South Hampton 5.4/1

DECLARATION FOR THE EXPLANATION OF SIGNIFICANT DIFFERENCES

SITE NAME AND LOCATION

South Municipal Water Supply Well Superfund Site
Peterborough, New Hampshire

STATEMENT OF PURPOSE

This decision document sets forth the basis for the determination to issue the attached Explanation of Significant Differences (ESD) for the South Municipal Water Supply Well Superfund Site in Peterborough, New Hampshire.

STATUTORY BASIS FOR ISSUANCE OF THE ESD

Under Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9617(c), if the U.S. Environmental Protection Agency (EPA) determines that the remedial action being undertaken at a Site differs significantly from the Record of Decision (ROD) for that Site, EPA shall publish an explanation of the significant differences between the remedial action being undertaken and the remedial action set forth in the ROD and the reasons such changes are being made. Section 300.435(c) of the National Contingency Plan (NCP), 40 C.F.R. § 300.435(c), and EPA guidance (Office of Solid Waste and Emergency Response [OSWER] Directive 9355.3-02), indicate that an ESD, rather than a Record of Decision (ROD) amendment, is appropriate where the changes being made to the remedy are significant but do not fundamentally alter the overall remedy with respect to scope, performance, or cost. Because the adjustments to the ROD provided in the ESD are significant but do not fundamentally alter the overall remedy for the Site with respect to scope, performance, or cost, this ESD is properly being issued.

In accordance with Section 300.435(c) of the NCP, this ESD and supporting documentation will become part of the Administrative Record which is available for public review at both the EPA Region I Record Center in Boston, Massachusetts and the Peterborough Public Library in Peterborough, New Hampshire.

OVERVIEW OF THE ESD

The 1989 ROD for the South Municipal Water Supply Well Superfund Site (Site) specifies a remedy which addresses contamination of ground water, soils, and wetland sediments. Between July, 1990, and January, 1993, extensive pre-design investigations were undertaken and the design finalized. As a result of having obtained new, more detailed technical information during these pre-design investigations, an ESD was issued on May 6, 1993, which documented modifications to the remedy principally for air emission controls and sediment excavation.

The ground water extraction and treatment system has been in operation since March of 1994 and the vacuum extraction system has been in operation since October of 1994. After reviewing quarterly ground water sampling data over the past two years of remedial actions and considering the changes in understanding which have occurred since the ROD was issued concerning the ability to restore ground water contaminated with dense non-aqueous phase liquids (DNAPLs), EPA has determined that it is technically impracticable from an engineering perspective to restore that portion of the contaminated ground water affected by DNAPLs to drinking water quality in a reasonable time frame. Therefore, this ESD documents EPA's decision to waive certain applicable or relevant and appropriate requirements (ARARs) for ground water, Federal Drinking Water Standards. Because of the determination of technical impracticability, three portions of the remedy are modified by this ESD:

1. Groundwater Extraction and Treatment

Two aspects of the ground water extraction and treatment component of the remedy will be modified.

> Air Sparging - The ROD stated that it might be necessary to implement technologies to enhance contaminant removal and to address the presence of free phase solvents in the saturated zone of the NHBB-area plume. Air sparging (in conjunction with the soil vacuum extraction system) was the selected technology. Because of technical problems encountered in implementing the air sparging system, it will not be operated so as to prevent further contamination problems.

Ground Water Extraction - The ROD specified that the ground water extraction system for the NHBB area would be designed to create a hydraulic barrier between the NHBB area plume and the rest of the aquifer. A time period of 19 to 32 years was estimated to be needed to restore that portion of the aquifer to drinking water quality. Since ARARs are to be waived, the pumping rates and extraction well configuration will be changed to maintain the hydraulic barrier between the NHBB plume area and the rest of the aquifer, but not necessarily to restore the NHBB plume to drinking water quality. Adjustments to the system will be made to allow for the use of the South Well if the Town of Peterborough elects to use it.

2. In-Situ Vacuum Extraction of Contaminated Soils

Since no soil contact threat was identified, the ROD prescribed a vacuum extraction system (VES) to remediate soils located near the corner of the NHBB facility solely to allow attainment of ground water cleanup levels. Therefore, since as described above, no air sparging will be employed and the ground water ARARs will be waived, vacuum extraction is no longer required and may be discontinued.

3. Long-Term Environmental Monitoring

Ground water monitoring (quality and water levels) will be conducted to determine if the ground water within the Technical Impracticability Waiver area is hydraulically contained. Based on the analysis of the monitoring data, adjustments to the extraction system will be made to ensure that containment is maintained. This will be especially important should the Town elect to re-use the South Municipal Water Supply Well.

4. Institutional Controls

In order to further ensure the protectiveness of the remedy, a deed restriction will be placed upon the NHBB property prohibiting extraction of the ground water for purposes other than the remedial action unless the extracted ground water meets or is treated to appropriate use standards and the extraction of the ground water does not adversely affect the remedial action.

DECLARATION

For the foregoing reasons, by my signature below, I approve the issuance of an Explanation of Significant Differences and associated Technical Impracticability Waiver for the South Municipal Water Supply Well Superfund Site in Peterborough, New Hampshire, and the changes and conclusions stated therein.

Feb. 3, 1997
Date

Linda M. Murphy, Director
Office of Site Remediation and Restoration
U.S. E.P.A., Region I

EXPLANATION OF SIGNIFICANT DIFFERENCES
SOUTH MUNICIPAL WATER SUPPLY WELL SUPERFUND SITE
PETERBOROUGH, NEW HAMPSHIRE

I. INTRODUCTION

A. Site Name and Location

Site Name: South Municipal Water Supply Well Superfund Site

Site Location: Town of Peterborough, Hillsborough County, New Hampshire

B. Lead and Support Agencies

Lead Agency: United States Environmental Protection Agency (EPA)

Support Agency: New Hampshire Department of Environmental Services (NHDES)

C. Legal Authority

Under Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9617 (c), Section 300.435(c) of the National Contingency Plan (NCP), 40 C.F.R. § 300.435(c), and EPA guidance (Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-02), if EPA determines that differences in the remedial action significantly change but do not fundamentally alter the remedy selected in the Record of Decision (ROD) with respect to scope, performance, or cost, EPA shall publish an explanation of the significant differences between the remedial action being undertaken and the remedial action set forth in the ROD and the reasons such changes are being made.

D. Summary of Circumstances Necessitating this Explanation of Significant Differences

The 1989 ROD for the South Municipal Water Supply Well Superfund Site (Site) specifies a remedy which addresses contamination of ground water, soils, and wetland sediments. Between July, 1990, and January, 1993, extensive pre-design investigations were

undertaken and the design finalized. As a result of having obtained new, more detailed technical information during these pre-design investigations, an ESD was issued on May 6, 1993, which documented modifications to the remedy principally for air emission controls and sediment excavation.

The ground water extraction and treatment system has been in operation since March of 1994 and the vacuum extraction system has been in operation since October of 1994. After reviewing quarterly ground water sampling data over the past two years of remedial actions and considering the changes in understanding which have occurred since the ROD was issued concerning the ability to restore ground water contaminated with dense non-aqueous phase liquids (DNAPLs), EPA has determined that it is technically impracticable from an engineering perspective to restore that portion of the contaminated ground water affected by DNAPLs to drinking water quality in a reasonable time frame. Therefore, this ESD documents EPA's decision to waive certain applicable or relevant and appropriate requirements (ARARs) for ground water, Federal Drinking Water Standards.

E. Availability of Documents

This ESD and supporting documentation shall become part of the Administrative Record for the Site. The ESD, supporting documentation for the ESD, and the Administrative Record (the index for the Administrative Record is attached) are available to the public at the following locations and may be reviewed at the times listed:

U.S. Environmental Protection Agency
Records Center
90 Canal Street
Boston, MA 02114
Weekdays from 10:00 a.m. to 1:00 p.m.,
and from 2:00 p.m. to 5:00 p.m.

Peterborough Public Library
Peterborough, New Hampshire
Monday through Thursday from 10:30 a.m. to 8:30 p.m., and
Friday through Saturday from 10:30 a.m. to 5:30 p.m.

II. SUMMARY OF SITE HISTORY, CONTAMINATION PROBLEMS, AND SELECTED REMEDY

A. Site History and Contamination Problems

The South Municipal Water Supply Well Superfund Site is located on Sharon Road, approximately two miles south of the center of the Town of Peterborough in Hillsborough County, New Hampshire. The South Municipal Water Supply Well was installed in 1952 and provided water to the Town of Peterborough for nearly 30 years, until it was closed in 1982.

The Site, located in a predominantly rural area, is situated in the Contoocook River Valley, approximately 350 feet southwest of the Contoocook River (see Figure 1). The New Hampshire Ball Bearings, Inc. (NHBB) manufacturing facility, is located on twenty-four acres of land about 1,200 feet northwest of the South Well.

In October 1982, the New Hampshire Water Supply and Pollution Control Commission (NHWSPCC) conducted routine sampling of water supplies and found volatile organic compounds (VOCs) in a water sample taken from the South Well. Due to the potential health risks of consuming low levels of organic chemicals, NHWSPCC recommended that the Town of Peterborough discontinue use of the South Well. The well was shut down on December 2, 1982.

In September 1984, the Site was placed on the National Priorities List (NPL), EPA's list of hazardous waste sites eligible for financing under Superfund. In 1985, EPA identified NHBB as a potentially responsible party for the well's contamination and requested that NHBB conduct the Remedial Investigation/ Feasibility Study (RI/FS) to determine the nature and extent of site contamination and to evaluate approaches to site cleanup. Under a Consent Order signed by both parties on July 22, 1986, NHBB agreed to conduct the RI/FS under EPA supervision.

The Remedial Investigation (RI) field studies for the RI/FS began in August 1986 and were completed in March 1989. The major conclusions of the Remedial Investigation (RI) were:

- high concentrations of VOC contamination exist in ground water at the Site, originating from past releases at the NHBB facility,

- VOC contamination in the soils continues to contribute to ground water contamination, and

- Polychlorinated Biphenyls (PCBs) and Polycyclic Aromatic Hydrocarbons (PAHs) were found in a small unnamed brook that crosses the NHBB property and are dispersed through the wetlands area east and northeast of the NHBB facility.

NHBB, in accordance with the Consent Order, conducted a Feasibility Study (FS) which developed and evaluated remedial alternatives to address the contamination at the Site. The FS was completed in July, 1989, and formed the basis of EPA's Proposed Plan released that same month. Subsequently the ROD was issued September 27, 1989. In July of 1990, EPA issued a Unilateral Order to NHBB and its parent corporation, Minebea Co., LTD., to perform the Remedial Design and Remedial Action prescribed in the ROD. As a result of the pre-design studies performed pursuant to that Order, EPA modified the Record of Decision through the issuance of an ESD on May 6, 1993. NHBB has completed the sediment remedy and is continuing to operate and maintain the soils and ground water remedial elements of the remedy.

B. Summary of the Selected Remedy

After evaluating the feasible alternatives presented in the FS, EPA selected a remedy, documented in the ROD and modified by the May, 1993, ESD, consisting of six components to address soil, sediment, and ground water contamination at the Site:

1. In-Situ Vacuum Extraction of Contaminated Soils

2. Excavation and/or Dredging with Dewatering of Contaminated Sediments and Off-Site Disposal

The May, 1993, ESD determined that only excavation was appropriate and that a small area of

contaminated sediments would be left in place and monitored to confirm the limited area involved.

3. **Wetlands Restoration**

4. **Ground water Extraction and Treatment with Air Stripping and Carbon Columns for Air Emission Control**

   The May, 1993, ESD documented the decision: 1) to remove the requirement for air emission control, 2) to use air sparging to attempt to enhance DNAPL removal, and 3) to allow natural attenuation of a small portion of the leading edge of the contaminated plume.

5. **Long-Term Environmental Monitoring**

6. **Institutional Controls, Including Restrictions on Use of the South Municipal Water Supply Well**

Currently, the vacuum extraction and the ground water extraction and treatment portions of the remedy are operating. The contaminated sediments have been removed, the wetlands have been regraded and replanted, and the restoration efforts are being monitored for effectiveness. The Town of Peterborough, using information supplied by NHBB, has enacted zoning changes prohibiting use of contaminated ground water. Discussions have been held with the Town concerning the potential for reuse of the South Well. However, there are currently no plans to use the aquifer for public water supply.

C. Technical Impracticability Evaluation

An evaluation of contaminant source information and ground water data (especially that collected during the past two years of the cleanup) has been conducted. A complete discussion of the factors leading to the technical impracticability waiver determination is attached. Two conclusions can be drawn from the evaluation: first, DNAPLs are present at the Site and second, while the exact locations of these DNAPLs are not known,

information suggests that more than one location of DNAPLs exists in the sub-surface soils and/or aquifer. Using this information, a calculation using the existing pumping rates and configuration which takes into account the presence of DNAPLs estimates an average time to remediate the portion of the aquifer which is west of Route 202 of 108 years, rather than the estimate in the ROD of a maximum of thirty-two years.

As part of this process, several remedial alternatives were investigated to determine if a more reasonable ground water cleanup time frame could be achieved. These have included: excavation, DNAPL pumping, in-situ biodegradation, containment with barrier walls, treatment with permeable reaction walls, solidification, stabilization and/or in-situ vitrification, soil flushing and natural attenuation. None would result in faster or more efficient cleanup times. Several would, in fact, be less effective.

The ROD set cleanup levels for the following VOCs based upon Federal Maximum Contaminant Levels (MCLs): tetrachloroethylene, trichloroethylene, 1,1,1-trichloroethane, 1,1-dichloroethylene, toluene, and vinyl chloride. In accordance with Section 121(d)(4)(C) of CERCLA, EPA may select a remedial action that does not attain an ARAR if compliance with the ARAR is technically impracticable from an engineering perspective. When the ROD was issued in 1989, EPA did not issue a waiver of these ARARs because EPA believed, based on data available at that time, that ground water ARARS would be attained within a time period of decades. EPA's reevaluation, based on recent data, indicates that the ARARs listed above may not be attainable for 108 years or more, because of hydrogeologic and contaminant related factors that limit the effectiveness of ground water remediation at the Site. Therefore, EPA is waiving ARARs, Federal Drinking Water Standards, for that portion of the aquifer which is currently being affected by DNAPLs (see Figure 2). Furthermore, the cleanup level for 1,1-dichloroethane which was based on a State Health Advisory will be waived in the same area.

DESCRIPTION OF SIGNIFICANT DIFFERENCES

Based upon the technical impracticability evaluation and related waiver of ground water ARARs and cleanup levels, modifications to three components of the remedy are warranted. A description of these modifications, by component, follows:

Ground Water Extraction and Treatment

Two aspects of the ground water extraction and treatment component of the remedy will be modified.

Air Sparging - The ROD stated that it might be necessary to implement technologies to enhance contaminant removal and to address the presence of free phase solvents in the saturated zone of the NHBB-area plume. In order to determine the advisability of this enhancement, pilot tests were conducted during pre-design investigations, which indicated that air sparging (forcing ambient air into the ground water) would strip significant amounts of VOCs from the ground water. The VOCs would travel with the ambient air upward through the soils and be captured by the vacuum extraction system. It was believed that this technique could be effective for as many as fifteen years. Therefore, this technology was identified in the May, 1993, ESD to be implemented as an enhancement to the pump-and-treat technology. However, after initiation of ground water pumping, water levels in several of the air sparging wells fell below the bottom of the well screens, thus preventing their use. If the wells had been drilled deeper, less pervious materials would have been penetrated which would inhibit collection of the VOC-contaminated air by the vacuum extraction system. New areas of the aquifer and sub-surface soils would have been contaminated. In addition, VOC levels were rising rapidly in a bedrock well located near the corner of the NHBB facility possibly due to the mobilization of DNAPLs through the extraction of ground water. Thus, the air sparging system was never operated and will not be operated so as to prevent further contamination problems.

Ground Water Extraction - The ROD specified that the ground water extraction system for the NHBB area would be designed to create a hydraulic barrier between the NHBB area plume and the rest of the aquifer. A time period of 19 to 32 years was estimated to be needed to restore that portion of the aquifer to drinking water quality. Since ARARs are to be waived, the

pumping rates and extraction well configuration will be changed to maintain the hydraulic barrier between the waiver area and the rest of the aquifer, but not necessarily to restore the waiver area to drinking water quality. Adjustments to the system will be made to allow for the use of the South Well if the Town of Peterborough elects to use it.

In-Situ Vacuum Extraction of Contaminated Soils

The ROD prescribed a vacuum extraction system (VES) to remediate soils located near the corner of the NHBB facility in order to attain ground water cleanup levels. Two years of operation were estimated to reach the soil cleanup levels. However, since the May, 1993, ESD indicated that air sparging would occur for up to fifteen years and since the VES would be needed to capture the resulting VOC-laden vapors stripped from the ground water during the air sparging process, the soil cleanup levels would not be expected to be achieved until approximately two years after the air sparging system stopped operating. However, soil vacuum extraction was proposed solely to allow for the remediation of the ground water, since no soil contact threat was identified. Therefore, since as described above, no air sparging will be employed and the ground water ARARs will be waived, vacuum extraction is no longer required and may be discontinued.

Long-Term Environmental Monitoring

Ground water monitoring (quality and water levels) will be conducted to determine if the ground water within the Technical Impracticability Waiver area is hydraulically contained. Based on the analysis of the monitoring data, adjustments to the extraction system will be made to ensure that containment is maintained. This will be especially important should the Town elect to re-use the South Municipal Water Supply Well.

Institutional Controls

In order to further ensure the protectiveness of the remedy, a deed restriction will be placed upon the NHBB property prohibiting extraction of the ground water for purposes other than the remedial action unless the extracted ground water meets

or is treated to appropriate water use and/or disposal standards in effect at the time of extraction and the extraction of the ground water does not adversely affect the remedial action.

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All of the proposed modifications embodied in this ESD will protect human health and the environment, will comply with all applicable or relevant and appropriate Federal and State requirements except those waived due to technical impracticability, will provide for a long-term and permanent remedy for the Site, will reduce the mobility, toxicity, and volume of contaminants at the Site to a similar degree as the remedy outlined in the ROD, and will pose the same short-term risks as the remedy contained in the ROD. The proposed modifications to the remedy will reduce certain remedial costs by approximately $3.5 million over thirty years.

IV. SUPPORT AGENCY COMMENTS

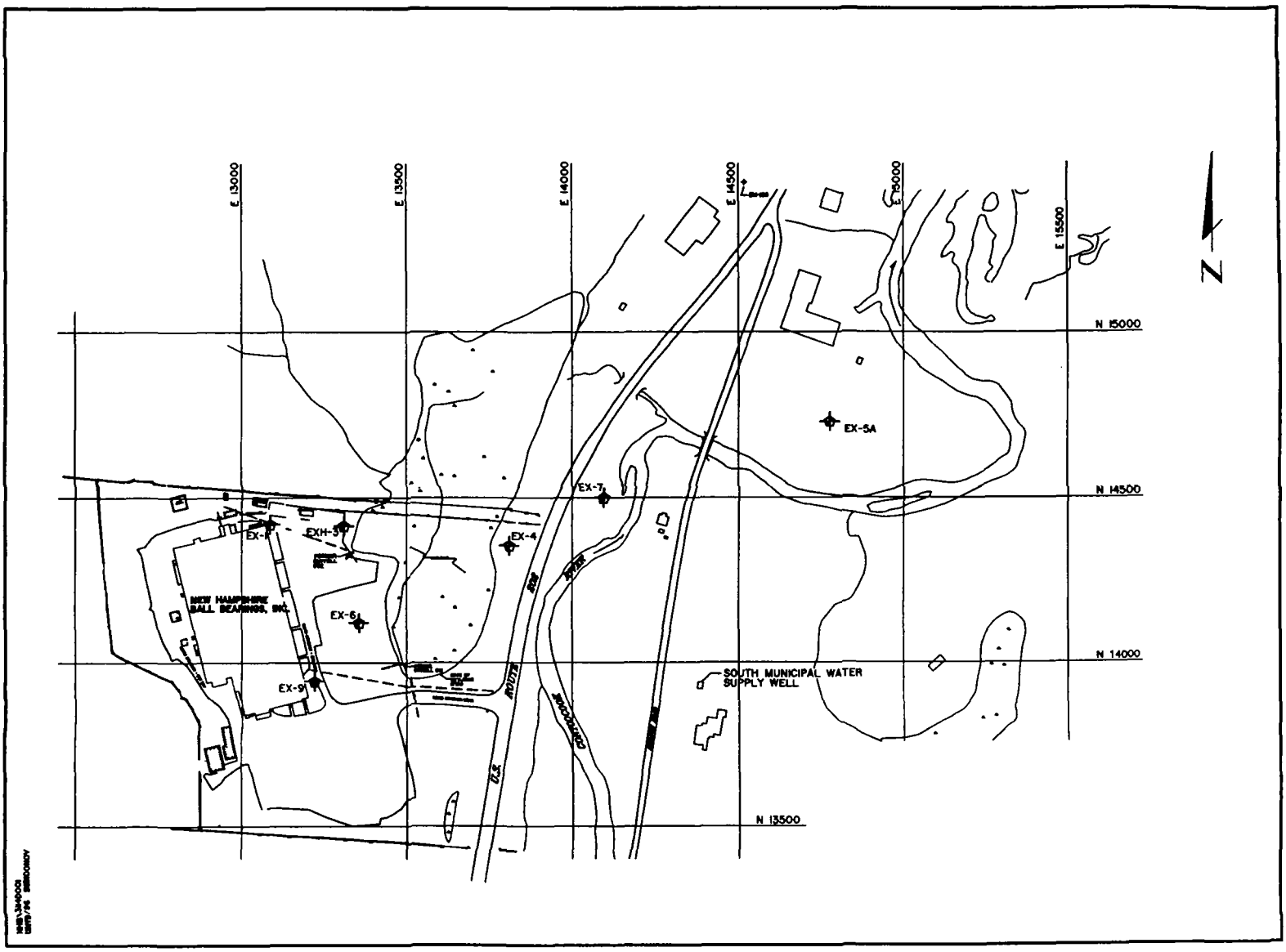
The State of New Hampshire has participated with EPA in developing the changes to the remedy presented in the ROD and May, 1993, ESD which are described herein. The State is in agreement with the changes.

V. STATUTORY DETERMINATIONS

EPA has determined that the selected remedy specified in the ROD, with the above-described changes, remains protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to this remedial action, and is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this Site.

VI. PUBLIC PARTICIPATION

This ESD was available for thiry-day public comment period which ended December 23, 1996. Comments received have been summarized and the Agency's response to those comments is attached to this ESD in a Responsiveness Summary.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SOUTH MUNICIPAL WATER SUPPLY WELL
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Figure 1

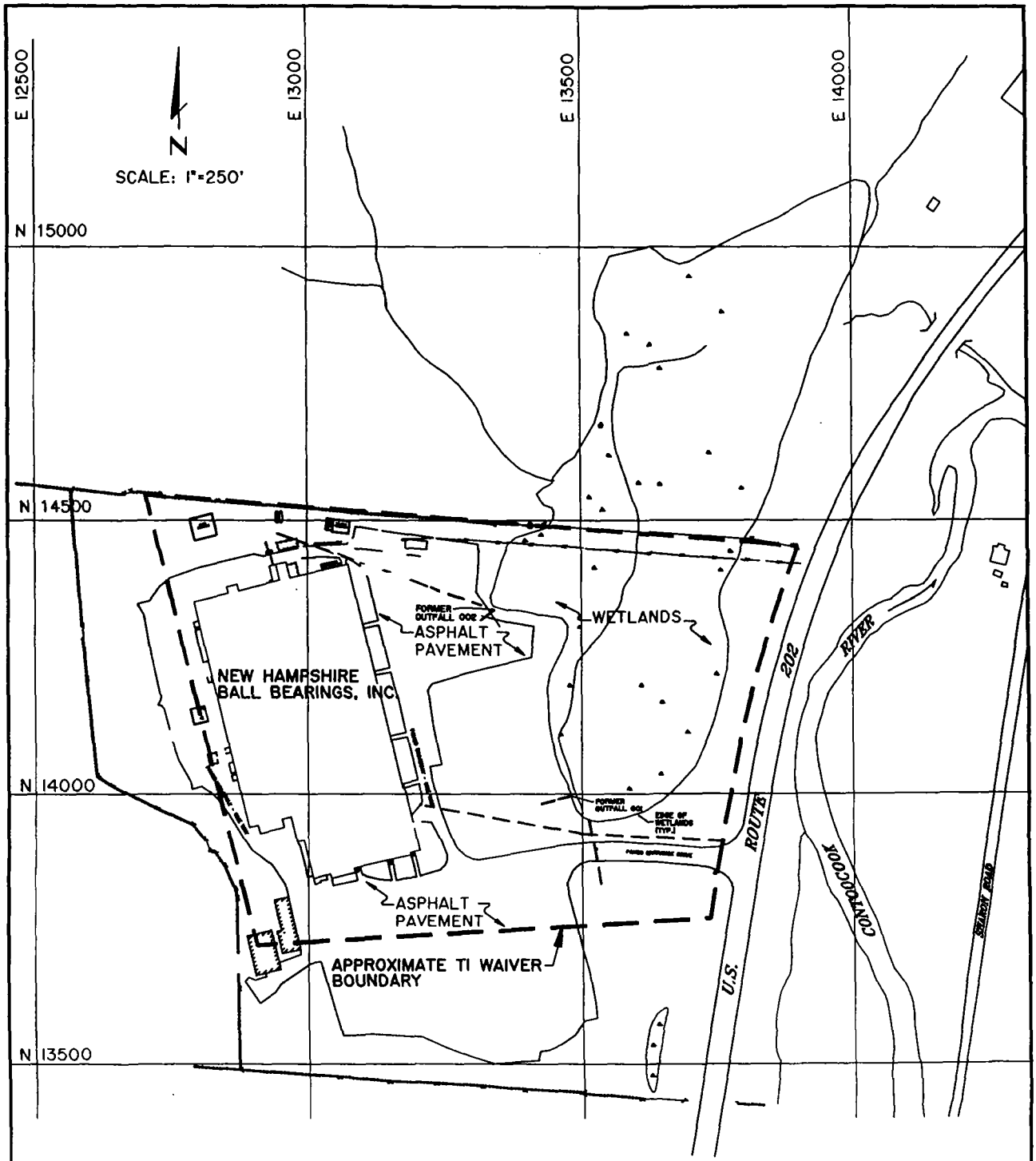

FIGURE 2

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Attachment to Explanation of Significant Differences for the South Municipal Water Supply Well Superfund Site
Technical Impracticability Evaluation

1. Specific ARARs

The September 27, 1989 ROD set Target Ground Water Cleanup Levels at Federal Maximum Contaminant Levels (MCLs) and, absent an MCL, at a proposed MCL, and at a New Hampshire Health Advisory. Thus, the ARARs for the Site in effect at the time of the ROD are: 1,1,1-trichloroethane - 200 ppb, trichloroethylene - 5 ppb, 1,1-dichloroethylene - 7 ppb, toluene - 2000 ppb, vinyl chloride - 2 ppb. The target level for tetrachloroethylene was based upon a proposed MCL while the target level for 1,1-dichloroethane was based upon the New Hampshire Department of Public Health Service consumption advisory for water supplies, since no MCL had been promulgated. The requirement to meet these cleanup levels is waived along with the others.

2. Spatial area over which the TI Waiver will apply

As shown on Figure 2, attached to the ESD, the waiver will apply to the New Hampshire Ball Bearings, Inc. (NHBB) property from fifty feet west of the centerline of Route 202 and to the north of a line running from the entrance to the parking lot to just south of well EM-107. This area will entirely encompass what was referred to in the ROD as the NHBB area plume. The waiver will include both the overburden aquifer and the bedrock aquifer beneath it. Little contamination has been found in the bedrock except at well GZ-4R. The affect of the waiver will likely be a reduced pumping rate and no extraction occurring near GZ-4R. This may result in lessening the increase in the contaminant concentrations in the bedrock as DNAPL pools will be under less hydrologic stress. However, the possibility of remediating the bedrock aquifer in a reasonable time frame if contamination does migrate into it is as problematic as remediating the overburden aquifer.

3. Site conceptual model

The conceptual model of the site is described in the ROD and summarized here as modified by information obtained after the issuance of the ROD.

The overburden aquifer behaves differently than that of the bedrock, but a hydraulic connection exists between the two. The overburden aquifer is semi-confined to unconfined. The bedrock aquifer behaves as a leaky confined aquifer. Aquifer parameters for the overburden aquifer are highly variable throughout the site. Vertical hydraulic conductivity is generally low relative to radial hydraulic conductivity indicating that lateral rather than vertical flow predominates.

The average flow direction is east-northeast in the vicinity of the NHBB plant and changes to a northerly direction at the Contoocook River, paralleling the river. The flow in the bedrock is generally upward throughout the Site.

The major constituents of the contamination plume are 1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene. Interviews and historical investigations indicate that these solvents were used by NHBB as pure products or mixtures. These investigations also indicate that these and other compounds were released to the environment through:

- in-house releases subsequently washed out floor drains or sinks to outfalls, or washed out facility doors, and

- exterior releases through the draining of a truck-mounted waste solvent tank.

Ground water data from the latest sampling event (February, 1996) indicate highest VOC levels at the northeast corner of the NHBB facility (PCE - 21,000 ppb), and at the tumble sump area (TCA - 1300).

The strongest evidence of DNAPL in ground water is near the northeast corner of the building (Outfall 003A), near the southwest corner of the building (the tumble area sump and related drain and/or the aboveground 1,1,1-TCA tank), and beneath the building near the GZ-7 well cluster (cracks in the floor and/or subgrade drains). An area near the warehouse and maintenance garage (where the tank trailers are reported to have been emptied) and another area along the south wall of the building (where the tank trailers were apparently stationed) are also strongly suspected of containing DNAPL. Of these, the source area near the northeast corner of the building appears to contain the greatest mass and/or largest distribution of DNAPL. An area beneath the wetlands and former locations of Outfall 002 are also suspected to contain DNAPL.

4. Restoration potential

The potential for restoring ground water to drinking water quality is dependent upon several factors:

a. As mentioned above, DNAPL sources occur throughout the aquifer on the NHBB property. One has been positively identified (the northeast corner of the building) while the others have been inferred from knowledge of disposal practices and evaluation of water quality data. The current well configuration and pumping scenario have isolated the DNAPL source areas from the portion of the aquifer identified in the ROD as the "dilute plume area." Based upon ground water modeling and aquifer characteristics, these source areas can continue to be hydrologically isolated or contained so as to allow full restoration of the aquifer outside of the waiver area and to allow use of the South Well.

b. Remedial systems installed at the site for contaminant source control and remediation of ground-water include: a seven well ground water extraction system and air stripping treatment plant, a ten well soil vacuum extraction (SVE) system, and a ground water sparging system.

The ground water extraction system has been in near-continuous operation since March 12, 1994. The total flow rate has averaged just below 600 gpm for over two years and the system has removed approximately 4,000 pounds of VOCs from ground water as of July, 1996. Reductions in VOC concentrations for most of the wells in the dilute plume area and within much of EX-4's capture zone have been large, with several of the formerly contaminated wells (e.g., the EM-3 couplet, MW-5B and EMH-2U) consistently having concentrations below Cleanup Levels. In some locations east of the parking lot the plume has shrunk in width up to fifty percent. VOC reductions observed in the dilute plume area indicate both that EX-5A and EX-7 are effective in removing contaminants from the aquifer and that upgradient wells, as mentioned above, are successfully providing hydraulic containment of source areas.

VOC concentrations near the building have shown both significant increases and decreases. In general, significant increases have been seen in lower wells near the northeast corner of the building (including GZ-4R and GZH-4L) and the central portion of the building (GZ-7L and GZH-7M). Most of the wells showing decreases in VOCs have shallow screens. It is probable that decreases in VOC concentrations in shallow wells (and increases in deep wells) are related at least in part to relatively shallow contamination being transported to deeper portions of the aquifer via downward flow induced by deeply screened, partially penetrating wells. Concerns also exist that VOC concentration increases seen in bedrock well GZ-4R may be related to mobilization and downward migration of DNAPL into bedrock, caused by drawdown created by EX-1. In general, the size of the plume near the building has changed little since pumping began. VOC concentrations measured in EX-1 have stabilized over the last year of pumping. Similar stabilization (but at lower concentrations) may be occurring at EXH-3 and EX-9. At least in the case of EX-1 the cause of the stabilization is attributed to the nearby presence of DNAPL. Evidence also points to the DNAPL being present within the capture zones of EXH-3 and EX-9.

The vacuum extraction system consists of ten vacuum extraction (VX) wells screened at various depths within the vadose zone near the northeast corner of the building. The system was started in October 1994, and has been roughly fifty percent operational. The primary cause of system shutdowns has been elevated water table conditions during wet months (primarily during the spring) and during periods when the ground water extraction system has been shut down for maintenance.

Total VOC concentrations for seven of the VX wells have been reduced by a factor of three or greater since the first two months of operation. However, none of the wells have contained VOC concentrations below detection limits for extended periods (i.e., months). It is anticipated that it will be difficult or impossible to obtain clean samples of extracted soil gas due to contribution via volatilization off of contaminated ground water.

Between October 1994 and 1996, roughly 4,200 pounds of VOCs were removed from contaminated soils. The average VOC removal rate was approximately 9.3 pounds per day.

While the SVE system has been effective in achieving contaminant mass removal in unsaturated soils and has the potential to remove a source for ground water contamination, it is not expected to have a significant bearing on the time frame for aquifer restoration since DNAPL beneath the water table is not influenced by vacuum extraction.

Due to the fact that the water table has been drawn to below the well screens for many of the sparging wells throughout most of the year, but primarily out of concern that sparging could induce uncontrolled mobilization of DNAPL, sparging has not been conducted at the Site. As ground water monitoring data have indicated the probable presence of DNAPL below the screens of the sparging wells and at several other locations at the Site, it was also recognized that sparging would ultimately not have an effect on the timeframe required to remove the DNAPL in its entirety.

c. An estimation of time required for complete dissolution of DNAPL can be made for a portion of the aquifer near the northwest corner of the building that contains DNAPL and where relatively intensive subsurface investigations have been conducted. The dissolution time (t) was calculated as follows using tetrachloroethylene as the representative contaminant:

$$t = m/v_i n C_w A$$

Where: m = the mass of DNAPL (20,400 grams/m^3),
v_i = the average interstitial ground water velocity (0.23 m/day),
n = the effective porosity in the aquifer (.15),
C_w = the dissolved DNAPL concentration in ground water (15 mg/l), and
A = the cross-sectional area of DNAPL (m^2).

The time for dissolution of tetrachloroethylene to a concentration of 15 mg/l was calculated to be 108 years. Remediation to ARARs would be longer still. The dissolution calculation is very sensitive to the mass of DNAPL per unit volume of aquifer. It is probable that much of the aquifer containing DNAPL has a lower mass per volume value than that used in the above calculation, and the dissolution time could be reduced to tens of years. It is equally likely that the aquifer contains pools of DNAPL where the mass per volume is higher than the value used above. It is these areas which will ultimately dictate the time required to clean up the aquifer, and it is therefore considered probable that close to source areas the aquifer will not be restored in a reasonable time frame.

d. Based on a literature review, several remedial technologies have been identified that have been used in attempts to restore ground water at DNAPL sites. Each technology is briefly described below, and an evaluation of its ability to attain Cleanup Levels within a reasonable time frame is examined within the context of Site hydrogeology and contaminant distribution.

Excavation - In order to be effective, excavation would require that virtually all DNAPL at the Site be excavated. Finding all of the DNAPL, if possible, would be extraordinarily expensive, and invasive investigative measures could cause migration of the DNAPL to deeper portions of the aquifer. As DNAPL probably exists beneath the building, excavation would require disruption of facility operations. The depth of DNAPL penetration in some portions of the Site is such that extremely expensive deep excavation would be required, if even possible; excavation of DNAPL in the bedrock would certainly not be possible. Finally, treatment or disposal costs for excavated media would be unacceptably expensive.

Pumping DNAPL - When pools or lenses of DNAPL can be located, it is possible to recover small quantities of free product by pumping from extraction wells or trenches. As the DNAPL saturation thickness decreases, the efficiency of a DNAPL recovery system generally decreases, and over pumping of a product recovery well or trench may result in truncation of the DNAPL layer and significantly reduce the formation transmissivity to DNAPL flow. Also, significant residual DNAPL (between 10% and 90% of the initial volume) will always remain after the removal of mobile DNAPL requiring further treatment/removal methods. All of the mobile DNAPL would need to be found in order to make removal by pumping marginally effective. The process of detecting the DNAPL could cause mobilization of DNAPL and it is unlikely it could be accomplished. Pumping of DNAPL is therefore not considered a practical remedial technology for the Site.

In-Situ Biodegradation - Naturally occurring microbes can be used to degrade hazardous chemicals in the subsurface. This treatment technology usually involves enhancement of the natural processes to increase the rate of degradation by delivery of oxygen, nutrients and/or specialized microorganisms to the contaminated zone via wells. In general, chlorinated solvents are relatively resistant to microbial degradation. Some chlorinated solvents degrade aerobically and anaerobically (trichloroethylene) and others degrade strictly anaerobically (tetrachloroethylene). Effective biodegradation at the Site would therefore require both an anaerobic dechlorination step and an aerobic step in which a supplemental carbon source is provided. Due to the toxicity of most DNAPLs and the lack of essential nutrients, electron acceptors and other requirements for life in the DNAPL pool itself, the potential for biologically mediated degradation of DNAPLs is limited. Biodegradation may be most appropriate as a polishing step after methods that remove the majority of DNAPL. However, as no methods have been identified to locate, much less remove DNAPL, bioremediation (enhanced or otherwise) is not considered a practical means of achieving cleanup of the Site.

Barrier Walls - The lateral migration of contaminants in the saturated zone can be impeded by the construction of low permeability, fine-grained barrier walls (i.e., slurry walls, concrete walls, sheet piling with grouted joints, etc.). These walls should be keyed into a low permeability, capillary barrier beneath the contaminant

(DNAPL) source to prevent vertical DNAPL migration. The walls are typically installed as an enclosure around the contaminated zone. Non-enclosing walls are typically installed downgradient of the contaminated zone, but require hydraulic controls (i.e., ground water extraction wells placed on the upgradient side of the barrier wall) to prevent contamination from flowing around the ends of the wall. Barrier walls would probably not be effective at the Site due to the absence of low permeability deposits down to the depth that DNAPL extends (the walls would need to be keyed into the crystalline bedrock). A barrier wall would require deep installation (up to 100 feet) and would need to be nearly 2,500 feet in length to encircle all areas that probably contain DNAPL, and would therefore be very expensive and disruptive to the wetlands. Barrier walls would also not be effective in decreasing the time necessary to dissolve DNAPL without employment of other remedial technologies, which, in turn, are dependent on detailed (and probably unattainable) knowledge of the distribution of DNAPL.

Reactive Walls - Reaction walls are high permeability walls that improve water quality by facilitating chemical or biological reactions in ground water passing through the wall. An important factor in the design and effectiveness of reaction walls is the retention time that contaminated ground water requires for a complete reaction. In areas where flow velocities are relatively rapid, the barrier wall needs to be thick or there needs to be auxiliary ground water controls (i.e., ground-water extraction). The long-term effectiveness, cost and maintenance requirements for reaction walls has not been thoroughly analyzed on the site scale. Further, the technology would not promote more rapid dissolution of DNAPL and hence would not provide for a shortened time frame for attainment of Cleanup Levels. Finally, based on rapid buildup of iron bacteria slime on extraction wells at the Site, there is concern that clogging would be a problem.

Immobilization - Subsurface contaminants can be contained or immobilized through the processes of solidification, stabilization and/or in-situ vitrification. In order to be effective, use of solidification and stabilization would require knowledge of all portions of the aquifer containing DNAPL. Further, during solidification/stabilization processes, the potential for migration of DNAPL would be high. Perhaps to a lesser extent, the same can be said for vitrification. Solidification/stabilization/vitrification methods are very expensive, and would require significant disruption of facility operations, particularly to address DNAPL under the building. For these reasons, solidification, stabilization and vitrification are not considered to be practical remedial technologies for restoration of the aquifer at the Site.

Soil Flushing - Soil flushing includes methods to flood the contaminated zone with flushing solutions to sweep the contaminants to recovery wells, drains, or high permeability reaction walls. Flushing methods applicable to DNAPLs include chemically-enhanced displacement and dissolution and steam displacement. The complex stratigraphy and uncertainties about the distribution

of DNAPL would make it impossible to design effective DNAPL collection systems at the Site. These factors also make delivery of dissolution agents into all areas containing DNAPL problematic. Finally, the complex stratigraphy and DNAPL distribution, expenses of installing and maintaining delivery systems, and the expense of displacement/dissolution agents makes the remedial technologies impractical for restoring ground water at the Site.

Natural Attenuation - Natural attenuation involves a passive approach to site cleanup, utilizing the natural processes of in-situ biodegradation and the dilution effects of ground water recharge and discharge. Costs for natural attenuation would be significantly less than those estimated for the existing treatment system. However, as gradients would be lower in a naturally attenuating system than in a system subjected to ground-water extraction, dissolution of DNAPL would be considerably slower. Natural attenuation would also likely result in a plume size and location similar to that seen before initiation of pumping, and therefore, the South Well could not be operated for extended periods. Finally, the dilute plume area would remain contaminated for as long as DNAPL exists in the source areas (probably for hundreds of years) so that ground water within the plume could not be used.

5. Additional Considerations

The area being considered for the Technical Impracticability Waiver lies entirely on NHBB property. Overlying land use is not compatible with domestic water supplies. The manufacturing facility, parking lots and access roads, and a wetland are above the aquifer. The original ROD foresaw the difficulties with remediating the heavily contaminated ground water near the NHBB facility and the problems which that would cause with the timely remediation of the down-gradient ground water. The concern was addressed by requiring that the two plume areas be hydraulically separated from each other and from the South Well. This Technical Impracticability Waiver will allow for the use of the South Well and for restoration of the ground water outside of the waiver area while acknowledging the technical impracticabiliy of restoring that portion of the aquifer which is impacted by DNAPLs..

6. Costs

Cost savings have been projected for the lower pumping rate and one-well extraction scenario which may be possible as a result of the waiver of ARARs. The savings is the result of lower O&M costs. The total present worth cost savings is approximately $3.5 million over the next thirty years.

RESPONSIVENESSS SUMMARY FOR THE EXPLANATION OF SIGNIFICANT DIFFERENCES FOR THE SOUTH MUNICIPAL WATER SUPPLY WELL SUPERFUND SITE
February 3, 1997

PREFACE

The U.S. Environmental Protection Agency (EPA) held a public comment period, from November 22, 1996, to December 23, 1996, to provide an opportunity for interested parties to comment on the draft Explanation of Significant Differences (ESD) and Technical Impracticability (TI) Waiver prepared for the South Municipal Water Supply Well Superfund Site (the Site) in Peterborough, New Hampshire. The draft ESD presented EPA's changes to the ground water remedy resulting from the determination that it is technically impractical to restore all of the aquifer to drinking water standards.

The purpose of this responsiveness summary is to identify major comments raised during the public comment period and to provide EPA response to the comments. EPA has considered all of the comments summarized in this document before issuing the final ESD for the Site in Peterborough, New Hampshire.

I. OVERVIEW OF THE SIGNIFICANT CHANGES

EPA has determined that it is technically impracticable from an engineering perspective to restore that portion of the contaminated ground water affected by DNAPLs to drinking water quality in a reasonable time frame. Therefore, this ESD documents EPA's decision to waive certain applicable or relevant and appropriate requirements (ARARs) for ground water. Because of the determination of technical impracticability, three portions of the remedy are modified by this ESD:

1. Groundwater Extraction and Treatment

Two aspects of the ground water extraction and treatment component of the remedy will be modified.

Air Sparging - The ROD stated that it might be necessary to implement technologies to enhance contaminant removal and to address the presence of free phase solvents in the saturated zone of the NHBB-area plume. Air sparging (in conjunction with the soil vacuum extraction system) was the selected technology. Because of technical problems encountered in implementing the air sparging system, it will not be operated so as to prevent further contamination problems.

Ground Water Extraction - The ROD specified that the ground water extraction system for the NHBB area would be designed to create a hydraulic barrier between the NHBB area plume and the rest of the aquifer. A time period of 19 to 32 years was estimated to be needed to restore that portion of the aquifer to drinking water quality. Since ARARs are to be waived, the pumping rates and extraction well configuration will be changed to maintain the hydraulic barrier between the NHBB plume area and the rest of the aquifer, but not necessarily to restore the NHBB plume to drinking water quality. Adjustments to the system will be made to allow for the use of the South Well if the Town of Peterborough elects to use it.

2. In-Situ Vacuum Extraction of Contaminated Soils

Since no soil contact threat was identified, the ROD prescribed a vacuum extraction system (VES) to remediate soils located near the corner of the NHBB facility solely to allow attainment of ground water cleanup levels. Therefore, since as described above, no air sparging will be employed and the ground water ARARs will be waived, vacuum extraction is no longer required and may be discontinued.

3. Long-Term Environmental Monitoring

Ground water monitoring (quality and water levels) will be conducted to determine if the ground water within the Technical Impracticability Waiver area is hydraulically contained. Based on the analysis of the monitoring data, adjustments to the extraction system will be made to ensure that containment is maintained. This will be especially important should the Town elect to re-use the South Municipal Water Supply Well.

4. Institutional Controls

In order to further ensure the protectiveness of the remedy, a deed restriction will be placed upon the NHBB property prohibiting extraction of the ground water for purposes other than the remedial action unless the extracted ground water meets or is treated to appropriate use standards and the extraction of the ground water does not adversely affect the remedial action.

II. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES

This responsiveness summary addresses the comments received by EPA concerning the ESD and TI Waiver for the Site. Only comments from the Potentially Responsible Party, New Hampshire Ball Bearings, Inc. (NHBB), were received. Copies of the comments are also available at the Peterborough Public Library and at the EPA Records Center at 90 Canal Street, Boston, Massachusetts, as part of the Administrative Record.

The comments and EPA responses are presented below.

1. Comment: NHBB pointed out that the eastern boundary of the TI Waiver area should extend to the eastern limit of the property (Lot 22 of the Peterborough R-3 Tax Map) controlled by NHBB. This would place the eastern boundary fifty feet to the west of the centerline of Route 202.

Response: This was EPA's intent. EPA has adjusted the boundary in the ESD and TI evaluation.

2. Comment: NHBB notes that the discussion of the "NHBB plume area" and the "dilute plume area" causes confusion since the TI Waiver area overlaps a portion of the dilute plume area. The TI Evaluation indicates that the dilute plume area can be fully restored, however.

Response: EPA acknowledges the confusion and has modified the text in the ESD and in the TI Evaluation and included the "Figure 1" provided by NHBB which eliminates the plume designations.

3 Comment: NHBB disagrees with that element of the institutional control which would require treating any ground water extracted from the waiver area to drinking water standards. NHBB maintains that no requirement is needed in the discussion of a deed restriction, but if it were, treatment to drinking water standards would be unreasonable if the water were not used for human consumption.

Response: The intent of the institutional control is to safeguard potential future users of the ground water by emphasizing the existence of water unsuitable for human consumption. However, the imposition of a requirement to treat to drinking water standards regardless of the intended disposition of the extracted water is not necessary. EPA has modified the standard to treat to "appropriate water use and/or disposal standards in effect at the time of extraction."