

Tables

Table 1. Evaluation of Public Potential Health Hazards at NWIRP Bedford

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
<p>Site 1 Old Incinerator Ash Disposal Area</p>	<p>Site 1 is located at the northern edge of the site, near the Facility Storage Building. The site housed an incinerator that was used for 19 years to destroy paint and film used at the site. Incineration of these materials over time produced about 2 pounds of silver, 320 pounds of zinc, 570 pounds of lead, and 190 pounds of chromium.</p>	<p>Groundwater: Metals were detected but at levels below ATSDR comparison values (CVs). Soil: Metals were detected, but at levels below ATSDR CVs. Surface Water: Concentrations of cadmium, copper, lead, and zinc were found to be higher than Ambient Water Quality Standards.</p>	<p>The site was investigated during a 1989 Phase I remedial investigation (RI) and site investigation and a 199X Phase II RI. The Phase II report concluded that no further characterization was needed and that a feasibility study should be performed to identify clean-up options.</p>	<p>Based on a review of site data and potential exposure scenarios, ATSDR anticipates no potential public health hazards at this site. The public has limited or no access and measures have been taken to reduce contaminant concentrations.</p>

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
<p>Site 2</p> <p>Components Laboratory Fuel Tank</p>	<p>Site 2 is located at the northeast corner of the Components Laboratory. The site housed a 20,000-gallon tank that supplied No. 6 fuel oil to boilers from 1953 to 1982. In 1982, the Navy drained and cleaned the tank and then installed an oil/water (o/w) separator. Oil and water from the separator was allowed to percolate through the soil. In 1989, the tank and about 50-75 cubic yards of contaminated soil were removed.</p>	<p>Groundwater: The VOCs TCE (up to 110 ppb), 1,1-dichloroethane (1,1-DCA) (up to 14 ppb), 1,2-DCA (1,2-dichloroethane) (up to 44 ppb), 1,1-DCE (28 ppb), methylene chloride (up to 10 ppb), and tetrachloroethylene (PCE) (up to 11 ppb) were detected in the groundwater in the area of the Components Laboratory.</p> <p>Soil: Total petroleum hydrocarbons were detected.</p> <p>Surface Water: Metals were detected.</p> <p>Sediment: SVOCs and metals (lead, nickel, zinc) were detected.</p>	<p>Actions to remove contaminated material began in early 1989 and included removal of the tank and about 50-75 cubic yards of contaminated soil. The Phase II report concluded that no further characterization was needed and that a feasibility study should be performed to identify clean-up options.</p>	<p>Based on a review of site data and potential exposure scenarios, ATSDR anticipates no potential public health hazards. The public had limited to no access to the contaminated subsurface soil in the past and the contaminated subsurface soil has since been removed. At the time of the ROD in 1997, none of the constituents of the plume were migrating off base at levels above the CVs, nor are they expected to in the future. Groundwater monitoring will be used to ensure that the natural attenuation is reducing the contaminant concentrations and preventing off-site migration.</p>

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
<p>Site 3</p> <p>Chlorinated Solvent Area</p>	<p>Site 3 is a chlorinated VOC groundwater plume located at the northern portion of the activity near the Facility Storage Building and the Components Laboratory. A dissolved-phase plume (known as the northwest plume) migrates from a subsurface dense non-aqueous phase liquids (DNAPLs) source area in a northwesterly direction across the site and into an off-site wetland. Another VOC plume of lower concentrations migrates easterly from the source area toward the eastern and northeastern boundary of the site. This plume is called the eastern plume.</p> <p>A 1979 Raytheon memo documents a spill at the site, releasing 1,1,1 trichloroethane (1,1,1-TCA). This spill may have contributed to the plumes. Potential sources of 1,1,1-TCA included the Components Laboratory, the Facility Storage Building print shop, a storm drain, the Antenna Range, the Transportation Building, AMRAD building, and the Hazardous waste storage area, and the Old Incinerator.</p>	<p>Groundwater: VOCs were detected in the groundwater at several locations at this site at levels above ATSDR CVs.</p> <p>Surface Water: TCE was detected at a maximum concentration of 7 ppb, and just above ATSDR’s CV, in samples collected from Elm Brook.</p>	<p>The site was investigated under the 1990-1991 Phase I and 1992-93 Phase II RI investigations. The Navy initiated an immediate response action (IRA) after 1989 field studies indicated the plumes were migrating from Hartwell’s Hill toward Elm Brook. The IRA consisted of an extraction and treatment system designed to remove naturally-occurring metals and chlorinated VOCs via granular activated carbon. The Navy has operated the groundwater treatment system since 1997, and they monitor performance quarterly. The RI Phase II recommended a feasibility study for this site. The Navy conducted a Pilot Study Area Characterization in February 2002. Results of the study indicated that the product was not encountered and that chemical concentrations were highest in the sandy till unit in the central portion of the study area north of the Components Laboratory. The Navy submitted a draft work plan for the Pilot Study in September 2002. The Pilot Study will attempt to achieve 95-99% reduction of total chlorinated VOCs in the pilot test area via electrical resistive heating. (ERH)</p>	<p>Based on a review of site data and potential exposure scenarios, no potential public health hazards are expected at this site. The public has had limited access to the site and the underlying groundwater is not used as a source of drinking water.</p>

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
<p>Site 4 BTEX Groundwater Plume</p>	<p>Site 4 is a plume containing benzene, toluene, ethylbenzene, and xylenes (BTEX) associated with a release (prior to 1984) from a 7,600-gallon underground storage tank (UST). The tank was located south of the Transportation Building from 1960 through 1984. The BTEX plume at Site 4 has migrated north, down Hartwell’s Hill.</p>	<p>Groundwater: BTEX compounds were detected in groundwater at concentrations exceeding ATSDR CVs.</p> <p>Soil: BTEX compounds were detected in soil at a maximum concentration of 35 ppm.</p>	<p>Site 4 was identified during the Phase II RI investigations. The UST and associated contaminated soil were removed in 1988 and 1989. The Navv used in-situ chemical oxidation with Fenton’s reagent to remediate the contamination. The process was effective at most wells, except one well that failed to meet the cleanup goal of 300 ppb for benzene. To supplement the cleanup process, the Navy will use the ERH thermal treatment process to achieve a reduction of benzene concentrations in groundwater to 50 ppb or below in the maximum contaminated areas.</p>	<p>Based on a review of site data and potential exposure scenarios, ATSDR anticipates no potential public health hazards at Site 4. The public has limited access to in soil, and no drinking water wells are located at this site.</p>

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
<p>Southern Flight Test Area</p>	<p>The Southern Flight Test Area (SFTA) is located on the southern portion of the NWIRP Bedford site, and borders the northern portion of Hanscom Field. The SFTA was primarily used to flight test prototype models at the Flight Test Facility. The SFTA also housed the Old Hanger, the Plating Laboratory, the Lark Building (for the former NWIRP Bedford publications Department), and the Van Duesen Building (for storage of Hawk missile equipment). VOCs were detected in groundwater near the Old Hangar.</p>	<p>Groundwater: Monitoring since 1989 has shown VOCs, primarily TCE, at levels up to 250 ppb in the overburden and bedrock groundwater beneath the site. These levels exceed ATSDR CVs.</p> <p>Soil: Semi-volatile organic compounds (SVOCs) were detected at concentrations up to 1.8 ppb for di-n-butylphthalate.</p>	<p>The SFTA was investigated through the 1990 Phase I Supplemental Investigation and the RI. Hanscom Air Force Base began operating a groundwater extraction and treatment system near the SFTA since 1991. The system was designed to treat and control contamination in groundwater migrating from three sites at Hanscom Field and Hanscom Air Force Base. The Navy agreed to conduct semi-annual groundwater monitoring groundwater at SFTA.</p>	<p>Based on a review of site data and potential exposure scenarios, ATSDR anticipates no potential public health hazards at the SFTA. The public has limited access to the contaminants in soil and no drinking water wells are located at this part of the activity.</p>

Sources: ENSR 2003; Tetra Tech NUS Inc. 2001, 2002.

Key:			
BTEX	benzene, toluene, ethylbenzene, and xylenes	ppm	parts per million
CV	ATSDR’s comparison value	RI	remedial investigation
1,2-DCA	1,2-dichloroethane	SFTA	Southern Flight Test Area
1,2-DCE	1,2-dichloroethene	SVOCs	semivolatile organic compounds
IRA	immediate response action	1,1,1-TCA	1,1,1-trichloroethane
o/w	oil water separator	TCE	trichloroethylene
PCE	tetrachloroethylene	VOCs	volatile organic compounds
ppb	parts per billion		

Table 2. Evaluation of Exposure Pathways at NWIRP Bedford

Pathway	Elements of an Exposure Pathway						Comment
	Source	Media	Point of Exposure	Route of Exposure	Time Frame	Exposed Population	
Completed Exposure Pathways							
<i>Off-Site Groundwater: Municipal Well Water Use</i> Exposure to VOCs and dissolved iron in the former Hartwell Road well field that served the town of Bedford between 1983 and 1984	Former NWIRP Bedford activities	Groundwater	Bedford municipal taps	Ingestion, dermal contact, and inhalation	Past (1983-1984)	Bedford municipal water supply users	<p><i>Past:</i> The former Hartwell Road well field located northwest of the NWIRP site contained VOCs and iron above ATSDR’s CV and EPA’s MCL during the first few months of operation in 1983-1984. Exposure occurred, but not likely at levels of health concern. The well field was closed in 1984 and Bedford residents have since been provided with an alternate source of water.</p> <p><i>Current and Future:</i> No current or future exposures are expected as the Hartwell Road well field remains closed and Bedford residents continue to rely on other sources of drinking water that routine tests show is safe to drink.</p>
Potential Exposure Pathways							
<i>Off-Site Groundwater Private Well</i>	Former NWIRP Bedford activities	Groundwater	Bedford private well taps	Incidental ingestion and skin contact	Past Current Future	Private well owners located near NWIRP Bedford	<p><i>Past, Current, and Future:</i> Local private wells are not likely used for drinking water because the residences are connected to the municipal water supply. Some private wells may be used for irrigation. The limited exposure associated with this type of use is not expected to cause health effects.</p>

Pathway	Elements of an Exposure Pathway						Comment
	Source	Media	Point of Exposure	Route of Exposure	Time Frame	Exposed Population	
Surface Water at Elm Brook Exposure of visitors to contaminants in Elm Brook surface water	Former NWIRP Bedford activities	Surface water	Elm Brook	Dermal Contact	Past Current Future	Visitors to Elm Brook	<i>Past, Current, and Future:</i> Low levels of contaminants were detected in Elm Brook surface water and sediment. People may have contacted or continue to contact these contaminants. The low levels of contaminants and type of exposure would not be expected to cause harm to visitors to the brook.
Indoor Air Exposure to vapors possibly inside buildings above groundwater plume	Organic compounds in the groundwater plumes that possibly volatilized and seeped into buildings at NWIRP Bedford	Indoor air	NWIRP Buildings	Inhalation	Past	Occupants of NWIRP Bedford buildings	<i>Past, Current, Future:</i> Some on-site buildings sit above or near groundwater plumes at NWIRP Bedford. Modeling predicts that the contaminants could enter the buildings, but at levels generally lower than those associated with adverse health effects.

Table 3. Maximum Contaminant Concentration in Groundwater at NWIRP Bedford

Contaminant	Concentration (ppb)	Comparison Value (ppb)
Benzene	75	0.6 CREG
Trichloroethylene	2,300	5 MCL
Iron	ND	300 Secondary MCL

Key: CREG=ATSDR’s cancer risk evaluation guide; MCL=EPA’s maximum contaminant level; ppb=parts per billion.

Table 4. Chronological Summary of Monitoring Activities at the Hartwell Road Well Field

Date	Activity
Summer and Fall 1981	Construction of three production wells at the Hartwell Road well field is completed. The wells 10, 11, and 12 were constructed as the primary water supply for the town and as a partial replacement for other municipal wells (Wells 3, 7, 8, and 9) lost due to industrial contamination.
	A 24-hour pump test was performed and water samples were collected and analyzed. Only a trace level of trichloroethylene (TCE) was detected in Well 12. The trace detection was not confirmed upon subsequent sampling. The initial concentrations of iron at the well field ranged from 180 to 5,000 parts per billion (ppb).
March 1983	The Hartwell Road Well Field Treatment Plant is completed and placed in service. Wells 10, 11, and 12 were pumped to 225 gallons per minute (gpm), 90 gpm, and 260 gpm, respectively.
October 1983	A routine sampling from a tap at the Bedford town offices showed volatile organic compounds (VOCs) in Wells 10 and 11. Subsequent sampling confirmed that VOCs were present in Wells 10 and 11, and now Well 12. The highest concentrations were measured in Well 11. Well 11 is taken off line.
December 1983	The town of Bedford began a water-testing program to assess the contaminant concentrations in the Hartwell Road well field.
Mid-December 1983	Although no changes had been made to the treatment operation, iron levels in the treatment plant's finished water began to increase and the chlorine residual began to fluctuate.
December 1983 –January 1984	TCE was initially detected at 33 ppb in the well field (date not provided). Through December 1983 and January 1984, TCE concentrations in Well 11 fluctuated between 14 ppb and 26 ppb, concentrations above ATSDR's current CV for TCE of 5 ppb.
January 10, 1984	Well 10 is taken off line.
February 1984	In early February, traces of benzene and other VOCs were detected in Well 12. By late February, benzene concentrations had increased to 5 ppb in that well. (Benzene was also detected at a high of 30 ppb in off line Well 10. Subsequent sampling did not confirm the high concentration.)
March 1984	By March 1984, only Well 12 was in service at the well field. Benzene was detected in finished water collected from the treatment plant at Hartwell Road at a concentration of 7 ppb.
April 3, 1984	The town of Bedford shuts down the treatment plant and the three production wells at Harwell Road.

Source: CDM 1984 a, b, c.

Table 5. Contaminant Concentrations in the Hartwell Road Well Field, 1983–1984

Well ID	Month Sampled	Contaminant Concentrations (ppb)		
		Benzene	TCE†	Iron
Well 10	October 1983		33§	
	November 1983			
	December 1983			11,000
	January 1984	< 10 P	10	31,000
	February 1984 (off line)	<5 P-30	11-13	
	March 1984 (off line)			
Well 11	October 1983			
	November 1983			
	December 1983 (off line)		21	
	January 1984 (off line)		14-26	
	February 1984 (off line)	<5 P	13-16	
	March 1984			
Well 12	October 1983			
	November 1983			
	December 1983			
	January 1984			
	February 1984	<5P-5	<1P-2	
	March 1984			
Finished Water	October 1983			
	November 1983			
	December 1983			
	January 1984	< 5 P	6-7	
	February 1984	<5 P-5	<1P-9	
	March 1984	7	5	

Source: CDM 1984b.

† A 24-pump test following completion of construction and before start up showed trace levels of TCE and between 180 and 5,000 ppb of iron.

§ TCE was initially detected at 33 ppb in the Hartwell Road well field. The date of this detection was not provided in site documentation.

Table 6. Maximum Contaminant Concentrations in Groundwater at the Hartwell Road Well Field

Contaminant	Concentration (ppb)	Comparison Value (ppb)
Benzene	35	0.6 CREG
Trichloroethylene	8.5 (upper aquifer)	5 MCL
Iron	310,000	300 Secondary MCL

Source: CDM 1984c.

Key: CREG=ATSDR’s cancer risk evaluation guide; MCL=EPA’s maximum contaminant level; ppb=parts per billion.

Table 7. Contaminant Concentration Range in Elm Brook Surface Water and Sediment

Contaminant by Media	Concentration (Frequency Above CV)	CV
Surface Water		
Arsenic	3.4 – 5.2 J*	10 ppb proposed MCL
Trichloroethylene	1 J – 7 J (1/4)	5 ppb EPA MCL
Sediment		
Arsenic	3.9 – 47.4 (7/7)	20 EMEG- child**
Benzo(a)pyrene	1.2	0.1 ppm ATSDR CREG

Source: Tetra Tech NUS Inc. 2000a,b.

Key: CREG=ATSDR’s cancer risk evaluation guide; MCL=EPA’s maximum contaminant level; ppb=parts per billion; ppm= parts per million; EMEG= Environmental Media Evaluation Guide.

**ATSDR has a 0.5 ppm CREG for arsenic; however, it is often below soil/sediment background concentrations and was not used as the screening level.

Note: J=estimated result; positive detected value less than the Contract Required Quantitation Limit (CRQL).
 J *=estimated results based on data validation criteria.

Table 8. BTEX Concentrations in the Northern Plume

Contaminant	Shallow Aquifer (Overburden)		Deep Aquifer (Bedrock)	
	Concentration ppb	Well / Sampling Event *	Concentration ppb	Well/ Sampling Event *
Total BTEX	99,800	MW18/Ph II (1993)	13 J	MW15R/ Ph II (1993)
Benzene	3,000	MW18/Ph II (1993)	ND	---
Toluene	49,000	MW18/Ph II (1993)	ND	MW15R/ Ph II (1993)
Ethylbenzene	7,800	MW18/Ph II (1993)	2 J	---
Xylenes	40,000	MW18/Ph II (1993)	11	MW15R/Ph II (1993)

Source: Tetra Tech NUS 2000.

Key: J=estimated value; ND=not detected.

* Phase II (Ph II) remedial investigation results were collected in 1993. Samples from six shallow (overburden) wells (MW2S, MW3S, MW15S, MW18, ELM2, GEI107U) and four bedrock wells (MW2B, MW3B, MW15R, GEI107R) were analyzed for BTEX compounds.