HEALTH CONSULTATION

SHIELD ALLOY METALLURGICAL CORPORATION (SMC)

NEWFIELD BOROUGH, GLOUCESTER COUNTY, NEW JERSEY

CERCLIS NO. NJD002365930

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PREPARED BY:

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
CONSUMER AND ENVIRONMENTAL HEALTH SERVICES

UNDER COOPERATIVE AGREEMENT WITH THE
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BACKGROUND AND STATEMENT OF ISSUES

Summary

The Shieldalloy Metallurgical Corporation, formerly known as Shieldalloy, is a National Priorities List site located in Newfield Borough, New Jersey. It is an operational manufacturing facility which processes ores and minerals to produce primary metals, specialty metals, and ferroalloys. The major contaminants associated with the site are chromium (Cr) and trichloroethene (TCE), which have been identified off-site in ground water, sediment, and surface water. Radiological materials which are processed at Shieldalloy are also potential contaminants. The site is of public health concern in the past because of the risk to human health caused by probable exposure to hazardous sustances at levels that may result in adverse health effects over time. However, current completed or potential exposure to hazardous substances have been eliminated. Community health concerns include: (1) risk to area residents from exposure to contaminants in private potable water wells southwest of the site; and (2) risk to area residents from exposure to contaminants in surface water and sediment of the creek and associated wetlands which is near the site.

Background

Location

The Shieldalloy Metallurgical Corporation (SMC) site is located at approximately 39° 31' 34" North 75° 1' 20" West. The SMC manufacturing facility occupies 60 acres in Newfield Borough (Gloucester County), New Jersey. SMC also owns approximately 7.5 acres of farmland in Vineland (Cumberland County), about 2,000 feet southwest of the main facility. Figure 1 shows the location of the site and the surrounding area.

The SMC facility is bounded on the west by a Conrail railroad line. To the north and east of the site are woods, residences, and small businesses. The Hudson Branch, a tributary of the Burnt Mill Branch of the Maurice River, flows along the southern boundary of the property and also through the southeast portion of the 7.5 acre tract of farmland. Most of the Newfield site is enclosed by a 10-foot high chain link fence. Figure 2 shows features of the Newfield site.

Metallurgical Activities

SMC, which was formerly called Shieldalloy Corporation, has been operating since approximately 1955. Past activities have included production of chromium (Cr) metal and chromium oxide, vanadium pentoxide and ferrovanadium, ferrocolumbium, and nickel columbium. From 1965 to 1967 SMC operated a titanium metal degreasing process using trichloroethene (TCE). Current production processes include aluminothermic and reduction smelting of ores, which produce purified metal, slags, and various by-products, co-products, and other materials. SMC products have included aluminum master alloys, ferroalloys, crushing and grinding metal powders, and pressed metal briquettes. Raw materials which have been stored at the facility include pyrochlore

($NaCaCb_2O_6F$), columbium, ferroboron, aluminum oxide, titanium oxide, strontium oxide, zirconium oxide, dolomite lime, steel slag, lead, nickel, ferromanganese, silicon, fluoride salts, and oxides of vanadium. As a result of these activities, SMC has generated slag, dross, baghouse dust, and wastewaters. A chronology of activities related to the SMC site is given in Table 1.

Radiological Materials

The ore which contains the mineral pyrochlore used in the manufacture of ferrocolumbium also contains radioactive materials (thorium and uranium). Due to the presence of these naturally occurring radioisotopes, a portion of the facility has been licensed and regulated by the Nuclear Regulatory Commission (NRC). The slags and dusts (including the radioactive components) which have resulted from the processing of the ore are stored in two large piles in the NRC-controlled area (see Figure 2). The NRC license for SMC expired in July 1985. The license renewal request was revised and resubmitted in 1988, after the NRC had required SMC to conduct a radiological survey to determine if any radioisotopes had migrated from the NRC-controlled area. The NRC is currently preparing an Environmental Assessment of radioactive materials at SMC.

Environmental Investigations

Several environmental investigations of the SMC property and vicinity have been conducted since 1972. The initial investigation[1] was conducted as a result of the detection of hexavalent chromium [Cr(VI)] in a well which supplied process water for SMC use. A subsequent study of ground water and surface water[2] prompted the installation of an ion exchange resin system to remove chromium from the contaminated ground water. In 1983 twelve monitoring wells were installed downgradient of the facility to evaluate the quality of off-site ground water and to determine the extent of chromium contamination. The site was proposed for inclusion on the National Priorities List (NPL) in 1983, and its addition became final in 1984.

The results of a four year study of the impact of the SMC site on ground water were published in 1988[3]. The report proposed a schedule for pumping and treatment of ground water to control the migration of chromium contamination.

In October 1988 the New Jersey Department of Environmental Protection (NJDEP) issued an Adminstrative Consent Order which required SMC to operate a pump and treat system using ion exchange technology and to conduct a Remedial Investigation/Feasibility Study (RI/FS). The pump and treat system began operations in May 1989; the RI Workplan[4] was finalized in October 1990, and the Draft Final RI[5] was released in July 1991.

In 1995 a Human Health Risk Assessment[6] was published. A Proposed Plan for the Ground Water Operable Unit was presented to the public in 1995 (the Final Record of Decision[7] was subsequently published in 1996), and a Draft Final Feasibility Study[8] on soil, sediment and surface waters was published in 1996.

Site Visit

The site was most recently visited by representatives of the New Jersey Department of Health [now New Jersey Department of Health and Senior Services (NJDHSS)], and the Agency for Toxic Substances and Disease Registry (ATSDR) on March 4, 1996.

The plant is in active use during multiple shifts, and has approximately 200 employees at present. A tour of the premises showed the property to be surrounded by a chain link fence topped by barbed wire. Access to the property was through the main gate. Other gates in the fence were observed on the north and south sides; it was stated that these gates were opened only occasionally by plant workers for maintenance purposes. The fence was in good condition, and there was no evidence of trespassing.

The site contains a number of structures, mostly metal process buildings and baghouses, and storage areas. Several buildings have "radioactive" and other warning placards attached. There are several empty lagoons on the site property. The eastern portion of the site, i.e., the NRC-controlled area, contains two large piles of radioactive waste material from the processing of pyrochlore ore. Gamma radiation measurements with a Ludlum Model 19 meter [NaI(Tl) detector] showed approximately 1 mR/hr at the edge of a pile in a storage building; approximately 1.5 mR/hr was measured at the edge of one of the slag piles, and 100 μR/hr was measured along the east end of the fenceline. Other gamma measurements showed approximately 325 μR/hr at a point on the north fenceline near the gate, about 300 μR/hr just inside Building 111 where the pyrochlore is processed, and approximately 30 μR/hr near the baghouses. Approximately 20 μR/hr was measured along the south fenceline near the outflow of the water treatment system. Background gamma in the vicinity of SMC was found to be 7-8 μR/hr.

There are several wells on the property which are used to monitor ground water contamination. There were several piles and pallets of aluminum ingots in the vicinity of the process buildings. One building contained pallets of drums which were labelled as "chromium". A large tank of liquid nitrogen is adjacent to one of the buildings.

A tour of property near the site showed the Hudson Branch to run through the wooded area along the southern fence line. The nearest structures in this area are located along Weymouth Road, approximately 100 yards south of the Hudson Branch. The Hudson Branch continues to the southwest through primarily wooded terrain, although it does pass through the 7 acre lot which is owned by SMC, but leased for farming. The Hudson Branch proceeds across private property (there is a small pond on one property where the Hudson Branch has been dammed) and empties into Burnt Mill Pond near Delsea Road (State Route 47). An area south of Weymouth Road west to Delsea Road (in Vineland, Cumberland County) has been designated a well restricted area since 1986. Residences in the restricted area which previously had been on private wells have been connected to municipal water since that time. Vineland Municipal Well #10, located on Delsea Road within the restricted area, has an air stripper for VOC treatment.

A small oil company is located on the western side of the SMC property near the main

entrance to the plant site. An unused landfill owned by Newfield Township is located adjacent to the eastern end of the site near Gorgo Lane.

Statement of Issues

As a result of the recent completion of the Feasibility Study and other documents,[6-8] the NJDEP Bureau of Federal Case Management requested that the public health implications of SMC be reevaluated. Significant public health issues at SMC which will be considered here include ground water contamination, and contamination of surface waters, soil and sediment in and near the Hudson Branch by metals and VOCs. In addition, possible exposure to surface waters, soil and sediment of the Hudson Branch which may be contaminated by the radioactive materials (thorium, radium, and uranium) which are by-products of pyrochlore processing will be evaluated.

Previous ATSDR Activities

There have been several previous evaluations of public health related to SMC. In 1988 the Agency for Toxic Substances and Disease Registry (ATSDR) issued a Preliminary Health Assessment[9], in which it was concluded that the site presented a "potential public health concern" due to risk of exposure to hazardous substances in ground water, surface water, soil, sludge, airborne particulates, and ingestion of contaminated fish. The Preliminary Health Assessment recommended that: (1) demographic information be collected to identify individuals who were potentially affected by the contamination; (2) radioactive areas be defined; (3) warning signs be posted; and (4) additional characterization of on- and off-site areas be conducted during the RI/FS process which would permit definition of environmental contamination and human exposure pathways.

In 1992, a Site Review and Update (SRU)[10] was published by ATSDR which recommended that a Health Consultation be conducted to evaluate the health effects related to contaminated groundwater. The SRU also recommended that a Public Health Assessment be conducted.

In 1993, a Health Consultation[11] evaluated alleged cyanide exposure to members of two families who reside in the area of the facility. No cyanide exposure was shown.

In 1994, a Health Consultation[12] evaluated the potential for exposure to radiological materials at SMC. Radiological contamination off-site was not found to present a hazard to human health. This conclusion, based on data from a radiological survey[13] conducted by Oak Ridge Associated Universities, was reached upon consideration of the possible ingestion of contaminated soil/sediment and exposure to external gamma radiation in the vicinity of the site boundary.

DISCUSSION

Ground Water Contamination

As previously indicated, ground water in the vicinity of the SMC property was discovered to be contaminated by chromium when a new supply well was being installed near the SMC property in 1972[1]. [It should be noted that chromium contamination of ground water was first identified in an on-site monitoring well in 1970, as a result of process waste waters having been discharged into unlined lagoons on SMC property between 1963 and 1970.] Subsequent testing of ground water from monitoring, municipal supply, and private potable water wells showed both inorganic and organic contaminants to be present at levels of concern in ground water in the area. As a result of the detection of trichloroethene (TCE), from the titanium degreasing process which operated on site in the mid-1960's, in off-site ground water, an area southwest of the SMC plant property was declared to be a "well restricted area" (see Figure 1) in 1986. All ground water users within the restricted area who until then had been supplied by private potable wells were placed on the municipal water supply. This restricted area continues in force, although several wells which are used for irrigation purposes apparently remain in operation.

The ground water recovery and treatment system (which was initially installed with one recovery well on the southwest corner of the property in 1979) utilized ion exchange resin beds to remove contaminant metals. After it was determined in 1989 that the ion exchange resin treatment system had been limited by high concentrations of naturally occurring iron in the ground water, an improved system was installed in 1992 which uses electrochemical methods of removing metals. This system removes chromium from the ground water more efficiently than the previously used ion exchange technique. There are currently 5 extraction wells (see Figure 3), and the treatment system now operates continuously at a combined rate of 400 gallons per minute. The ion exchange system remains in place, but is no longer used. VOCs are removed from the extracted ground water by air stripping. The treated waters are discharged to the surface waters of the Hudson Branch.

Figures 4 through 7 show the approximate extent of ground water contamination by the major contaminants (TCE and chromium) as of April, 1995[7]. In these figures, "shallow wells" denotes those monitoring wells which draw water from less than 50 feet in depth; "deep wells" denotes those which draw water from more than 50 feet below ground level. Monthly monitoring of the five extraction wells has shown that, during the period 1991 through 1995, total chromium concentrations in both "shallow" and "deep" wells have declined by 30 to 50%. Nevertheless, as shown in Figures 6 and 7, total chromium in ground water remains substantially above the Maximum Contaminant Level (MCL). Similarly, as shown in Figures 4 and 5, TCE concentrations also remain above the MCL.

In addition to chromium and TCE, earlier sampling[5] of "deep" ground water (so-called Rounds 1 and 2 conducted in December, 1990 and April, 1991, respectively) detected arsenic

(As), lead (Pb), antimony (Sb), and vanadium (V) in excess of MCLs. The "shallow" ground water was shown to contain As, boron (B), manganese (Mn), and V in addition to chromium and TCE. Table 2 presents MCLs and Comparison Values for these contaminants in drinking water. However, the principal ground water contaminants are chromium and TCE.

The Record of Decision (ROD)[7] for ground water contamination requires SMC to modify the system to maximize recovery and treatment of contaminated ground water, specifically: (1) improve the extraction of ground water by adding one additional deep well and three additional shallow wells; (2) continue electrochemical and air stripping treatments; and (3) continue to discharge the treated waters to the Hudson Branch. It is expected that treatment will be required for more than additional five years to reduce contaminant levels to achieve applicable ground water standards.

Surface Waters and Sediments of the Hudson Branch

The surface waters of Hudson Branch and associated ponds were analyzed for contaminants in 1990[5] and 1995[8]. The results of these analyses are shown in Table 3, along with MCLs and Comparison Values for As, beryllium (Be), Cr, nickel (Ni), Pb, and V. As shown, with the exception of V, surface water samples which exceeded Comparison Values and/or MCLs are primarily located in the Hudson Branch near the southern boundary of the SMC property. Conversely, V was found in surface water samples taken as far as the Burnt Mill Pond (sample locations are shown in Figure 8). Although there is no MCL for V, NJDEP has established a proposed cleanup criterion of 260 ppb[8].

Sampling of sediments of the Hudson Branch was initially conducted in 1990[5]; a more extensive characterization of sediments was performed in 1995[8]. [The locations of these samples are also shown in Figure 8.] The results of the analyses of these samples for As, Be, Cr, Ni, Pb, and V (see Table 4) show that Cr, Ni, and Pb are present in the sediments of the Hudson Branch as far as Burnt Mill Pond. Since there are no ATSDR Comparison Values for contaminants in sediment, the results are compared in Table 4 with NJDEP guidance[14] and Ontario provincial guidelines[15]. for contaminants in sediment. These guidelines, however, are derived from effects to aquatic/benthic organisms, and should not be applied to human health outcomes.

The Draft Final Feasibility Study[8] recommends that contaminated sediment of the Hudson Branch immediately south of the SMC property be remediated by excavation and backfilling; removal of some "hot spots" further downstream is also recommended. Existing water flow of the Hudson Branch, as well as outflow from the ground water treatment, would be temporarily re-routed during the sediment remediation.

Surface Soils

Surface soils on and adjacent to the SMC property were sampled and analyzed in 1990[5] and in 1995[8]. [Note: these "surface soil" samples were typically 0-6" or 0-12" in depth, rather than the ATSDR definition of 0-3".[16]] Approximately 64 samples were taken from a grid on 200 foot

centers on SMC property. Other surface soil samples were taken near the plant property, along the northern boundary, and south of the property in the vicinity of the Hudson Branch (see Figure 8). Table 5 presents the results for As, Be, Cr, Ni, Pb, and V of samples taken on SMC property near its boundary, as well as those locations off the property. As shown, contaminants found at several locations near and off site property exceed NJDEP Residential Direct Contact criteria, although they generally do not exceed Comparison Values.

The Draft Final Feasibility Study[8] recommends that on-site chromium contaminated soil be excavated and removed to an appropriate disposal facility. On-site soil which exceeds the 10^{-6} risk level (but is below the removal criteria) would be paved or covered with clean soil. The site fence would be extended to encompass adjacent areas which exceed Residential Direct Contact criteria. Non-adjacent off-site chromium contaminated soils which exceed Residential Direct Contact criteria would be excavated and consolidated on-site. The removal of chromium-contaminated soils would also result in the removal of the other soil contaminants.

Radiological Materials

Since pyrochlore ($NaCaCb_2O_6F$) ore, the source material for columbium (niobium), may contain as much as 2% thorium (2200 pCi/gram) and 0.4% uranium (1320 pCi/gram) by weight, SMC was issued a NRC license for "source material" in 1980. When SMC applied for license renewal in 1985, the NRC required that a survey be done to verify adequate control of radioactive materials. The survey,[13] conducted in 1987, showed concentrations of up to 243 pCi Ra-226/gram, 700 pCi U-238/gram, and 1,460 pCi Th-232/gram in the so-called "high-ratio" slag pile, and up to 318 pCi Ra-226/gram, 520 pCi U-238/gram, and 1,500 pCi Th-232/gram in the so-called "standard" slag pile within the controlled area. However, as shown in Table 6, there was also evidence that radioactive material had migrated to the boundary of the SMC property, and also to the sediment of the Hudson Branch (see Table 7). These concentrations may be compared with the "background" soil concentrations of Th, Ra, and U shown in Table 8.

A more recent characterization of radiological parameters on and in the vicinity of SMC property was conducted in 1991.[17] Measurements of ambient gamma radiation levels were taken on a grid of 20 meter centers within the site property, along the property fenceline, along the Hudson Branch near the site, and along the so-called Haul Road which leads to the gate in the south fenceline. These measurements, taken at 1 meter level, showed external gamma levels as high as 75 μR/hr along the southern fenceline, 55 μR/hr along the east fenceline, 131 μR/hr along the northern fenceline, 22μR/hr along the Hudson Branch immediately south of the site, and 26 μR/hr where Haul Road intersects with Weymouth Road.

During the same survey, soil and sediment samples were taken outside the southern fenceline along the Hudson Branch. Soil samples were also taken beyond the northern fenceline. The sediment samples taken from the Hudson Branch, analyzed for U-238 and Ra-226, Th-232 and Ra-228, showed as much as 11 pCi U-238/g, 9 pCi Th-232/g, 77 pCi Ra-226/g, and 83 pCi Ra-228/g. Soil samples taken beyond the north fenceline showed as much as 41 pCi Th-232/g.

Surface water samples, taken from the Hudson Branch and from surface runoff adjacent to the south fence, showed gross alpha and gross beta activities as great as 7800 pCi/l and 3600 pCi/l, respectively.

NRC license decommissioning requires a plan for disposal of the radioactive materials. As a result, the NRC is preparing an Environmental Assessment which will include the potential environmental impact of *in situ* disposal of the slag piles which has been proposed by SMC[18].

Public Health Implications of Chemical and Radiological Exposure at SMC

Chemical Contaminants

The primary issue of public health concern to residents of the area is ingestion of contaminated ground water. It is likely that, for a number of years (most probably between 1972 and 1986), residents who drank water from private wells located southwest of the SMC plant were exposed to chromium and TCE, and perhaps arsenic and beryllium, which was contained in the ground water at levels which exceeded Comparison Values. Exposure by inhalation of TCE which vaporized (during showering, for example) from the ground water was also possible. However, these exposures ceased in 1986 when use of private wells for drinking water was restricted, and municipal water was made available to users in the area.

Other possible, but less likely to be completed, pathways for exposure to residents of the area include: (1) incidental ingestion of contaminated (arsenic, beryllium, chromium, and vanadium) surface waters of the Hudson Branch and associated ponds; and (2) direct contact with chemically contaminated sediments (chromium, nickel, and lead) and surface soil (beryllium, chromium, nickel, lead, and vanadium) in the vicinity of the Hudson Branch.

The Human Health Risk Assessment [6] which was published in 1995 evaluated cancer and non-cancer risk associated with 5 scenarios: (1) on-site trespasser (current); (2) on-site commercial/industrial (current); (3) off-site residential (current); (4) construction (future); and (5) on-site residential (future). These scenarios were evaluated using contaminant concentrations for both Reasonable Maximum Exposure (RME), i.e. 95% Upper Confidence Level, and Most Likely Exposure (MLE), i.e., the 50th percentile of measured sample concentrations. Cancer risk in excess of 10^{-6} and non-cancer risk due to exposure in excess of the oral Reference Dose (RfD) were calculated for the chemicals of concern.

Two of the above scenarios are of particular interest in considering potential effects on public health. For example, it was estimated that children trespassing on the site could be subject to an excess cancer risk due to ingestion of arsenic and beryllium in surface waters. This scenario assumed ingestion of the RME concentrations in 50 milliliters of water per day at a frequency of 30 days per year for nine years. However, past or current exposure to contaminated surface waters according to these assumptions is unlikely.

For the off-site residential scenario, it was predicted that ingestion of ground water (from both "shallow" and "deep" wells) with RME exposure point concentrations in 2 liters per day, 350

days per year for 30 years would result in excess cancer risk for arsenic and beryllium. This scenario also predicts an excess non-cancer exposure risk for ingestion of chromium. While exposure to chromium-contaminated ground water was a significant possibility in the area southwest of SMC property until 1986, this scenario is no longer likely because the use of potable wells in this area has ceased.

Radiological Contaminants

The 1994 Health Consultation[12], which was based on the data from the 1988 ORAU survey, estimated exposure which could result from ingestion of radionuclides in the soil/sediment (see Table 7) of the Hudson Branch immediately adjacent to southern boundary of SMC property. The estimate was based on ingesting 200 mg of contaminated soil/sediment per day for 100 days per year. The Health Consultation also considered exposure (for 1 hour per day for 100 days per year) to the gamma radiation measured near the north fenceline. It was determined that these potential exposures would not "currently pose a public health hazard." The radiological data which were gathered in 1991 (and reported in 1992[17]) show similar levels of ambient gamma radiation and radionuclides in the off-site surface soil/sediment. Radiological survey during the brief site visit in 1996 implied that external gamma radiation dose rates are now higher than those found in the previous survey. Nevertheless, dose rates (i.e. external exposure) or soil/sediment radiological concentrations of 5-10 times greater than the previously measured quantities would be necessary to exceed the recommended annual exposure to the general public of 100 millirem (in excess of background) per year.

Employees and other workers on the SMC property may have been exposed by incidental ingestion of radiologically contaminated soils, or by inhalation of fugitive dusts. SMC employees were also likely to have been exposed to ionizing radiation in excess of normal background levels due to the presence of radioactive materials on the site. However, with appropriate control measures and personal dosimetry, exposure of the workers in excess of permissible levels (as specified in NRC regulations) of ionizing radiation would have been unlikely.

Potentially Exposed Population

Figure 9 indicates that there are currently approximately 3,000 individuals who reside in about 1,000 housing units within one mile of the SMC property. Since the primary areas of potential exposure are located south and west of the SMC property along the Hudson Branch and within the well restricted area, it is estimated that as many as several hundred individuals may have been exposed at levels of public health concern (through past ingestion of ground water from approximately 60 potentially contaminated wells). The number of individuals who may have been exposed to contaminated surface soils and surface water/sediment is likely to have been less than one hundred.

Determination of Health Outcomes

Biological monitoring of ten individuals (two families) for cyanide exposure was conducted

as reported in the 1993 Health Consultation[11]. No cyanide exposure was shown. No other study of health outcomes associated with SMC has been conducted.

CONCLUSIONS

As discussed above, the following conclusions may be drawn regarding exposures to contaminants associated with the SMC site:

- exposure to levels of public health concern has existed in the past due to ingestion of chromium and TCE in ground water; however, as a result of the restriction on the use of wells for potable water in 1986, this exposure pathway no longer poses a public health hazard.

- the possibility exists for past exposure to: (1) arsenic, beryllium, chromium, and vanadium in surface waters; (2) chromium, nickel, and lead in sediment; and (3) beryllium, chromium, nickel, lead, and vanadium in surface soil. However, these exposure pathways are less likely to have been completed than the ingestion of ground water pathway.

- off-site exposure to radioactive materials and associated external gamma radiation is not likely to have been a completed exposure pathway at levels of public health concern. However, there is evidence of transport of radiological materials to soil and sediment along the Hudson Branch.

- based on the data which are currently available, there is no apparent public health hazard associated with the SMC site.

RECOMMENDATIONS

The following recommendations are made to protect the public heath and welfare:

Recommendations to Limit Exposure

- restrictions on the use of ground water wells within the current well restricted area for potable water should be maintained until monitoring demonstrates that concentrations of As, Be, Cr, Pb, Ni, and V in "shallow" and "deep" wells are below MCLs;

- radiation warning signs/placards (which face out) should be placed on the southern fence along the Hudson Branch, along the northern boundary in the vicinity of the railroad siding, and on the eastern end of the site.

Public Health Actions

The Public Health Activities Plan (PHAP) for SMC contains a description of the actions to be taken by ATSDR and/or NJDHSS at or in the vicinity of SMC subsequent to the completion of this Health Consultation. The purpose of the PHAP is to ensure that this Consultation not only

identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a committment on the part of ATSDR and NJDHSS to monitor this plan to ensure that the plan is implemented. ATSDR will provide an annual follow-up to this PHAP, outlining the actions which have been completed, and those actions in progress. This report will be placed in repositories that contain copies of this Consultation, and it will be provided to persons who request it. The public health actions to be implemented by ATSDR/NJDHSS are as follows:

Actions Undertaken

- The environmental sampling data and proposed remedial activities have been evaluated within the context of human exposure pathways and other relevant public health factors.

- The Health Consultation conducted by ATSDR in 1993 found no likelihood of human exposure to cyanide for two families who reside in the vicinity of SMC.

- The well restricted area imposed by the Vineland Health Department in 1986 terminated the ingestion of ground water as a potential exposure pathway.

- A Physician Education Newsletter/Resource Guide which provides information on the potential health effects of exposure to chromium and other heavy metal contaminants at SMC has been prepared by NJDHSS and will be distributed to primary care physicians and other interested individuals in the Newfield/Vineland vicinity.

Action Planned

- ATSDR and NJDHSS will coordinate as deemed necessary with the Vineland (Cumberland County) Health Department, Gloucester County Health Department, NJDEP, and other appropriate environmental agencies to develop plans to implement the recommendations contained in this Consultation.

Certification

This Health Consultation for Shieldalloy Metallurgical Corporation (SMC) in Newfield Borough (Gloucester County) was prepared by the New Jersey Department of Health and Senior Services (NJDHSS) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the Health Consultation was initiated.

Technical Project Officer, SPS, SSAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR has reviewed this Health Consultation and concurs with its findings.

for Branch Chief, SSAB, DHAC, ATSDR

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Table 1. Chronology of Events at Shieldalloy Corporation

Date	Activity
1955	Shieldalloy begins operations
1965-1967	Titatium degreaser unit (TCE) operations
1963-1970	Discharge to unlined lagoon
1970	Cr (VI) contamination found in on-site groundwater
1972	12 jetted well points and 1 well installed on site
1973	3 off site wells installed
1979	Installation of groundwater treatment plant
1982	Treatment plant determined to be insufficient
1983	Proposed for NPL; 14 offsite wells (S/D) installed
1984	ACO by NJDEP requiring FS for improved treatment
1986	VOCs found in groundwater; area wells restricted
1988	ACO requiring RI/FS
1989	Public meeting
1990	Public meeting
1991	RI Workplan submitted; start groundwater FFS ACO Treatment Optimization, sampling, effluent
1992	Electrochemical treatment unit installed
1993	SMC filed for bankruptcy; NRC scoping meeting
1994	FFS for groundwater completed
1995	Public meeting; Proposed Plan for Groundwater treatment; Human Health Risk Assessment completed
1996	NRC public meeting NJDOH Site Visit Draft Final Soil, Sediment, and Surface Water FS Groundwater ROD published

Table 2. Comparison Values - Surface/Ground Water (ppb)

Contaminant	Child	Adult	CREG	MCL
TCE	20	70	3	5(1 NJ)
Sb	4*	10*	NA	6
As	3*	10*	0.02	50
B	100**	400**	NA	--
Be	50*	200*	0.008	4
Cr(VI)	50*	200*	3	100(NJ)†
Pb	--	--	--	15AL
Mn	50*	200*	NA	50
Ni	200*	700*	NA	100
V	30**	100**	NA	260AL(NJ)

MCL - Maximum Contaminant Level
CREG - Cancer Risk Evaluation Guide
AL - Action Level
NA - Not Applicable
-- Not Established
† Total Chromium
*Reference Dose Comparison Value
**Intermediate Comparison Value

Table 3. Surface Water Contaminants[5,8] (µg/l)

Location	As	Be	Cr	Cr(VI)	Ni	Pb	V
SW-1	2.0	1.3	43.3	ND	20.8	**28.0**	**272**
SW-2	**34.6**	**25.1**	**8520**	ND	**618**	ND	**5700**
SW-3	ND	1.0	**120**	ND	29.6	7.6	**310**
SW-4	2.4	1.0	**208**	54	17.7	3.8	**246**
SW-5	ND	ND	99.0	ND	17.1	5.5	**286**
SW-8	**3.2**	0.7(ND)	**101**	20(ND)	10.2	2.9	**64.3**
SW-11	1.8(ND)	0.7(ND)	47.6	20(ND)	12.3	0.7(ND)	**33**
SW-21	1.8(ND)	1	19.6	20(ND)	6.8(ND)	0.7(ND)	**257**
SW-25	2.8	2.6	46.8	20(ND)	19.2	2.7	**413**
SW-27	1.8(ND)	1	38.7	20(ND)	8.1	3.4	**144**
SW-30	1.8(ND)	0.7(ND)	2.7(ND)	20(ND)	6.9(ND)	0.9(ND)	3.5(ND)
SW-31	1.8(ND)	0.7(ND)	2.7(ND)	20(ND)	10.5	0.9(ND)	3.5(ND)
Child	3	50*	10000**	50*	200*	--	30***
Adult	10	200	40000**	200*	700*	--	100***
MCL	50	4	100	--	100	15AL	--
CREG	0.02	0.008	NA	3	NA	--	NA

Note: SW-1 thru SW-5 and SW-8 - 1990
CREG - Cancer Risk Evaluation Guide
MCL - Maximum Contaminant Level
-- Not Established
ND - Not Detected
NA - Not Applicable
* Reference Dose Comparison Value
** Reference Dose Comparison Value for Cr(III)
*** ATSDR Intermediate Comparison Value

Table 4. Sediment Contaminants - Hudson Branch[5,8] (ppm)

Location	As	Be	Cr	Cr(VI)	Ni	Pb	V
SD-1	5.1	9.1	**1220**	ND	**64.1**	**364**	1890
SD-2	16.1	22.8	**15700**	ND	**423**	**338**	4850
SD-3	12.3	5.9	**1950**	ND	**257**	**104**	1160
SD-4	8.4	3.8	**1770**	ND	**135**	**51.8**	647
SD-5	9.8	5.6	**2350**	ND	**96.5**	**69.8**	800
SD-6A	1.9	1.8	**61.5**	0.68(ND)	25.2	**97.8**	284
SD-6B	1.4	0.81	**30.1**	0.58(ND)	11.7	**59.6**	134
SD-6C	2.1	1.6	**66.2**	0.66(ND)	29.5	**97.2**	261
SD-7	0.46	1	**150**	0.67(ND)	24	**109**	137
SD-8	1	1.4	**628**	1.1(ND)	**80.9**	**46.9**	150
SD-9	4.6	1.8	**1400**	1.4(ND)	**57.1**	**97.7**	781
SD-9A	7.3	2.4	**4600**	2.6(ND)	**131**	**117**	1050
SD-10	8.2	4	**5360**	2.4	**559**	**336**	3530
SD-11	16.3	8.2	**4040**	3.4(ND)	**256**	**148**	1330
SD-12	23.8	3.5	**9740**	5.6(ND)	**199**	**280**	2720
SD-13	14.6	13.2	**8050**	2.7(ND)	**142**	**208**	2010
SD-14	18.7	6	**8190**	2.8(ND)	**124**	**144**	710
SD-15	16.1	21.1	**2100**	1.4(ND)	**1090**	**140**	3680
SD-16	11.6	11.7	**6730**	3(ND)	**552**	**149**	1740
SD-17	12.6	4.6	**5760**	1.6(ND)	**428**	**133**	658
SD-18	7.5	5.4	**3620**	2.2(ND)	**210**	**143**	753
SD-19	24.6	16.3	**4060**	6.9	**572**	**147**	2690
SD-20	2.3	1.3	**736**	0.95(ND)	22	21.3	122
SD-21	22.1	6.4	**5820**	2.2(ND)	**122**	**174**	791
SD-22	7.7	2.2	**1360**	1.4(ND)	**57**	**44.2**	283

SD-23	11.8	4.9	**3500**	1.8(ND)	**108**	**68.2**	658
SD-24	1.1	0.34	**83.4**	0.88(ND)	3.3	5.4	36.7
SD-25	1.7	0.76	**340**	1.3(ND)	10.3	5.3	91.9
SD-26	0.36	0.21	**110**	0.87(ND)	2.7	4.4	32.2
SD-27	0.39	0.18	**72.4**	0.89(ND)	1.9	5.8	15.2
SD-28	1.6	0.39	**122**	0.72(ND)	3.2	17	62.9
SD-29	1.2	0.18	4.4	0.62(ND)	2.4	11.6	7.2
SD-30	2	1.6	6.8	2.3(ND)	16.2	**58.5**	10.9
SD-31	0.27	0.18	1.6	0.74(ND)	2.6	4	1.4
NJDEP*	33	--	80	--	30	35	--
ONT**	6		26		16	31	

SD-1 thru 5 taken October 1990 All samples 0-6"
NJDEP* - Reference 14 (Effects Range Low)
ONT** - Reference 15 (Lowest Effect Level)
ND - Not Detected
-- Not Established

Table 5. Surface Soil Contaminants[5,8] (ppm)

Location	As	Be	Cr	Cr(VI)	Ni	Pb	V
SS-1	NA	0.52	NA	NA	NA	NA	NA
SS-2	NA	0.55	NA	NA	NA	NA	NA
SS-3	NA	0.68	NA	NA	NA	NA	NA
SS-4	NA	0.84	NA	NA	NA	NA	NA
RA-56	1.3	1.8	39.2	ND	28.1	58.4	208
SS-5	NA	4.1	360	5.9	NA	NA	739
SS-6	NA	1.7	283	0.41	NA	NA	275
SS-7	NA	0.8	38.3	0.23(ND)	NA	NA	101
SS-8	NA	0.38	8.0	0.23(ND)	NA	NA	17.8
RA-30	4.2	2.1	421	1.6	78	25.6	390
SS-21	2.3	0.13	11.6	0.23(ND)	4	20.4	19.7
SS-22	1.5	0.13	8	0.22(ND)	2.2	15.5	14.1
SS-23	2.3	0.28	8.6	0.25(ND)	2.4	17.3	22.4
SS-24	1.6	0.19	9.5	0.24(ND)	3.4	14.4	22.4
RA-13	6.2	6.8	123	0.38	90.4	319	1360
RA-14	4.2	12.8	218	ND	1290	257	2560
SS-26	NA	4.3	NA	NA	NA	NA	NA
SS-27	NA	0.35	NA	NA	NA	NA	NA
RA-5	4.5	1.4	29.7	ND	26.9	76.4	203
Pica	0.6	10*	2000*	10*	40*	None	6**
Child	20	300*	50000*	300*	1000*	None	200**
Adult	200	4000*	700000*	4000*	10000*	None	2000**
CREG	0.5	0.2	None	60	None	None	None
NJDEP †	20	1	100	None	250	400	370

SS- samples 0-12"
RA samples (on site inside boundary) taken in 1990 (0-6")
NA - Not Analyzed
ND - Not Detected
* Reference Dose Comparison Value
** ATSDR Intermediate Comparison Value
† NJDEP Residential Direct Contact Soil Clenaup Criteria

Table 6. Radiological Characteristics along SMC Perimeter[13] -1987

Location*	Gamma Waist (μR/hr)	Gamma Surface (μR/hr)	Th-232 (pCi/g)	Ra-226 (pCi/g)	U-238 (pCi/g)
180	165	103	10.6	5.5	5.4
200	144	82	8.3	4.5	7.2
320	62	52	8.5	5.7	3.3
400	16	21	5.9	1.6	2.7
600	19	23	7.3	2.6	2.2
610	19	37	27.2	5.1	16.8
620	12	21	1.4	2.6	5.4
640	12	14	4.1	6.2	3.4
650	37	57	68.1	13.7	31.0
660	47	41	52.3	6.7	13.4
680	12	21	3.4	6.1	3.2
700	22	33	14.6	6.4	5.3
720	9	10	6.3	3.0	4.0
1320	29	39	7.3	5.9	2.8
1340	33	52	13.1	2.6	5.3
1363	78	330	41.1	192	147
1800	87	62	5.3	1.7	2.2
1810	43	47	17.5	3.4	17.9
1820	58	52	12.3	4.2	3.2
1840	58	165	6.6	29.3	3.4
1841	82	206	4.1	61.9	<2.4
1860	41	41	6.0	2.4	2.5
1880	45	49	12.7	5.6	5.9
1888	102	123	9.3	76.3	63.5
1915	58	82	18.1	7.2	11.0
1920	49	41	9.1	2.4	4.5
2023	29	95	5.9	5.0	3.6
2090	41	37	2.6	1.0	0.9
2095	66	103	1.6	0.8	0.9
2115	103	412	1.1	0.6	0.7

* Distance in meters along perimeter fence counterclockwise from northeast corner of site

Table 7. Radiological Analyses of Sediment (pCi/gram)[13]

Location*	Th-232	Ra-226	U-238
19 (Drain Exit A)	4.5	2.5	12.5
20 (Drain Exit B)	33.6	15.5	20
21 (Drain Exit C)	14.1	5.4	7.3
32 (Perimeter Fence - 1476 m)	20.2	24.8	<6.6

* Locations along southern site boundary/Hudson Branch

Table 8. Radiological Background Near SMC[13]

Location*	Gamma Rate (μR/hr)	Th-232 (pCi/g)	Ra-226 (pCi/g)	U-238 (pCi/g)
1	7	0.3	0.5	1.3
2	7	0.5	0.4	<0.4
3	6	0.1	0.3	0.3
4	7	0.1	0.2	<0.3
5	7	0.4	0.7	<0.4
6	7	0.5	0.9	0.4
7	8	0.6	0.5	0.8

* Locations 1-5 km from SMC

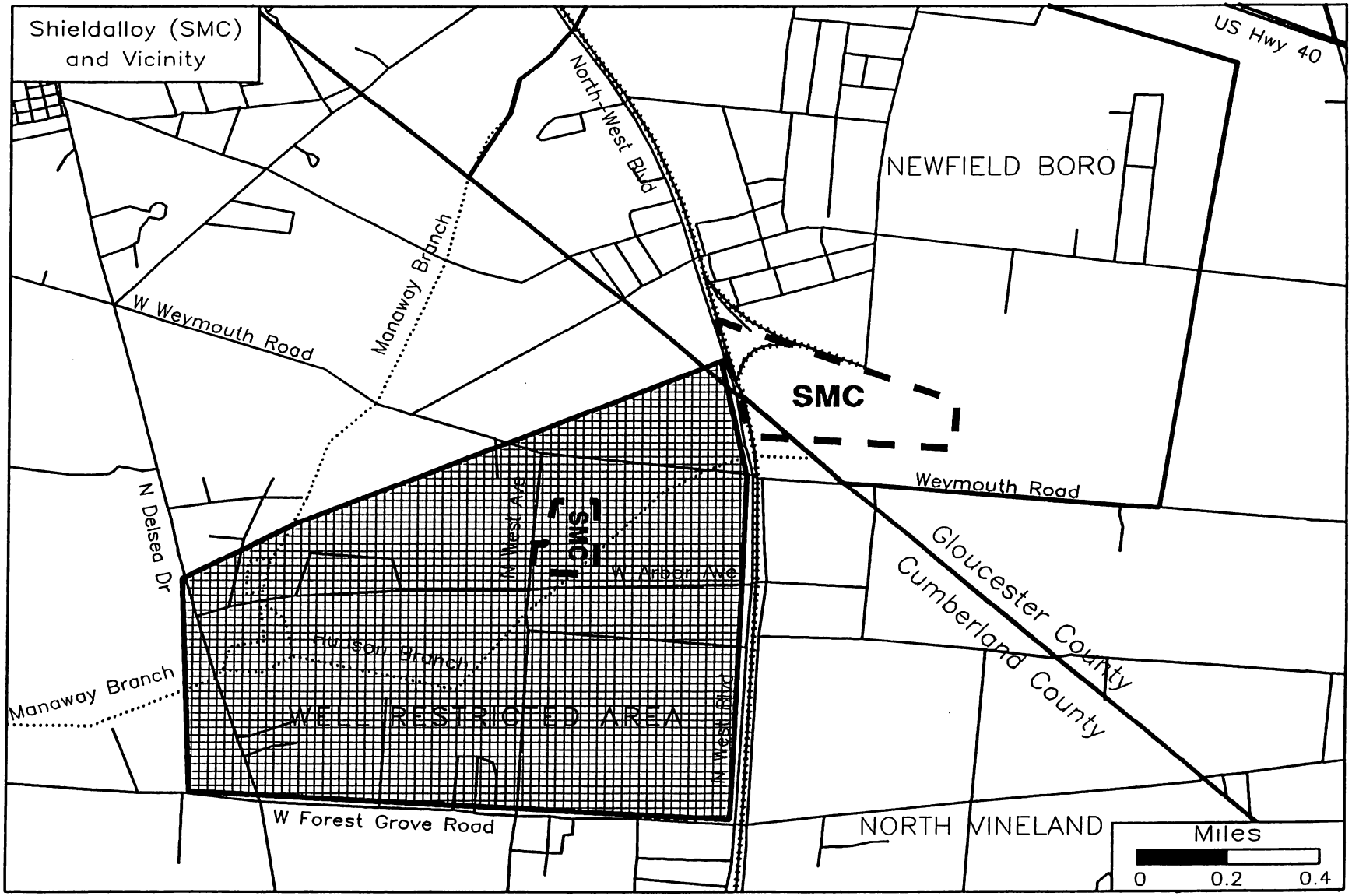

Figure 1. Shieldalloy (SMC) and Vicinity

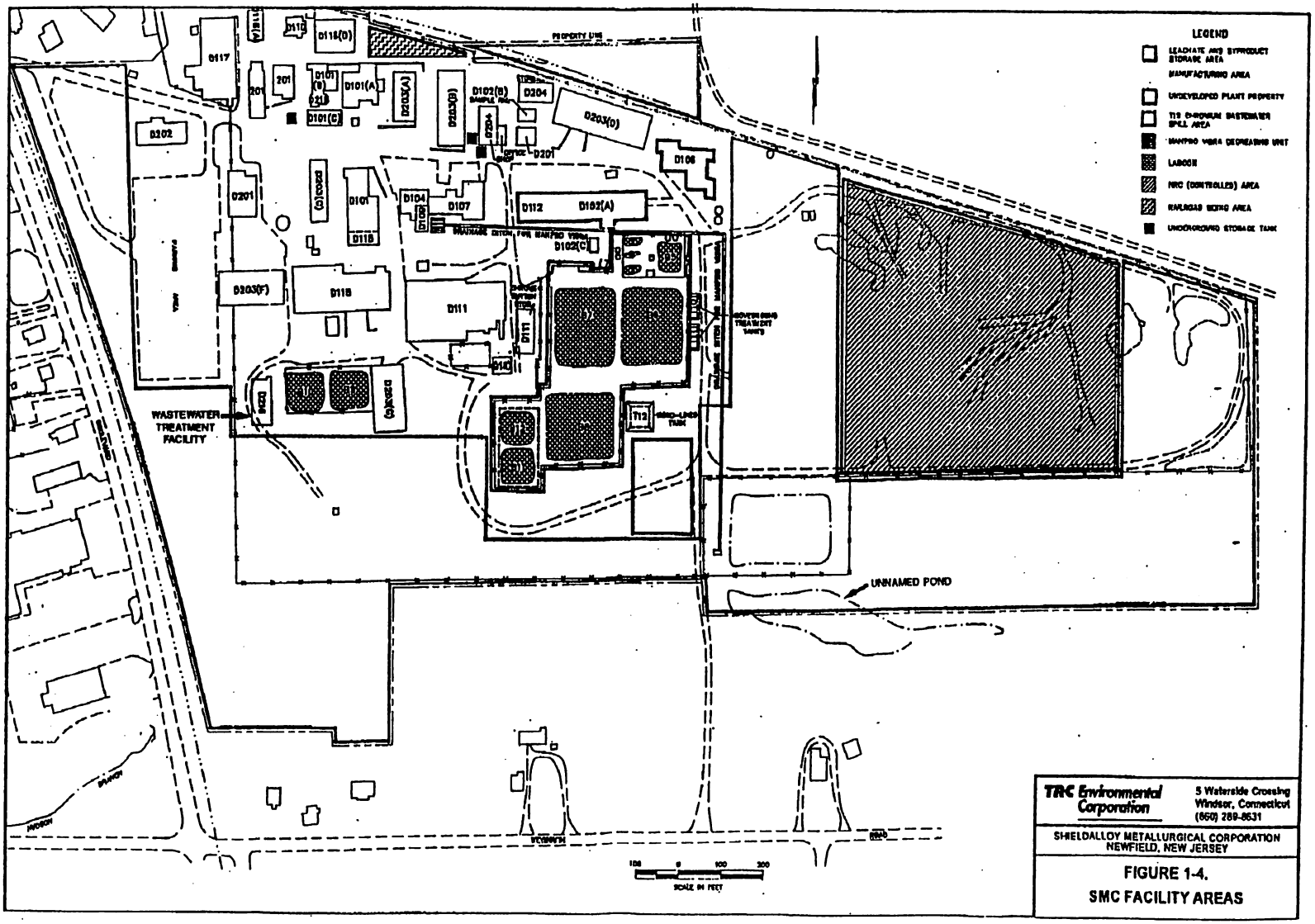

Figure 2. SMC Facility

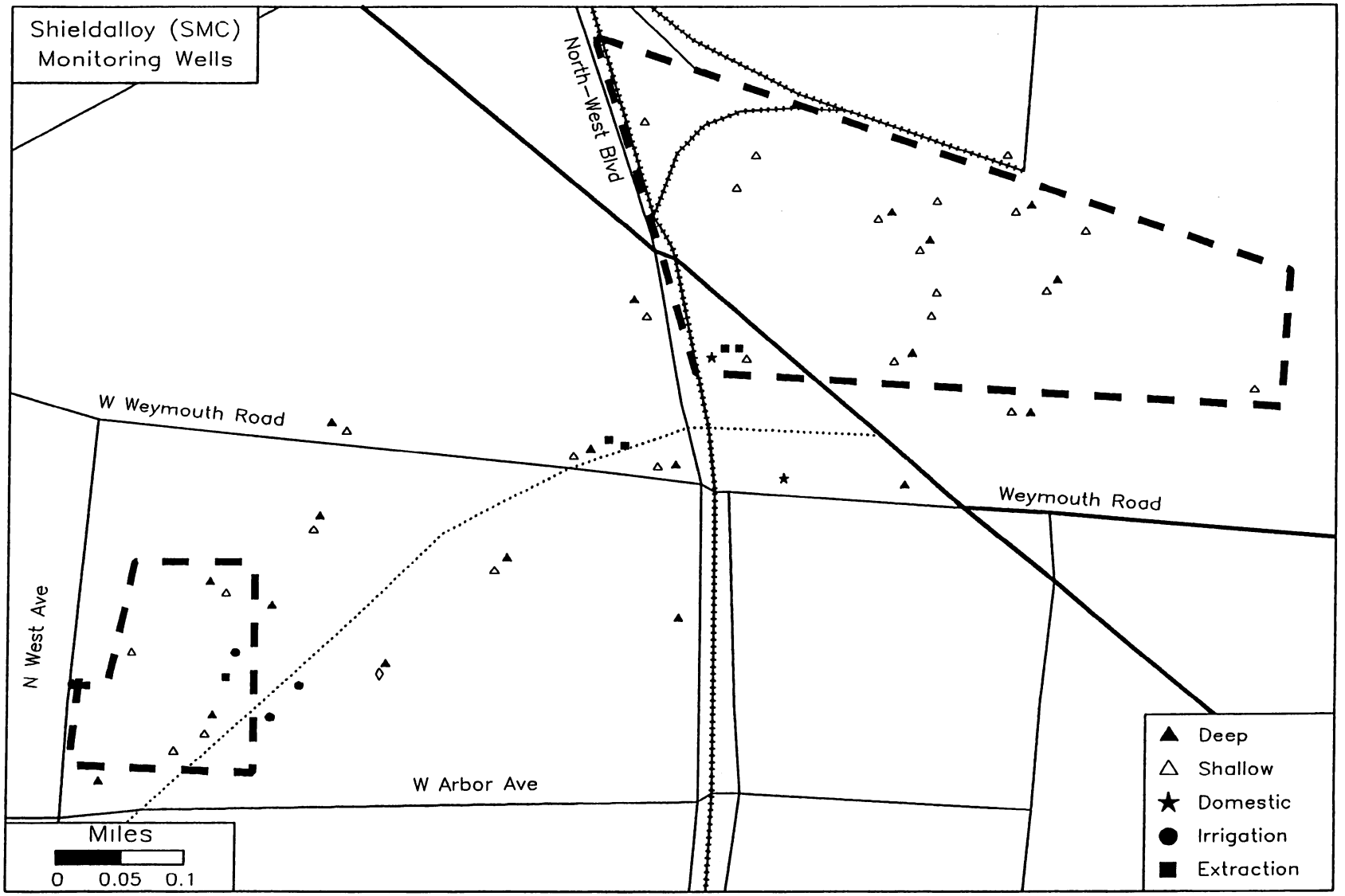

Figure 3. Monitoring Wells - SMC

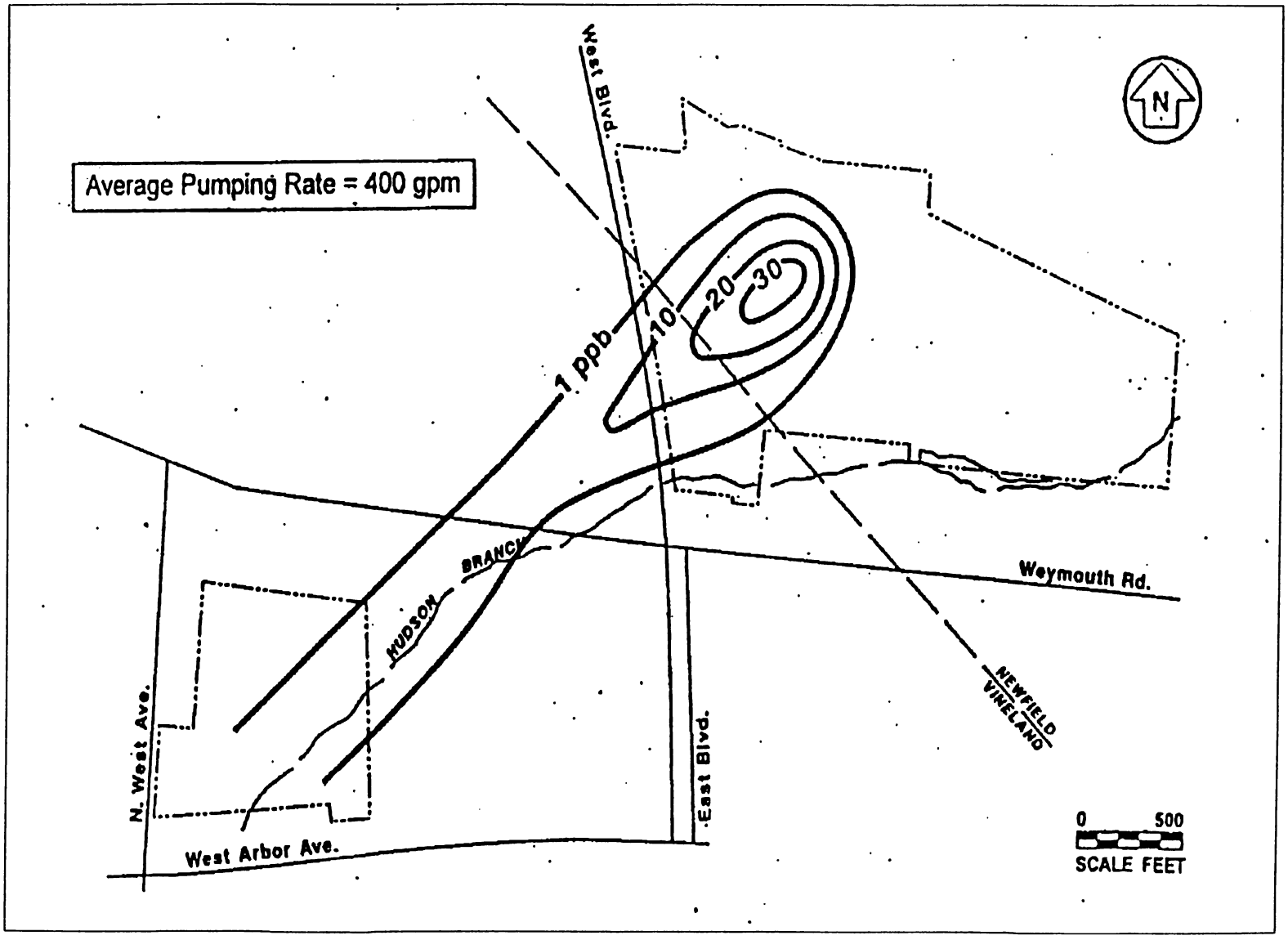

Figure 4. Trichloroethene Plume - Shallow Wells (1995)

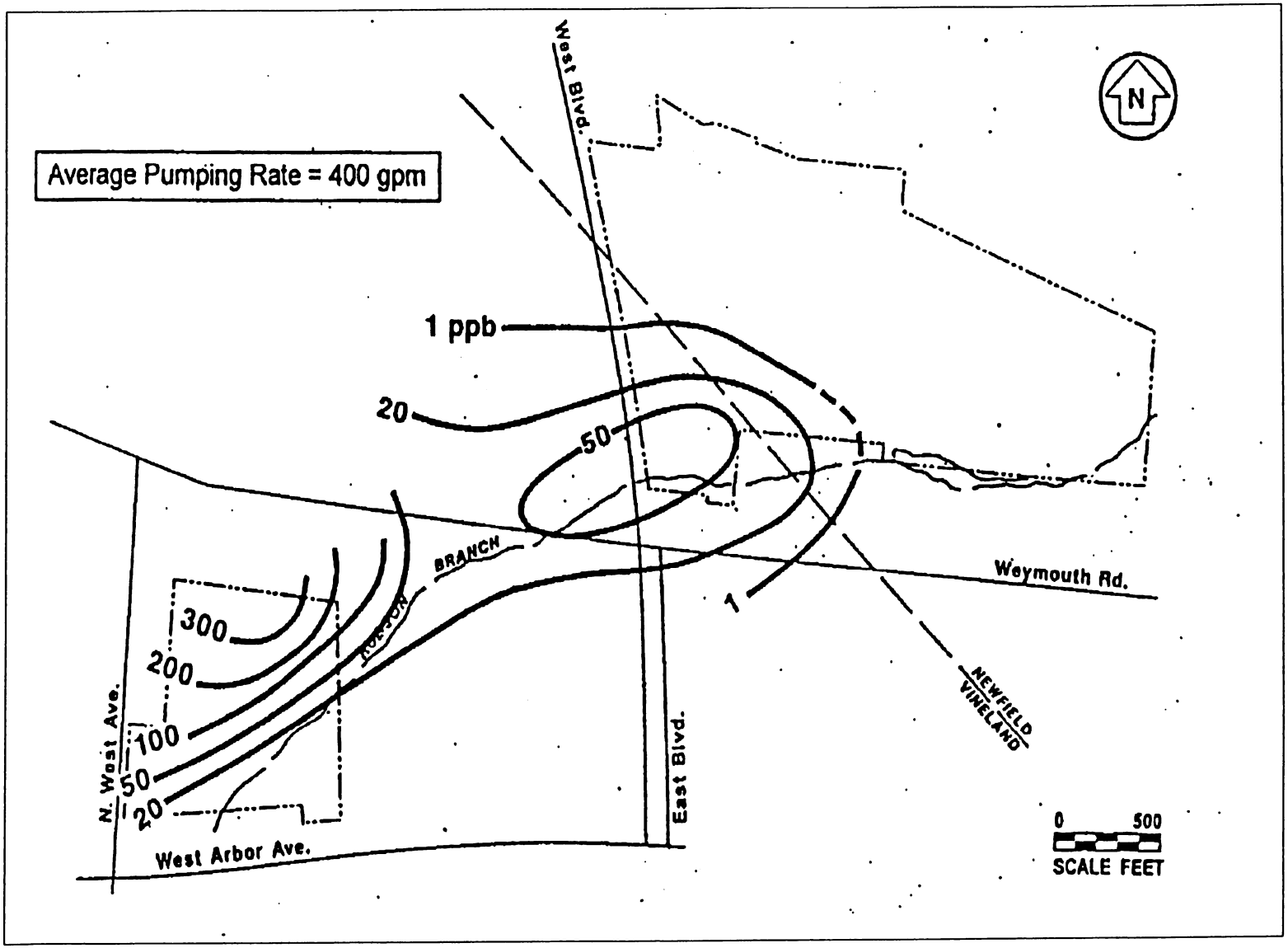

Figure 5. Trichloroethene Plume - Deep Wells (1995)

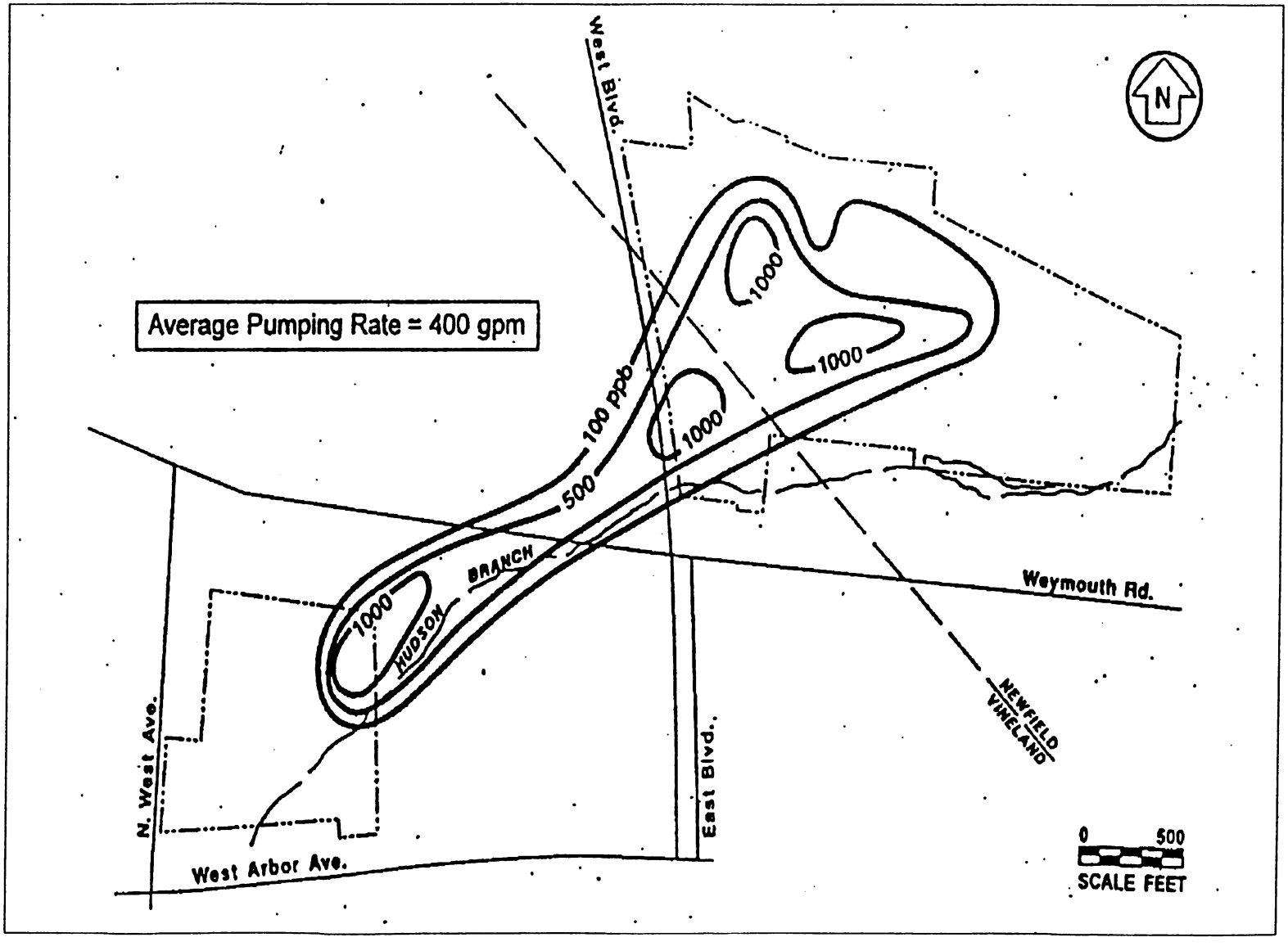

Figure 6. Chromium Plume - Shallow Wells (1995)

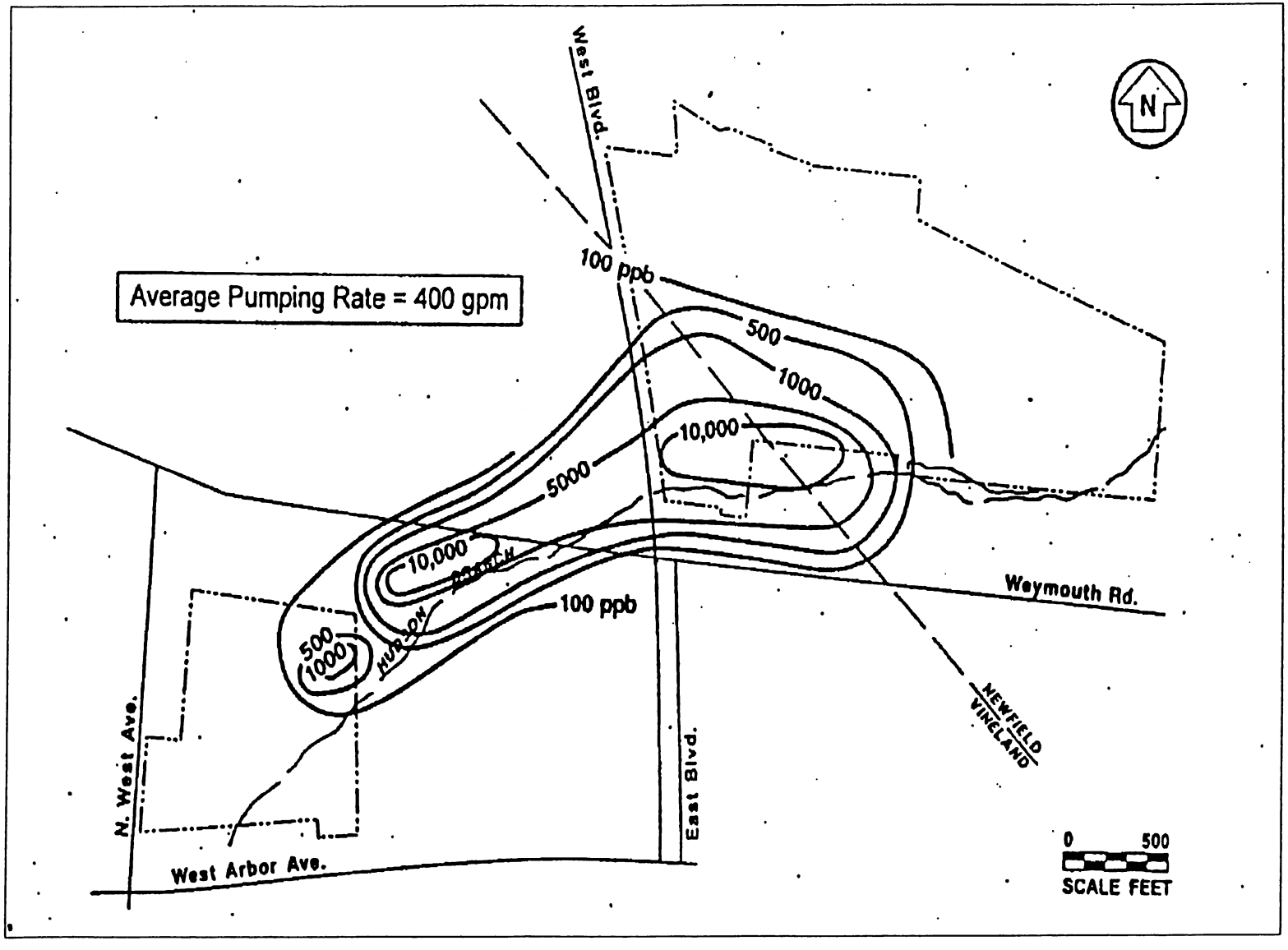

Figure 7. Chromium Plume - Deep Wells (1995)

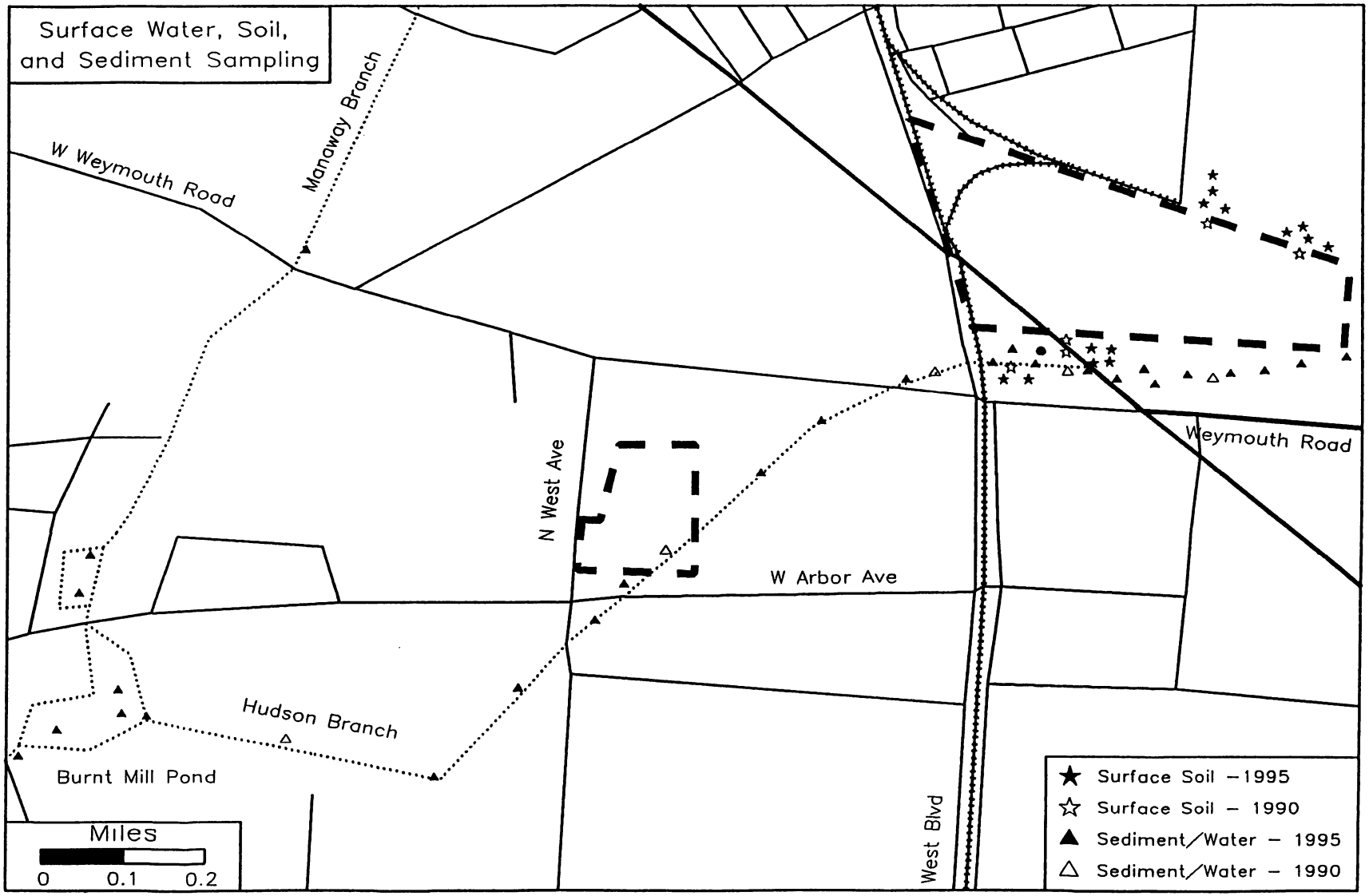

Figure 8. Sampling of Surface Media - SMC