Site and Radiological Survey Histories

The Watertown Arsenal encompasses approximately 53 hectares (130 acres) along the north branch of the Charles River, approximately 11 kilometers (7 miles) west of Boston, Massachusetts. The Watertown Arsenal had been part of the Army Ordnance Department, from its inception in 1812, until the transfer of its functions to the Army Materials Command [now Army Research Laboratory (ARL)] in 1962. From 1946 to 1953, the Massachusetts Institute of Technology conducted a research program for the Manhattan Engineering District on African ore containing uranium.

In 1958, the Atomic Energy Commission (AEC) issued a source material license to the U.S. Army for the depleted uranium activities at the Watertown Arsenal. Locations of use were not specified in the license. However, based on historical assessments, the following Watertown Mall Areas were determined to have been used for source material activity: Building 34, which housed a uranium machine shop; a portion of Building 41, which contained a foundry that was used for uranium work; and, Building 421, which was used for experimental uranium oxide production with thorium used as crucible material, and later was used for depleted uranium projectile prototype research. Waste storage and processing activities, including burning depleted uranium in drums, was conducted in the Northeast Parcel, a 5-hectare (12-acre) site located near the Watertown Arsenal.

In 1968, the eastern half of the Watertown Arsenal, encompassing 24 hectares (59 acres) and 21 buildings, including the three facilities using licensed source material, was declared excess government property, and transferred to U.S. General Services Administration (GSA) and subsequently sold to the Watertown Redevelopment Authority (WRA). The area was renamed the Watertown Mall Area. The remaining western half of the Watertown Arsenal was renamed the Materials Technology Laboratory (also known as the Arsenal), which retained U.S. Nuclear Regulatory Commission (NRC) license SUB-238. In addition, the Northeast Parcel was accessed to the GSA in a radiologically contaminated state. GSA retained ownership of the Northeast Parcel, and it continues to be an Site Decommissioning Management Plan (SDMP) site.

The Watertown Mall Area, a Formerly Utilized Defense Site, or FUDS property, currently includes apartments [1.2 hectares (2.8 acres)], the Harvard Community Health Program Watertown Branch [1.3 hectares (3.1 acres)], the Arsenal Marketplace [7.7 hectares (19.1 acres)], an Ann & Hope retail department store [4.5 hectares (11.2 acres)], condominiums [0.7 hectares (1.6 acres)], Massachusetts Development Corporation land [3 hectares (7.46 acres)], and Arsenal Park [5.5 hectares (13.7 acres)], two Massachusetts Department of Environmental Protection (MADEP) - listed chemical disposal sites, and former Buildings 34, 41, and 421. These three buildings were razed in the mid-1970s after their transfer to the WRA, with only the concrete floor slabs, access driveways, and underground utility service trenches remaining. During the 1980s, these areas were redeveloped. The concrete pad of Building 34 was broken up, buried in an excavation pit 7.6 meters (25 feet) deep, and re-graded as a parking lot for the Arsenal Marketplace. The concrete pad of Building 41 was covered with 0.6-3 meters (2-10 feet) of fill, and re-graded as a parking lot for the Ann & Hope Store. The concrete pad for Building 421 was used as a foundation for tennis courts in Arsenal Park. Figure 1 depicts these areas as well as the connecting sewer systems from these former buildings. Gamma scanning surveys and soil sampling for radiological contamination were performed in some of the areas not involved with licensed activities (e.g., mall buildings,

recreational areas, and residential housing). No radioactive contamination was identified in the unaffected areas.

In 1967, the Army performed a radiological survey of the former uranium processing and machine shop areas in Buildings 34 and 41 to characterize the residual contamination in preparation for the transfer of the eastern portion of the Arsenal to the GSA. In 1967, it was reported that Building 421 was decontaminated under the supervision of the Army; however, records of the decontamination procedures and final radiation survey were not located during an extensive archival record review. During a records search in 1991-1993, decontamination procedures and final radiation survey records for Buildings 34 and 41 indicated radiologically contaminated equipment was removed and transferred or disposed of in accordance with regulatory requirements. One pre-decontamination survey noted radiation levels as high as 0.4 milliSievert per hour (mSv/h) [40 millirem per hour (40 mR/h)] in a pipe trench and 0.20 mSv/h (20 mR/h) in a drain line in Building 34. Several decontamination efforts were required, including jack-hammering cracks in concrete to remove discrete areas of fixed contamination. At the completion of these activities, all surface areas were below the residual radioactive release criteria used by the Army as specified by AEC in 1968. These criteria were more restrictive than the SDMP criteria for alpha radiation, and consistent with the SDMP Action Plan criteria and the ARL Decommissioning Plan criteria for beta and gamma radiation (which was approved by NRC in 1992 for the ARL/Mall Area site). The SDMP Action Plan criteria were used as the basis to evaluate the historical survey data.

From 1977 through 1981, the Argonne National Laboratory (ANL) performed radiological surveys of the remnants of the former Buildings 34, 41, and 421 under the Department of Energy's Formerly Utilized MED/AEC Sites Remedial Action Program. These reports were issued in 1980 and 1983. The U.S. Army Corps of Engineers' (hereafter, the Corps) Risk Assessments evaluated these survey results against the SDMP Action Plan criteria.

Building 421 pad contains three small areas of fixed radioactive contamination greater than 5,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2)(beta) in an area that is less than 5,200 cm^2 (out of a total concrete pad area of 22,630 meters $(m)^2$). These areas contained 220,000 dpm/100 cm^2 in two areas less than 100 cm^2 and 85,000 dpm/100 cm^2 in one area approximately 0.5 m^2. The fixed contamination was determined to be natural uranium. There was no fixed alpha contamination detected. All direct GM readings were at background levels , except for one direct reading at twice background. Soil core samples from eight perimeter locations were within the background values for natural uranium in this area and all ambient exposure-rate measurements were consistent with background. A water sample from the storm sewer was also consistent with background concentrations. ANL evaluated the contaminated spots and did not identify a significant risk, assuming that the contaminated spots were removed via jack-hammering. The Corps' Risk Assessment from 1996 concluded that although these spots exceeded the SDMP Action Plan criteria, the ANL evaluation was reasonable and the spots did not represent a significant risk to the public. As noted below, the Corps conducted gamma surveys of the tennis courts to attempt to locate the spots. However, all readings were consistent with background levels. Also, additional soil sampling was conducted in the Arsenal Park and tennis courts to determine if there was any washout of contamination. All soil samples were consistent with background levels.

Building 34 pad contained one small area of 6,000 dpm/100 cm^2 (beta) in an area not greater than 7,000 cm^2 (out of a total concrete pad area of 3,600 m^2). Under the elevated activity

criteria, which weights the activity for the contiguous 1 m^2, this area also meets the SDMP Action Plan criteria. Soil core sample results indicated 5 out of 15 soil corings from the perimeter of the pad exceeded natural background for uranium. The maximum soil activity reported was 0.6 Becquerels per gram (Bq/g) [15.5 picoCuries per gram (15.5 pCi/g)] uranium; however, the average contamination for the perimeter of Building 34 was less than 0.3 Bq/g (8 pCi/g), at least a factor of 4 less than the SDMP Action Plan criteria of 1.3 Bq/g (35 pCi/g) for depleted uranium. The site-wide average soil concentration was consistent with background.

No contamination was found on the Building 41 pad. However two thirds of the pad was covered with soil. Soil results were generally within background levels for uranium, except for one sample that showed 0.32 Bq/g (8.7 pCi/g) of uranium. Sludge and water samples were taken from a floor drain/sump and a sewer closest to the concrete pad for Building 41. The sludge and suspended solids from the water samples were reported as 0.4 Bq/g; 0.4 Bq/g; 0.07 Bq/g; and 0.2 Bq/g (10.2 pCi/g; 12.0 pCi/g; 1.8 pCi/g; and 5.8 pCi/g) of uranium, respectively. All soil, sludge, and suspended solids results were less than the SDMP Action Plan criteria for natural uranium, depleted uranium, and thorium. All ambient exposure-rate measurements were consistent with background.

After the ANL surveys, various surface and ambient exposure-rate surveys were conducted at several areas at the site. Soil samples were also collected. The results confirmed that no radiation levels above background were present. Sampling of sediments and gamma surveys of the available site sewer system were completed in 1996. Except for a radium anomaly from one sample location, all measurements and samples were reported as not in excess of natural background. Based on an extensive record review, and the surveys conducted in the 1990s, in September 1996, the Corps submitted a report entitled " Radiological Risk Evaluation Summary Report for the Former Watertown Arsenal" which evaluated risk using the SDMP Action Plan criteria; the ARL Decommissioning Plan Criteria (essentially the same as the SDMP Action Plan criteria); the MADPH radiological criteria of 0.1 mSv/year (10 mrem/year); and, the requirements of the MADEP Massachusetts Contingency Plan (the Comprehensive Risk Evaluation that evaluated both hazardous and residual radioactive material was submitted to MADEP in 1998). The results of the radiological risk evaluation indicated that, under current and future site conditions, no significant human health or ecological risks would be expected from residual radiological material at the site.

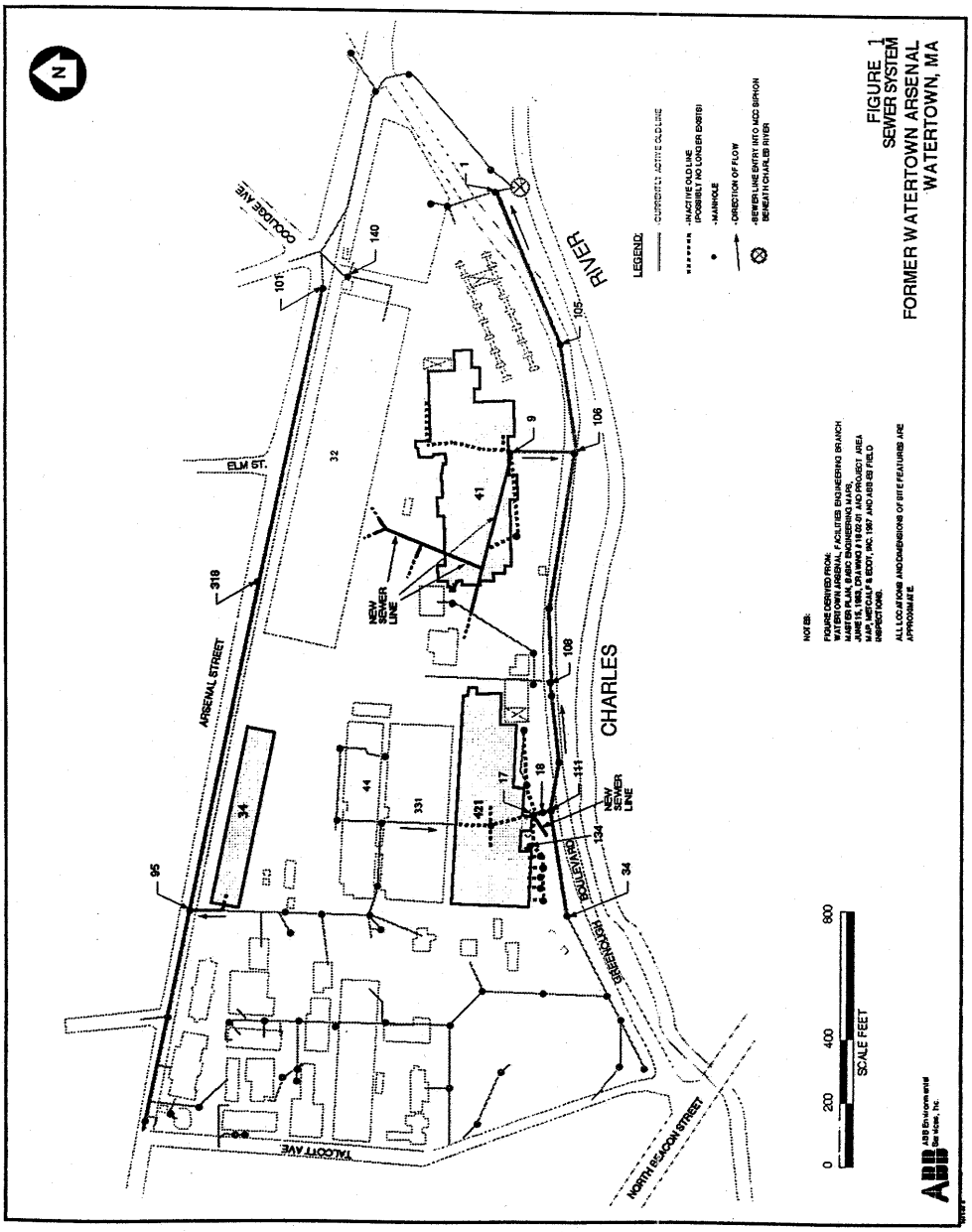
A Public Health Assessment for the Watertown Arsenal, including the Mall Area, was completed by the U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR) in February 1997. With respect to residual radioactive material, ATSDR evaluated exposures from contaminated subsurface soil and building remnants on the FUDS parcel and previous air releases of depleted uranium. ATSDR concluded that people are not currently being exposed, but that there was a potential for future possible exposure if workers unearthed radiologically contaminated piping that may have been left in place. The NRC staff concluded that the exposure scenario used by the licensee to estimate potential doses to future site inhabitants (i.e., a residential family farm scenario) is a more conservative scenario than one involving the excavation and disposal of the pipe and, as such, the doses estimated using the residential family farm scenario would be bounding.

In July 1998, the Corps, through its contractor, submitted the final "Phase II Comprehensive Site Assessment Report for the Former Watertown Arsenal FUDS property." Although it primarily evaluated the nature and extent of chemically hazardous material at the site, it

provided additional historical information and field observation data regarding underground piping and sewer systems to determine if any additional actions would be required to address potential radiological contamination. As summarized, a 1957 survey showed two sewer connections from Building 34, while a 1963 sewer map indicated one line that discharged to the sewer main (sample data from this location found no radiation, above background, in sediment samples, or dose rate measurements above background levels). No manholes from the former system were observed because the building foundation was destroyed and the ground beneath the former building was excavated to a depth of 7.6 meters (25 feet). It was assumed that all former sewer lines connected to the building were also excavated. Sewer lines associated with former Building 41 converged at Manhole 9 and discharged southward through a 5-centimeter (12-inch) line to the sanitary sewer line connected to the main sewer line at Manhole 106. Although Manhole 106 was sampled in 1996, Manhole 9 could not be opened. Redevelopment plans indicated that the old sewer lines under the building were plugged just above Manhole 9. Since the former building foundation was left in place, it is assumed that the underlying plugged sewer pipes were not removed. Sewer lines associated with the former Building 421 were also assumed to be plugged and left in place. Field observations indicated Manhole 134 from the old sewer line was inactive, but connected to Manhole 17. Sample results from 1996 did not identify any radioactive material contamination.

NRC staff also noted that the Redevelopment Plans stated that the existing drain lines were flushed before being plugged. Based on the sewer sampling done in 1996, and the field observations and historical review in 1998, only Manhole 9 needed further evaluation. NRC staff also noted that in a letter dated December 31, 1994, MADEP agreed with the Corps groundwater classification (GW-3) for this site (i.e., a non-Potential Drinking Water Source Area). No municipal or private wells obtain groundwater from this site or area.

To resolve the concern regarding the radiological condition of the sewer line from the former Building 41, NRC conducted an independent survey in July 1999. NRC Confirmatory Inspection Report No. 040-2253/99-02, dated October 4, 1999, indicated that most survey and sample results were consistent with environmental levels of uranium; however, two direct surface measurements were in excess of the SDMP Action Plan criteria for depleted uranium. To determine if this sewer line needed to be remediated, a dose assessment was requested and received by NRC in July 2000. The results demonstrated that the potential doses from the residual radioactive contamination were well below the NRC dose-based release criterion of 0.25 mSv/y (25 mrem/y) as specified in 10 CFR 20.1402.



ATTACHMENT 1