the ground water not be used for potable water supply purposes without appropriate treatment.

The Borough of Lodi currently obtains potable water through private water supply companies. The Lodi Municipal Well is not utilized as a source of potable water.

STATE ACCEPTANCE

The State of New Jersey has not yet established a final position concerning the no action response for the Lodi Municipal Well site.

DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes from the preferred remedial approach presented in the Proposed Plan.