US Army Corps of Engineers®
Buffalo District

Preliminary Assessment

Superior Steel Corporation
Scott Township, Pennsylvania

Prepared by:

U.S. Army Corps of Engineers, Buffalo District
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Abbreviations, Acronyms, and Symbols

AEC	Atomic Energy Commission
AHP	Applied Health Physics Inc.
Argonne	Argonne National Lab
AR	Army Regulation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
DOE	Department of Energy
dpm	Disintegrations per minute
EDR	Environmental Data Resources
EPA	Environmental Protection Agency
ESSAP	Environmental Survey and Site Assessment Program
FUSRAP	Formerly Utilized Sites Remedial Action Program
gpm	Gallons per minute
MED	Manhattan Engineer District
mrem	millirem
MOU	Memorandum of Understanding
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NEPA	National Environmental Policy Act
NIOSH	National Institute of Occupational Safety and Health
NRC	Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NUREG	Nuclear Regulatory Guidance
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
PA	Preliminary Assessment
PADEP	Pennsylvania Department of Environmental Protection
PENNDOT	Pennsylvania Department of Transportation
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
RI	Remedial Investigation
SAIC	Science Applications International Corporation
SSC	Superior Steel Corporation
U	Uranium
USACE	United States Army Corps of Engineers
µR/h	microRoentgen per hour
yr	year

1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE) in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) performed a Preliminary Assessment (PA) of the former Superior Steel Corporation site. The purpose of this PA was to review information to determine the need for further action by USACE under the Formerly Utilized Sites Remedial Action Program (FUSRAP) to ensure the protection of human health and the environment. The scope of the assessment included a review of existing information about the site and a site visit on August 29, 2006.

The former Superior Steel Site in Scott Township, Pennsylvania, processed uranium metal in support of the U.S. Atomic Energy Commission (AEC) fuel-element development program from June 27, 1952 to contract termination on September 30, 1957. The uranium-processing contract originated with the AEC New York Operations Office and later was administered by the AEC Oak Ridge Operations Office beginning on July 1, 1954. The contract was transferred to the AEC Savannah River Operations Office on October 15, 1954. Upon contract termination, the AEC Savannah River Operations Office destroyed the official contract file in accordance with its records disposition schedule.

In addition to the work performed for the AEC, Superior Steel was licensed in 1956 (No. C-3480) to receive possession of and/or title to thorium metal for the purpose of forging, roll cogging, finish rolling, and cutting. This license allowed Superior Steel to receive source material (thorium metal) from another commercial licensee (Babcock & Wilcox Company under license No. C-3465) and process it into the desired shape. According to the Nuclear Regulatory Commission (NRC), the Superior Steel AEC license expired in 1958 and records indicate that there was neither a closeout survey nor inspection of the facility to support termination of this license (NRC 2006). Any residual radioactive contamination associated with commercial operations involving thorium metal is not eligible for cleanup under FUSRAP (Owen 2006).

The primary AEC operations performed at the Superior Steel Site consisted of salt bathing, rolling, brushing, shaping, cutting, stamping, and coiling of uranium metal. Records indicate that natural and enriched uranium were processed at the site; recycled uranium from reprocessed spent nuclear fuel may also have been processed at the site.

In March of 1974, FUSRAP was initiated under the direction of the Atomic Energy Commission (AEC) and in 1975 was assigned to the Energy, Research, and Development Administration (ERDA) until 1977, when program responsibility was assigned to the newly created Department of Energy (DOE). In the Energy and Water Development Appropriations Act, 1998, (Title I, Public Law 105-62, 111 Stat. 1320, 1326) Congress transferred the responsibility for the administration and execution of cleanup at eligible FUSRAP sites to USACE. In the Energy and Water Development Appropriations Act, 2000 (Title VI, Public Law 106-60, 113 Stat. 483, 502), Congress directed that any response action taken under FUSRAP by the Secretary of the Army, acting through the Chief of Engineers, shall be subject to CERCLA and the NCP.

In March of 1999, USACE and DOE signed a Memorandum of Understanding (MOU) that defined the administration and execution of responsibilities of each party under FUSRAP. Pursuant to that MOU, when a new site is considered for inclusion in the FUSRAP, DOE is responsible for performing historical research to determine if the site was used for activities that supported the Nation's early atomic energy program. If DOE concludes that the site was used for that purpose, the agency will provide USACE with that determination. USACE is then responsible for preparing a PA in accordance with the CERCLA process to determine if a response action is appropriate because of releases related to AEC-related operations.

On 3 February 2006, the DOE provided USACE with a determination that the site was used for AEC activities that supported the Nation's early atomic energy program (Attachment A). Accordingly, the former Superior Steel Corporation may be eligible for inclusion into the FUSRAP, if it is determined under section III.D.2 of the Memorandum of Understanding (MOU) between the DOE and USACE that further CERCLA response actions may be necessary to address FUSRAP-related contamination at the site and there is indication that further detailed analysis will show the Federal Government may be responsible under CERCLA for the contamination.

The purpose of this PA is to determine whether an unpermitted release or threat of release of FUSRAP eligible hazardous substances occurred at the site and pose a threat to the public health or the environment, as defined in Section 101(22) of CERCLA. If the assessment determines that there is a release or threat of release, which may pose a threat to the public health or the environment, then CERCLA authorizes further response actions to investigate the site as necessary. This action does not respond to releases that are federally permitted or addressed by a legally enforceable license, permit, regulation or order issued pursuant to the Atomic Energy Act of 1954 or other Federal statute. Response actions may include removal (if imminent threat to human health or environment) or additional investigation (Site Inspection). If radiological risk is evident, then the CERCLA process progresses through a Remedial Investigation, Feasibility Study, Proposed Plan and Record of Decision. If no evidence of release, or threat of release, is found and no significant threat to the public health or environment is identified to eligible FUSRAP related contaminates, then the PA will recommend no further action.

In addition to the documents transferred by DOE to USACE referencing Superior Steel, USACE contracted with Argonne National Laboratory (Argonne) to perform additional records search. Argonne completed this search in August 2006 and a complete list of records obtained is located in Attachment 1 of Argonne's report (Argonne, 2006). Representatives from Argonne and USACE visited several locations including the National Archives and Records Administration, the Pennsylvania Departments of Environmental Protection and Transportation, the Pennsylvania State Archives, and the Pennsylvania State Library. Additionally, Argonne contacted representatives from the NRC, the DOE Office of Legacy Management, and the Pennsylvania Department of Health (which subsequently contacted the Agency for Toxic Substances and Disease Registry). These activities led to the identification of additional records that were not previously identified in the documents provided by the DOE. Further, a preliminary legal analysis must show some Federal Government responsibility for the contamination, based on CERCLA principles of liability, otherwise a recommendation will be

made that FUSRAP activities be terminated at the site and any necessary cleanup be conducted under the jurisdiction of an appropriate federal or state agency.

2.0 SITE DESCRIPTION, OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

2.1 Site Description

The former Superior Steel Site is located in an industrial complex at 500 Superior Street in Scott Township, Allegheny County, Pennsylvania, (latitude 40.398569, longitude -80.0096351) about 8 km (5 mi) southwest of downtown Pittsburgh. The Superior Steel site is located in Environmental Protection Agency (EPA) Region 3. The 25-acre site originally was occupied solely by the Superior Steel Company and now consists of several separately owned manufacturing, storage, and office buildings. The site is bounded on the north, west, and south by Chartiers Creek and on the east by Superior Street (Figure 1). The building that housed the uranium processing facilities (Building Complex Number 23) is now owned by Superbolt, Inc., a manufacturer of mechanical stud and bolt tensioners.

Superbolt Building Complex Number 23 consists of five interconnected steel-frame warehouses (Figure 2) with metal roofs with corrugated steel siding. The floor construction varies from area to area and is a combination of poured concrete, brick, and bare earth. The building has a few windows, several garage-type doors, some standard door entrances, and various roof ventilator fans. Superior Steel used three of the five areas in Building 23 to process AEC-related material. Superbolt Inc. had previously leased the potentially contaminated areas to other businesses for use as storage space and limited light industrial activity. However, Superbolt Inc., discontinued this once the NRC identified residual radioactivity in Building 23. On August 29, 2006 during a site visit to the former SSC complex, representatives from Superbolt Inc. indicated that the northern third of Bldg. 23B is leased to a trucking company. This industrial complex, including Building 23, sustained extensive flood damage on September 18, 2004, when a discharge of 15,900 cubic feet per second occurred on Chartiers Creek (NRC 2006).

2.2 Owner – Operator Information

At the time of AEC contract operations, the company was known as Superior Steel Corporation (SSC) and later as Copper Weld, Inc. and as Lot and Block 102J210. The buildings and facilities at the site have been sold a number of times over the intervening years, and other names associated with the former Superior Steel Site are Lange Machinery Company, Inc., J.G. Industries, Inc., Carnegie Industrial Park, and Superior Tube Company (ORAU 2005). The current owner of Building Complex Number 23 is Superbolt Inc., who uses the building for storage (NRC 2006).

2.3 Operational History and Waste Characteristics

For the purposes of this assessment, the operational history of the former SSC began with a unit-price AEC contract that extended from June 27, 1952 through September 30, 1957. The original SSC contract is unavailable (contract No. AT 30-1-1412), although a contract awarded to Metals & Controls for similar work was assumed to have the same boilerplate contract articles (Aerospace Corporation, 1985). The contract originated from the AEC New York Operations office, later transferred to the Oak Ridge Operations office, and then on October 15, 1954 to the Savannah River Operations office. According to the Savannah River Operations office, SSC contract files were destroyed. However, correspondence files relating to the work done by SSC indicate they rolled, cut, and finished uranium metal into flat plates under a unit-price contract.

In addition to the work performed for the AEC, Superior Steel was licensed in 1956 (No. C-3480) to receive possession of and/or title to 700 pounds of thorium metal to forge test. The license was amended one month later for forging, roll cogging, finish rolling, and cutting of 45,000 pounds of thorium ingots for the Babcock & Wilcox Company. However, no confirmation of receipt or handling of thorium has been found. Due to the limited size of the Superior Steel facilities and its production capacities, it can be assumed that the both commercial work and work performed for AEC by Superior was done on the same equipment and process line. Additionally, it was noted by Aerospace Corporation that work performed for AEC by Superior Steel occurred on the weekends when the plant would have otherwise been idle, indicating that commercial work was potentially done on these same equipment lines (Aerospace Corporation, 1985). The Superior Steel AEC license expired in 1958 and NRC records indicate that neither a closeout survey nor inspection of the facility was performed to support the license termination (NRC 2006). Any residual radioactive contamination associated with commercial operations involving thorium metal is not eligible for cleanup under FUSRAP (Owen 2006).

AEC-contracted work performed by SSC occurred in Building Complex Number 23 (or Bldg. 23), although only three of the five areas were used for uranium manufacturing activities: the Mill Area (Area 23A), the Rolling Area (Area 23D), and the Motor Room (Area 23E). While Areas 23B and 23C were not identified as being used in uranium processing activities, the most recent radiological survey conducted by ORISE for NRC addressed all five areas and documented radiological contamination in all five areas (Adams 2003).

Area 23A covers about 2,300 m^2 (25,000 ft^2) and contained the salt bath, roughing mill, brushing station, finishing stands, and shear; the majority of the uranium handling and metal shaping occurred here. All equipment used in this process has been removed and subfloor pits approximately 2.5 m (8 ft) deep located below this uranium processing equipment are now filled in with rubble and capped with 15 cm (6 in.) of concrete by previous owners, Lange Machinery of Coraopolis, Pennsylvania (Myrick, 1981) subsequent to Superbolt Inc owning the site. Historical reports indicate that the sides of the pits are constructed of concrete but it is undetermined if the floor of the pits are also of concrete construction due to the debris now located in the pits. The Adams (2003) report refers to this subfloor feature as consisting of multiple pits extending the length of the former process layout (Figure 3) in Areas 23A and 23D (Figure 2), as well as approximately 15 m (50 ft) outside the building north of Area 23A. Area 23A was used later to rebuild coke oven doors and is now a storage area for equipment not

associated with either the uranium milling or coke door rebuilding processes; about 50% of the floor space is used for storage.

Area 23D covers about 1,250 m^2 (13,000 ft^2) and was used to roll metal for shipping to customers desired specifications. Area 23D is separated from Area 23A by a sheet-metal wall. There were two pits in the south end of Area 23D that were filled with rubble and finished with concrete to floor level. A small storage shed that is attached to the west side of Area 23D was remediated including contaminated soil underneath the shed, in 1997. The north end of Area 23D is used by Superbolt for storing materials and supplies. The south end of Area 23D is currently empty except for containers filled with radioactive waste from the 1997 remedial action (storage shed and nearby contaminated soil) and radioactive wastes associated with the ORISE surveys. These stored wastes are physically separated from the rest of Area 23D by a temporary wall and are covered with a tarp. Superbolt Inc. uses about 20% of the floor space in this area for storage.

Area 23E covers about 1,300 m^2 (14,000 ft^2) and contained the motors and control panels that powered the mill equipment in Area 23A. This area was considered the clean side of the mill because the atmosphere was controlled to provide proper operating conditions for the motors and instruments. About 30% of the floor space is currently being used for storage purposes.

Areas 23B and 23C were not used in the uranium processing activities conducted by Superior Steel. Area 23B covers about 1,760 m^2 (19,000 ft^2) and Area 23C about 920 m^2 (9,900 ft^2). Superbolt used Area 23B to store the waste from the 1997 remedial activities, which were relocated to the south end of Area 23D and consolidated with wastes generated during the ORISE surveys. About 10% of the floor area in Area 23B is used by Superbolt to store supplies. Area 23C is generally empty, with less than 10% of the floor space used by Superbolt to store materials and supplies. A small trailer, which belongs to the trucking company, is parked in the north end of the building.

2.4 Previous Radiological Surveys

Five radiological surveys of Superbolt Building Complex Number 23 have been documented.

2.4.1 ORNL Survey

Oak Ridge National Laboratory (ORNL) performed the first survey conducted of the SSC site in July 1980 at the request of the Department of Energy. The purpose of the survey was to provide information on the present condition and use of the former mill area and to determine the need for a detailed survey of the site. The survey report concluded that uranium contamination was found in the Mill Area (Area 23A), the Rolling Area (Area 23D), and in the storage shed adjacent to the Rolling Area. Elevated gamma exposure rates were measured up to 500 microroentgens per hour (μR/hr) in the pits of the Rolling Area, and a soil sample from the bottom of a pit had a measured uranium-238 (U-238) concentration of 5,800 picocuries per gram (pCi/g). Gamma exposure rates in the storage shed were measured up to 400 μR/hr, and a soil

sample collected from beneath the wood floor had a U-238 concentration of 1,100 pCi/g. The full extent of contamination could not be determined in the survey areas due to the thick coke dust and residue on horizontal and vertical surfaces, heavy equipment and other stored materials on the floor, and rubble in the subfloor pits. The transmittal letter for this report recommended that a more complete survey be performed to determine the full extent of radioactive contamination at the site (Myrick and Clark, 1981).

2.4.2 Applied Health Physics (1)

The second radiological survey was performed at the request of the site owner Superbolt Inc. The survey was performed on April 15 and 16, 1997 by Applied Health Physics (AHP) under a contract with Superbolt's environmental contractor, Environmental Assessment Company. The goal of the survey was to provide a preliminary radiological characterization of the former SSC site. The AHP survey included gamma-exposure rate measurements and surveys of removable surface contamination. Swipes of accessible areas were taken throughout the facility; no area was identified as having removable contamination in excess of NRC regulatory limits for unrestricted release. Accessible areas included tops of brick walls (up to 8 feet), wall penetrations, floor drains, in the Mill area. Inaccessible areas were classified as overhead surfaces to include crane beams and the covered pits in the Mill Area.

The measured gamma exposure rates at 1 m (3 ft) above the floor in the Mill Area (Area 23A), the Rolling Area (Area 23D), and the Motor Room (Area 23E) were at reported background levels. Peripheral gamma radiation surveys of areas outside Building 23 included a storm drain on the southeast corner of the Mill Area (the likely outfall for the Mill Area cooling pits) and a cursory gamma radiation survey of the general property, including the banks of Chartiers Creek. These measurements were conducted at 1 m (3 ft) above the ground surface and showed no elevated gamma radiation levels (AHP, 1997a).

However, elevated gamma radiation levels were detected at the storage shed by the Rolling Area, which was confirmed by sampling for uranium. A contact gamma-radiation exposure rate of 40 to 60 μR/hr was measured in the southwest section of the storage shed. Elevated gamma exposure rates of 20 μR/hr at 1 m (3 ft) above the ground and contact readings ranging from 100 to 200 μR/hr were identified in soil on two sides of the shed. Removable contamination swipes taken in the storage shed identified slightly elevated levels of alpha contamination, that were below the NRC limits for unrestricted release (AHP, 1997a).

Applied Health Physics Inc. in conjunction with PADEP representatives concluded that due to the levels of radiation and contamination identified in and surrounding the storage shed that a more in depth analysis of the storage shed and surrounding area would need to be done.

2.4.3 Applied Health Physics (2)

Superbolt Inc., following the recommendations in AHP's radiological characterization survey contracted with AHP to perform additional radiological characterization of the storage shed area. Applied Health Physics Inc., returned during the summer and fall of 1997 and focused on the storage shed by the Rolling Area, which exhibited radioactive contamination

above NRC limits for unrestricted release. Surveys for removable surface contamination were conducted in the storage shed during July 1997 and no values in excess of NRC regulatory limits were identified. Elevated levels of gamma radiation were measured above the storage-shed floor and portions of the concrete floor were removed to evaluate the underlying soil. A gamma screening of the surface soil identified elevated readings throughout this area at depths up to 0.76 m (2.5 ft) (AHP, 1997b). Applied Health Physics Inc. along with PADEP representatives recommended that the storage shed and the soil underneath be remediated to a depth of at least four feet.

The storage shed and adjacent contaminated soil area were remediated and the resultant wastes placed in containers, which were stored in Area 23D at the conclusion of the remedial effort. Two additional contaminated areas identified by PADEP in the Rolling Area (Area 23D) also were remediated. About 13 m^3 (465 ft^3) of radioactively contaminated soil and concrete (including the floor of the storage shed) were removed during the remedial actions conducted during October and November of 1997. This radioactive waste was placed in five B-25 containers and two 55-gallon drums and moved to Area 23B for storage; these wastes were subsequently moved to the south end of Area 23D. Follow-up surveys of the remediated areas were performed by AHP, who applied release criteria of twice the background gamma exposure rate of 9 μR/hr and a total uranium concentration of 30 pCi/g in soil. Several values exceeding these criteria are indicated in AHP's Field Service Report Dated December 2, 1997 (AHP, 1997c).

2.4.4 ORISE Phase 1

In April 2000, the NRC's Division of Nuclear Safety, Region I Office requested that the Environmental Survey and Site Assessment Program (ESSAP) of ORISE perform a radiological scoping survey. The focus of the scoping survey was on various portions of the SSC site on those areas not previously addressed by the NRC, PADEP, and AHP. The fourth survey was performed by ORISE in Areas 23A, 23E, and 23D from August 28 through September 1, 2000. This Phase 1 survey of the three areas that records indicate were used by Superior Steel in its uranium processing activities included alpha, beta, and gamma scans, as well as surface beta activity measurements, gamma-exposure rate measurements, soil sampling, and debris sampling. Results of this survey indicated that significant residual surface contamination remained at the site on the horizontal structural surfaces (floor and overhead beams) within Area 23D and in soil at various locations throughout the interior and exterior of the three surveyed areas; surface activity measurements were not taken in Areas 23A and 23E.

The gamma exposure rates measured at five locations in the southern portion of Area 23D were at background levels. However, the surface total beta activity levels on the floor of this area ranged up to 170,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2), with lower (but elevated) levels reported for the lower walls and overhead beams. Gamma surface scans were conducted on approximately 75% of the available exterior area out to 5 m (16 ft) from the exterior walls on the east, west, and south sides, and out to about 20 m (66 ft) along the north end of the facility. There is no indication that the survey covered any of the exterior building surfaces up to and including the roof of the structure. Elevated gamma exposure rates

were identified near the former storage shed and on the north side of the facility near the salt-bath area.

Soil and debris samples were collected by ORISE and analyzed for uranium-235 (U-235) and U-238 by gamma spectroscopy. Six locations in the subfloor pits were exposed by removing the flooring and backfill, and soil samples were collected from four of the six excavations; most of the removed material was returned to the pits. The ORISE report did not specify the depths at which samples were taken from the pits; a general statement is made in the beginning of the report stating that the pits were assumed to be approximately 2.5 meters deep. In addition, cores were drilled through the floors of Areas 23A, 23E, and 23D, and through the asphalt and a roadway surrounding the facility to allow for the collection of soil samples. All areas were repaired as appropriate following collection of samples. Forty-six soil samples were collected including those from the three excavated pits in Area 23A, one excavated pit in the salt bath area, and randomly selected locations inside and outside the facility. All areas were repaired as appropriate following collection of samples.

Many of the samples had measured uranium concentrations that were comparable to naturally occurring background levels. Table 1 presents the elevated soil sample results from this survey. The maximum reported U-238 concentrations of 7,180 pCi/g was collected from a soil sample in the salt bath area of Area 23A. The U-235 concentration for this sample was reported as 529 pCi/g. Five soil samples also were analyzed by alpha spectroscopy and produced concentration ratios of uranium-234 (U-234) to U-238 of essentially one (unity) results are presented in Table 3 (Adams, 2001). The ORISE report does not give the sample locations of the five alpha spectroscopy analyzed samples. An examination of nuclide ratios is inconclusive as to whether enriched uranium exists at the site.

The ORISE report concluded that the results of its survey indicated that significant residual contamination remains at the site within the soils at the north and southwest ends (salt bath and storage shed areas) of the exterior of the facility and on the horizontal surfaces within the Bldg. 23 complex.

2.4.5 ORISE Phase 2 Survey

The NRC's Division of Waste Management requested that ESSAP of ORISE perform additional radiological evaluations of portions of the SSC complex. The fifth survey was performed by ORISE from August 18 through 20, 2003. This Phase 2 survey, although similar to the Phase 1 survey of 2000, addressed portions of the site not covered during the Phase 1 survey. The Phase 2 survey included all five warehouse components (Areas 23A, 23B, 23C, 23D, and 23E) within the Superbolt Building Complex Number 23. A much larger portion of the warehouse floor surface area was available for this survey than during the Phase 1 effort. In addition to conducting radiological measurements at the site, data were gathered to support the development of a cost estimate associated with the evaluation of the subfloor pits (Adams, 2003). However, the Phase 2 report does not provide any documentation of a cost estimate being performed by ESSAP as indicated by the report and documentation of a cost estimate was not uncovered during the records review by Argonne.

Results of the Phase 1 and 2 surveys were similar, although a significant amount of contamination in Areas 23B and 23C, was identified during the Phase 2 survey. Gamma exposure rates that were measured at a minimum of five locations in each warehouse area ranged from 6 to 11 μR/hr, which is generally consistent with background exposure rates. The exterior gamma surface scans did not identify any areas of elevated radiation. The maximum reported surface total beta activity levels were found in Areas 23B (lower wall) and 23C (floor) at values of 130,000 and 140,000 dpm/100 cm^2, respectively. One surface soil sample that was collected from beneath a brick floor adjacent to a structural I-beam footer in Area 23B produced concentrations of 221 pCi/g for U-238 and 9.2 pCi/g for U-235. Ten residue samples produced maximum concentrations for U-238 and U-235 of 3,600 and 138 pCi/g, respectively.

2.4.6 ORAU Dose Assessment

In addition to the five aforementioned radiological surveys, a dose reconstruction project was initiated by the Oak Ridge Associated Universities (ORAU) for the National Institute for Occupational Safety and Health (NIOSH). The ORAU noted that the possibility of enriched and recycled uranium having been processed by Superior Steel could affect the ratios of the uranium isotopes present at the site. The ORAU dose assessment stated the possibility that Superior Steel also rolled recycled uranium (ORAU, 2005). If recycled uranium was processed at the site, this material could have contained certain transuranic radionuclides including neptunium-237 and plutonium-239 (ORAU 2005). No previous survey or sampling programs were designed to test for possible fission-product or transuranic radionuclides.

3.0 SOIL EXPOSURE AND AIR PATHWAYS

3.1 Physical Conditions

The Superior Steel site of Scott Township, PA lies within the Pittsburgh Low Section of the Appalachian Plateau physiographic province, which is characterized in southwestern Pennsylvania as upland plateaus dissected by deep or incised stream valleys. The regional geologic structure is the East Dunkard Basin, which contains Mississippian to Pennsylvanian (Carboniferous) Formations exhibiting coal resources. Superior Steel likely is underlain by the Conemaugh and/or the Monogahela Groups, which are comprised of interlayered sandstones, siltstones, shales and coal seams. The Dunkard Group is located to the south and contains similar lithology.

The site occupies an alluvial terrace adjacent to Chartiers Creek. Topography varies from about 900 ft in the eastern residential upland to 760 ft along the bank of Chartiers Creek. The industrial site is relatively flat lying and locally varies between 780 and 770 ft, and thus about 10 to 20 feet above the normal creek level. The interior of the Bldg. 23 complex is a mix of concrete and dirt floors, while the exterior of the building is predominantly a mix of concrete, asphalt, and gravel out to approximately 25 feet. Very little if any exposed soil surrounds the building.

The USDA-NRCS STATSGO (State Soil Geographic) data indicate that soils in the Chartiers Creek valley are predominantly Alleghany soil types normally found on 3- to 8-percent slopes. The soils vary up to 7 feet deep and are composed of silt to silty clay loams that coarsen with depth to silty sand and gravelly silt, sand and clay mixtures (homogenous loams). This vertical texture change is coincident with the alluvial depositional setting in the Chartiers Creek valley. Deeper site soils will reflect the variably textured point bar and floodplain deposits common to upland stream systems. Alleghany soils are designated hydrologic group B, soils that are well drained and permeable; they normally are found on terraces, footslopes, and alluvial deposits, such as those underlying the SSC site.

3.2 Soil and Air Pathways and Direct Radiation

The 2000 Federal census estimated that Scott Township contains 17,288 people, including 3,437 children ages 19 and under, within a total land area of 3.86 square miles. The nearest residential area is located about 100 yards east of the former SSC facilities.

Potential air pathway receptors from residual radioactivity at the former SSC site are to workers from Superbolt Inc and individuals living and working around the former SSC that must access the Bldg. 23 complex to store or retrieve product or supplies from this area. Superbolt Inc. previously leased contaminated areas to other businesses as storage space and limited light industrial activities; the leasing of Bldg. 23 complex ceased after the ORISE surveys. However, on August 29, 2006 during a site visit to the former SSC complex, representatives from Superbolt Inc. indicated that the northern third of Bldg. 23B is leased to a trucking company. Superbolt representatives indicated the owner of the company used the area occasionally for performing maintenance on his vehicles. Potential offsite receptors located in the general vicinity of the site include other manufacturing and office buildings occupying the former SSC complex. Schools, residential areas and other commercial businesses are found within a mile of the site.

Of the five radiological surveys completed at the former SSC site, the two ORISE surveys were the most comprehensive since they assessed each area within the Bldg. 23 complex. Each building area in the Bldg. 23 complex was surveyed using various methods that included soil and residue sampling, surface scans, and exposure rates. The soil and residue sampling indicates that radiological contamination is present in the Bldg. 23 complex and salt bath area above interim screening values found in NUREG-1757. The interim screening values in NUREG-1757 for surface soils for U-238 and U-235 are 14.0 and 8.0 pCi/g, respectively. These values represent surficial soil concentrations of individual radionuclides that would comply with the 25mrem/yr unrestricted release dose limit in 10 CFR 20.1402. Table 1 shows the historical soil and residue sample results in the various buildings within the Bldg. 23 complex.

Table 2 presents elevated surface scan measurements for beta activity that were performed within the Bldg. 23 complex during the 2000 and 2003 ORISE surveys. Of the 149 direct measurement locations during the ORISE surveys, 43 exceed the average guideline found in Engineer Manual 385-1-80, Table 6-4, Surface Radioactivity Values (dpm/100 cm^2) for

natural uranium, which are 1000 dpm/100 cm^2 for removable and 5,000 dpm/100 cm^2 for total average concentration over one square meter .

3.3 Soil Exposure, Air Pathway, and Direct Radiation Conclusions

Data indicate that elevated concentrations of U-235 and U-238 are present at the former SSC site in concentrations above screening guidelines indicating that the site would not be suitable for NRC license decommissioning without further evaluation. Elevated activity defined by the two ORISE surveys (2000 and 2003) in the uranium metal processing area indicate surface and subsurface contamination exist in areas occupied by the salt bath and the old storage shed which are both external to the Bldg. 23 complex as depicted in Figure 2.

The residue samples and surface scans taken from various other areas indicate that both fixed and removable contaminations are present within the Bldg. 23 Complex. Superbolt representatives have indicated that they now only lease a small area in Bldg. 23B to a small trucking firm. The removable contamination within areas of the Bldg. 23 complex may pose a threat, or potential threat, of migration to the environment outside of the complex if site conditions were to change.

The document search and the results of the ORISE surveys indicate that there is evidence of AEC related contamination at the site and contamination has migrated to the environment from inside the Bldg. 23 complex. Further investigation is warranted at the site to evaluate the nature and extent of AEC contamination from uranium metal processing.

4.0 GROUNDWATER PATHWAY

4.1 Hydrogeologic Setting

The greatest portion of groundwater used in Allegheny County, about 80% to 90%, comes from valley-fill alluvial aquifers. The remainder comes typically from bedrock aquifers of the Conemaugh or Allegheny Groups; significant yields also consistently come from the Morgantown Formation sandstones. The carbonate rocks of the Sewickley Formation are also a reliable source of groundwater.

The local or site groundwater hydrology is inferred from regional features that include an upland area to the east and Chartiers Creek along the remainder of the site, which lies within a meander bend in Chartiers Creek. The floodplain that the site occupies is likely underlain by alluvial sediments that vary from clayey silt to silty gravel at depth. This depositional setting is confirmed partly by the STATSGO soil data provided by the USDA (NRCS), which is normal for such a depositional feature.

Groundwater flow is expected to flow from east to west on the SSC site. The eastern upland represents a groundwater recharge area that likely creates a radial flow pattern from the upland towards the creek. The site groundwater flow patterns probably transmit groundwater from the upland, through the sediments underlying the site, and into the creek. Stage heights in

the creek likely affect short-term groundwater levels, although not the final fate of groundwater flow to the creek. Potential releases of site contaminants to groundwater would eventually migrate to Chartiers Creek.

4.2 Ground Water Pathways

The residents in this area, including the Borough of Carnegie and the city of Pittsburgh, receive their drinking water from a municipal water source described further in section 5.0 of this document. The Allegheny County Health Department has stated that no drinking water wells are reported (or recorded) to exist within 1 mile of the site (via personal communication). This does not preclude the existence of unreported wells in the area.

The SSC site owner also stated that no drinking or operations water is derived from on-site groundwater sources.

4.3 Ground Water Pathway Conclusions

A potential exists for an on-site release of uranium to migrate to groundwater and discharge to Chartiers Creek. However, this pathway is diminished due to the availability of municipal drinking water located in the region.

Groundwater at the SSC site has not been sampled for radionuclides and the exposure pathway remains uncharacterized. A groundwater quality investigation is required to assess potential doses from groundwater and associated media (e.g., discharges to surface water).

5.0 SURFACE WATER PATHWAY

5.1 Hydrologic Setting

The upland area east of the SSC site is occupied by residential development and St. Joseph's Cemetery. Surface water runoff is directed to storm sewers and possibly a small network of drainage ditches that flow to Chartiers Creek. A USGS gaging station on Chartiers Creek (#3085500) adjacent to the SSC site actively monitors stage height for a drainage area of 257 square miles. The average discharge of Chartiers Creek at the gage station is 293 cubic feet per second at a stage elevation of 755.45 feet, which is based on annual average discharge data from 1920 to 2005. This elevation is 15 to 25 feet below the average site topography and indicates the site drains to Chartiers Creek; underlying groundwater also likely discharges to the reach along the site. From the site and nearby gage station, Chartiers Creek flows 8.9 miles into the Ohio River at a confluence downstream of Pittsburgh.

The topography of the site along the creek has led to localized flooding, which occurred most recently in September 2004, when the remnants of Hurricane Ivan inundated the Bldg. 23 complex under 4 feet of water.

5.2 Surface Water Pathways

Southwestern Pennsylvania drains into the Monongahela, Allegheny, and Ohio Rivers via a large network of tributaries (up to fifth order streams). The pool of rivers and various streams is regulated by the US Army Corps of Engineers at intervals along the rivers. The Ohio River drains into the Mississippi River, which eventually drains into the Gulf of Mexico. Chartiers Creek bounds the former SSC site on the north, south and west and is a tributary of the Ohio River.

The Monongahela River is the sole source of drinking water for the Pennsylvania American Water Company, which provides drinking water to the Town of Carnegie, the City of Pittsburgh, and other municipalities in the area. The Monongahela River is upstream of where Chartiers Creek enters the Ohio River. The Pennsylvania American Water Company maintains treatment facilities on the Monongahela River capable of producing a maximum of 110 million gallons of water per day. The water supply is distributed for residential, commercial, and industrial use.

5.3 Surface Water Pathway Conclusion

The presence of surface soil, building, and subsurface contamination may have impacted site surface water (storm water) management systems. A potential exists for contaminated sediments to exist in storm water sewer lines and near surface water outfalls into Chartiers Creek due to the flooding that occurred in 2004 at the site. The flooding that occurred in 2004 may have deposited AEC-related material into storm sewer catch basin and into the sediment of Chartiers Creek. This potential exposure pathway was not characterized by past surveys and thus the potential risk remains unquantified.

6.0 COMBINED PATHWAY CONCLUSION

A complete pathways analysis could not be derived from the information at hand. Data indicate that elevated concentrations of uranium 235 and 238 are present at the SSC site above interim screening values. Areas of elevated activity exist both inside and outside of the Bldg. 23 complex where AEC operations occurred. In addition, areas within the Bldg. 23 complex that were not known to have been used for AEC-related work, have radioactive contamination present as indicated by the ORISE surveys.

Data collected during the ORISE surveys indicate that both surface (0”-6”) and sub-surface (6”-12”) radiological contamination exist at the site. Subsurface media is impacted in several areas however, the vertical extent of contamination at the site is not known.

The groundwater pathway remains unquantified and therefore suspect since both surface and subsurface soil contamination is present. The potential for site contamination to leach to groundwater is evident in the salt bath area, central pit feature, and soil adjacent to the Building 23 complex. A groundwater investigation should be performed to quantify flow vectors, potential contaminant concentrations, and migration pathways to Chartiers Creek and associated receptors.

The surface water pathway also remains unquantified but potentially contaminated due to soil contamination on site. The quantification of potential contamination in this media (surface water and associated sediment) will determine pathway risks to on-site occupants and potential receptors (both ecologic and human) in contact with water and sediments in Chartiers Creek.

7.0 SUMMARY AND CONCLUSIONS

The United States Army of Corps of Engineers has reviewed existing available data on the former Superior Steel Corporation Site. Based on that review, there is evidence of release or threat of release of radioactive materials related to the Nation's early atomic energy program. Migration of AEC-related material has occurred from the Bldg. 23 complex to the surrounding surface and subsurface soils. There is the potential for waterborne AEC-related material to migrate from the site, and if future ground water or surface water receptors were identified, there may be an adverse impact on human health and the environment.

Therefore, in accordance with CERCLA, it is recommended that further investigation be undertaken within FUSRAP, beginning with a remedial investigation to determine the nature and extent of AEC-related contamination and the associated risks to human health and the environment.

8.0 REFERENCES

Adams, W.C., 2001, *Radiological Scoping Survey of Portions of the Former Superior Steel Company, Carnegie, Pennsylvania*, Final Report, ORISE 01-0740, prepared by Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee, for U.S. Nuclear Regulatory Commission, Region 1, May.

Adams, W.C., 2003, *Radiological Scoping Survey for Portions of the Superbolt Facility (Formerly Superior Steel Company), Phase 2, Carnegie, Pennsylvania*, Final Report, ORISE 03-1528, prepared by Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee, for U.S. Nuclear Regulatory Commission, Region 1, November.

Aerospace Corporation, 1985, *Authority Review – The Former Superior Steel Corporation Site – AEC Contract No. AT(30-1)-1412*, letter from Charles D. Young (Environmental Controls and Analysis Directorate, Government Support Division) to Mr. Arthur Whitman (Division of Facility and Site Decommissioning Projects, Office of Nuclear Energy, U.S. Department of Energy) with attachment, September 30.

AHP (Applied Health Physics), 1997a, *Field Service Report*, report from Todd Mobley, Technical Services Supervisor, Applied Health Physics, Inc., Bethel Park, Pennsylvania, to Mr. Rolf Steinbock, Superbolt, Inc., Carnegie, Pennsylvania, June 24.

AHP, 1997b, *Field Service Report*, report from Todd Mobley, Applied Health Physics, Inc., Bethel Park, Pennsylvania, to Mr. Rolf Steinbock, Superbolt, Inc., Carnegie, Pennsylvania, September 3.

AHP, 1997c, *Field Service Report*, report from Todd Mobley, Applied Health Physics, Inc., Bethel Park, Pennsylvania, to Mr. Rolf Steinbock, Superbolt, Inc., Carnegie, Pennsylvania, December 2.

Argonne National Lab, 2006, Records Review and Evaluation Report for the Former Superior Steel Site, Carnegie, Pennsylvania, October 2006.

Myrick, T.E., and C. Clark, 1981, *Preliminary Site Survey Report for the Former Superior Steel Mill at Carnegie, Pennsylvania*, prepared by Oak Ridge National Laboratory, Oak Ridge, Tennessee, for Environmental and Safety Engineering Division, Office of Environmental Protection, Safety, and Emergency Preparedness, U.S. Department of Energy, April.

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NUREG –1757, Consolidated NMSS Decommissioning Guidance, U.S. Nuclear Regulatory Commission, September, 2002

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Owen, M.W., 2006, letter from Michael W. Owen (Director, Office of Legacy Management, U.S. Department of Energy) to Don T. Riley (Major General, Director of Civil Works, U.S. Army Corps of Engineers), February 3.

Whitman, A.J., 1985, letter from Arthur J. Whitman (Division of Facility and Site Decommissioning Projects, Office of Nuclear Energy, U.S. Department of Energy) to Mr. Andrew Wallo III (The Aerospace Corporation), October 28.
USEPA (United States Environmental Protection Agency), 1991. Guidance for Performing Preliminary Assessments Under CERCLA. September 1991.

ATTACHMENT A
DOE Eligibility Letter

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
WASHINGTON, D.C. 20314-1000

CECW-LRD

MAR 2 2 2006

MEMORANDUM FOR COMMANDER, GREAT LAKES AND OHIO RIVER DIVISION, P.O. BOX 1159, CINCINNATI, OH 45201-1159

SUBJECT: Formerly Utilized Sites Remedial Action Program Site of the former Superior Steel Company Site in Carnegie, Pennsylvania

1. Enclosed is a copy of the letter received from the Department of Energy (DOE) regarding the former Superior Steel Company in Carnegie, Pennsylvania. In their letter of 3 February 2006, DOE stated that the site is eligible for inclusion in FUSRAP. In accordance with the Memorandum of Understanding (MOU) between the U.S. Army Corps of Engineers and DOE, the Corps is responsible for doing the radiological characterization of the site that is required to determine whether contamination exceeds current guidelines and cleanup is warranted.

2. As stated in their letter, DOE has performed additional historical research and revisited the 1985 determination regarding the inclusion of the site in the FUSRAP. The research results confirm that this site was used for activities that supported the Nation's early atomic energy program. Additional characterization under Section III.D.2 of the MOU is necessary to determine the need for cleanup at the site to address the FUSRAP-related contamination

3. I request you provide a Preliminary Assessment (PA) report and preliminary legal analysis per Engineer Regulation 200-1-4. This information will be used to determine if the site will be designated for cleanup under the FUSRAP.

4. Mr. Allen Steinbock, Vice President of Superbolt, Inc., is the point of contact at the former Superior Steel Company site and can be reached at (412) 279-1149. Point of contact at the DOE is Mr. Christopher Clayton at (202) 586-9034.

5. Please provide a cost estimate and schedule for completion of the PA and preliminary legal analysis by 28 April 2006. My point of contact for this action is Mr. Dale Moeller, Program Manager, CECW-LRD at (202) 761-4494.

FOR THE COMMANDER:

[redacted]

Encl

DON T. RILEY
Major General, USA
Director of Civil Works

Department of Energy
Washington, DC 20585

February 3, 2006

Don T. Riley, MGEN, USA
Director of Civil Works
HQ, US Army Corps of Engineers
441 G St, NW
Washington, D.C. 20314-1000

Dear General Riley:

I am writing to notify you that the current owner of the former Superior Steel Company site in Carnegie, Pennsylvania, (Superbolt, Inc.) has, with the knowledge and support of the Commonwealth of Pennsylvania and regional representatives of the Nuclear Regulatory Commission (NRC), requested assistance in arranging for cleanup of residual radioactive material on the site under the Formerly Utilized Sites Remedial Action Program (FUSRAP).

Although copies of the contract have not been found, historical records indicate that June 27, 1952, was the effective date of the AEC contract with the former Superior Steel Company. The scope of work included the rolling and machining of flat plates of uranium metal into strips used as the cores of fuel elements. The contract was terminated on or about September 30, 1957. The facilities owned and operated by Superior Steel during the mid-1950s are located in the area currently occupied by the Carnegie Industrial Park on Superior and Hammond Streets, Scott Township, Pennsylvania. The large steel structure that housed the uranium processing areas is currently owned by Superbolt, Incorporated. The report of the preliminary site survey conducted in 1980 by personnel of the Oak Ridge National Laboratory (ORNL) is available on the Department of Energy (Legacy Management) web page at http://csd.gjo.doe.gov. The document number is PA.03-4. A more current description of the site (about 25 acres bounded on the north, west and south by Chartiers Creek and on the east by Superior Street) and the building in which the contract work was performed is included in the May 2001 Radiological Scoping Survey report prepared for the NRC, Region I, by the Oak Ridge Institute for Science and Education (ORISE) (copy attached).

This site was previously considered for cleanup under FUSRAP. The preliminary radiological survey conducted at the site by the Oak Ridge National Laboratory in 1980 found evidence of residual uranium contamination in several areas of the remaining structures on the site. However, due to site conditions limiting access to suspected areas of contamination and other factors, consideration for cleanup under FUSRAP did not proceed beyond the preliminary survey. More detailed characterizations of the site have since been conducted. The scoping survey conducted in 2001 by ORISE served to confirm the continued presence of residual uranium contamination and provide the information necessary to develop a more comprehensive characterization plan for the site. Mr. Allen Steinbock, the Vice President of Superbolt, Inc. can be reached at (412) 279-1149.

In addition to the work performed for the AEC, Superior Steel Corporation was licensed in 1956 to "...receive possession of and/or title to unlimited quantities of thorium metal for rolling and cutting." The purpose of the license was to receive source material (thorium metal) from another commercial licensee and to process the metal into the desired shape.

Section III.D.1. of the Memorandum of Understanding (MOU) between the DOE and the Army Corps of Engineers regarding the program administration and execution of the FUSRAP provides that DOE:

a. Shall perform historical research and provide a FUSRAP eligibility determination, with historical references, as to whether a site was used for activities which supported the Nation's early atomic energy program;

b. Shall provide the Army Corps of Engineers with the determination, a description of the type of processes involved in the historical activities at the site, the geographic boundaries of those activities (as reflected by documentation available to DOE), and the potential radioactive and/or chemical contaminants at the site; and,

c. Shall maintain records of determination of eligibility and other files, documents and records associated with the site.

In accordance with the MOU and the request from Superbolt, the DOE has conducted additional historical research and revisited the 1985 determination regarding the inclusion of the site in FUSRAP. The results of the research confirm that this site was used for activities that supported the Nation's early atomic energy program and is eligible for inclusion in FUSRAP. Any residual radioactive contamination from commercial operations involving thorium metal is not considered eligible for FUSRAP cleanup. Additional radiological characterization under Section III.D.2 of the MOU is necessary to determine the need for cleanup at the site to address the FUSRAP-related contamination. Additional relevant historical documents will be furnished under separate cover.

We appreciate the Corps' assistance and will continue to work cooperatively with your staff in carrying out the terms of the MOU. Please contact Christopher Clayton of my staff at (202) 586-9034 if you need further information in this matter.

Sincerely,

[redacted]

Michael W. Owen
Director
Office of Legacy Management

Enclosure

cc: Sharon Wagner, CECW-IP
HQ, US Army Corps of Engineers
441 G St, NW
Washington, D.C. 20314-1000

FIGURES

Figure 1
Superior Steel Site Location

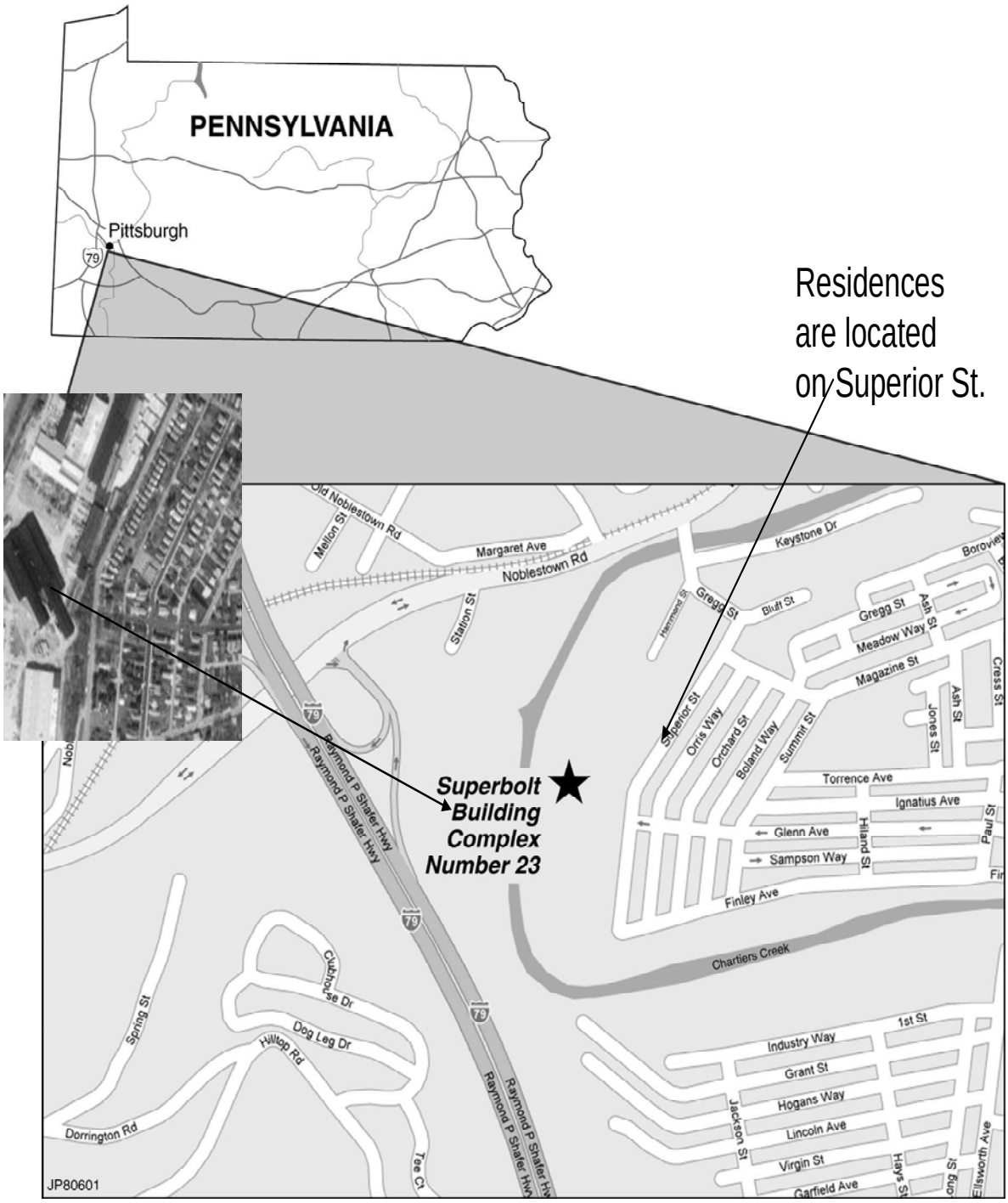


Figure 2
Layout of Building 23 Complex Areas
And
Locations of Process Machinery

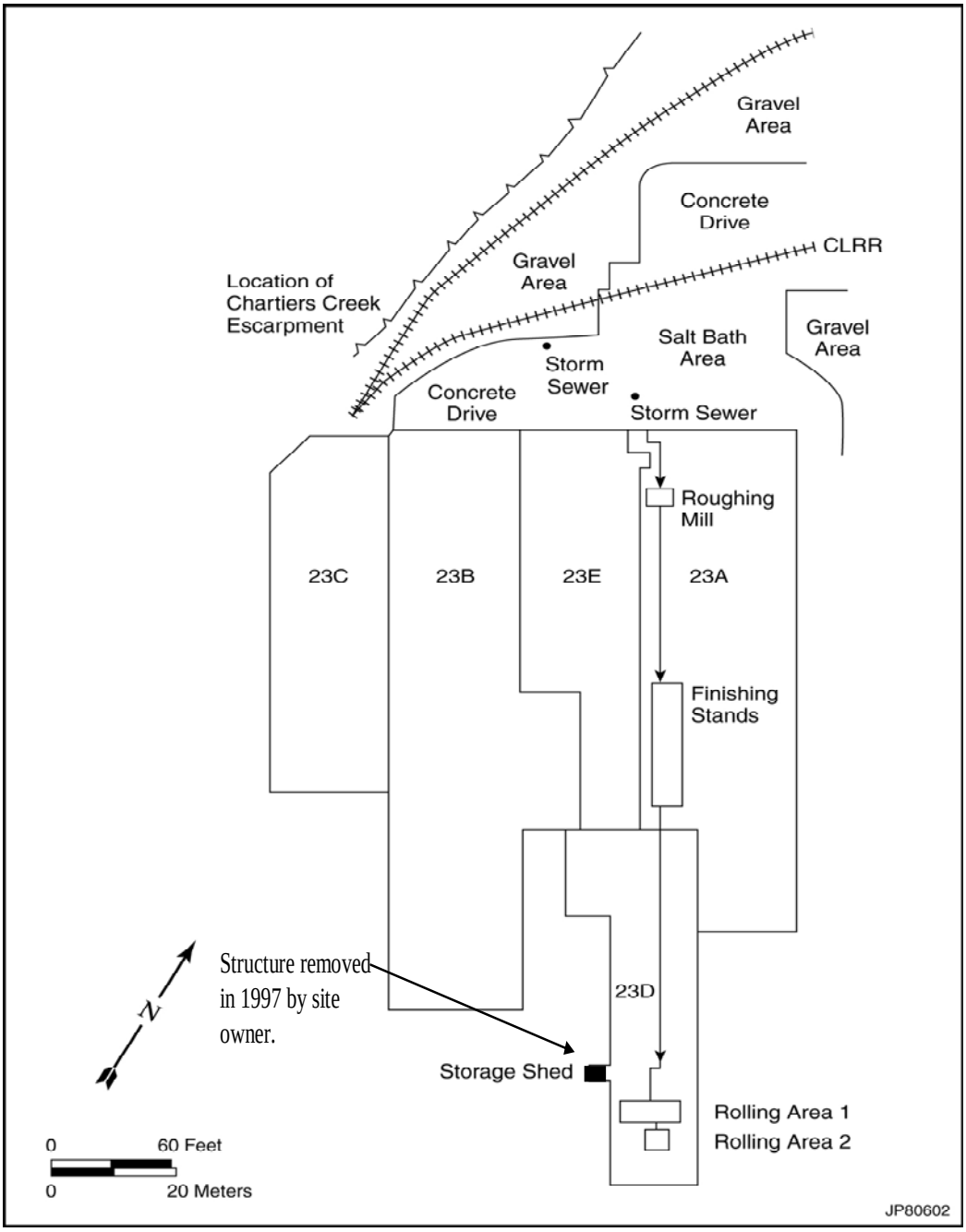
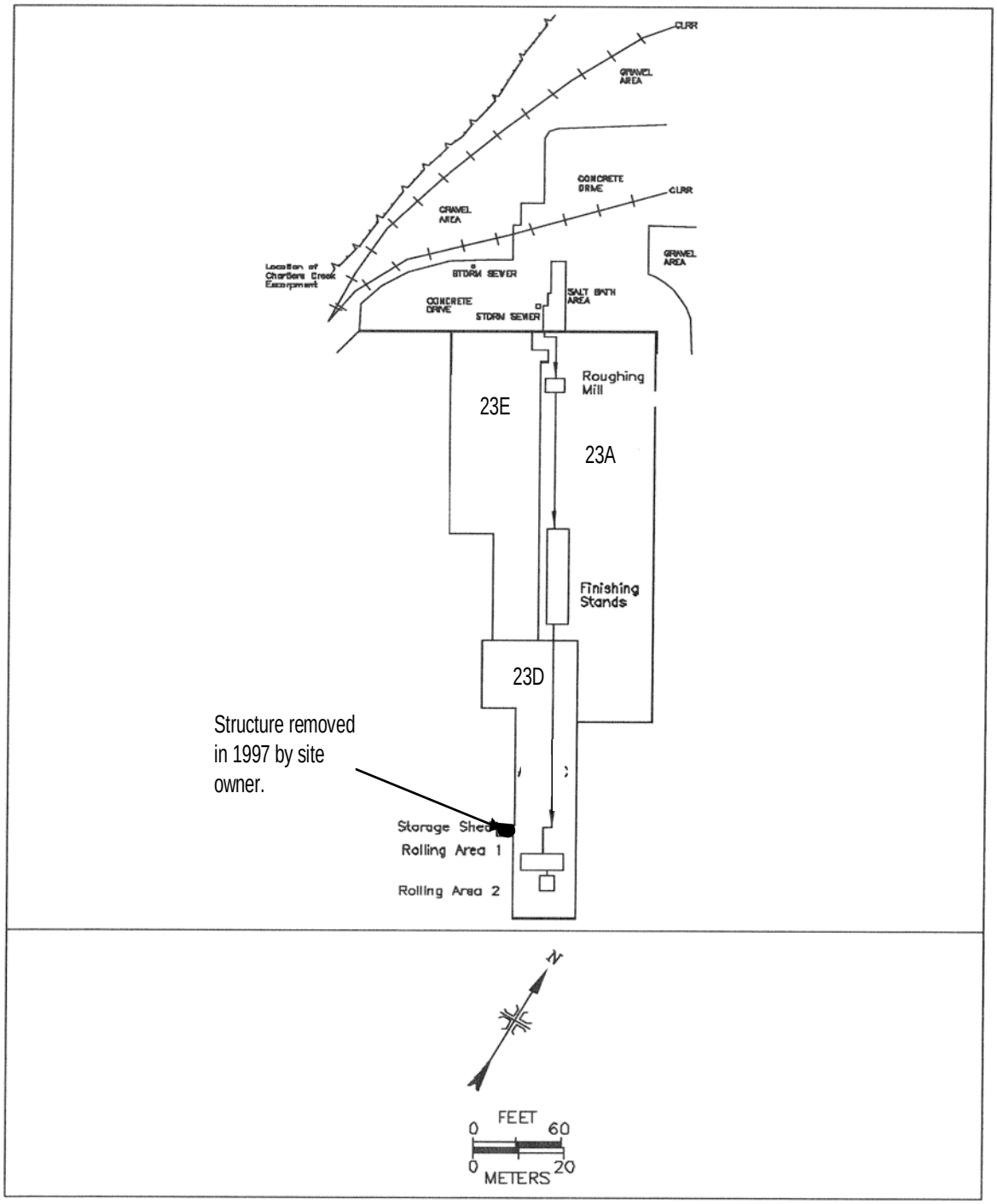


Figure 3
Process Layout



TABLES

Table 1

Historical Elevated Soil/Residue Samples

Building Location (Bolded type indicates exterior sample locations)	Sample Type	Radionuclide Concentration (pCi/g)	
		U-235 Surface Soil Screening Value from NUREG-1757 is 8 pCi/g	U-238 Surface Soil Screening Value from NUREG-1757 is 14 pCi/g
Salt Bath (1)[1]	North of 23A at 0" – 6" depth	**529**	**7180**
Salt Bath (1) [1]	North of 23A at 6" – 12" depth	**18.2**	**250**
Salt Bath (2) [1]	North of 23A at 0" – 6" depth	**128.8**	**2013**
Salt Bath (2) [1]	North of 23A at 6" – 12" depth	3.8	**53.8**
Salt Bath (pit 1) [1]	North of 23A	**128.8**	**530**
23B[2]	Residue/dust from I-Beam	**15.9**	**380**
23B[2]	Brick with residue from floor	**27.6**	**590**
23B[2]	Residue from floor surface	**15.6**	**323**
23B[2]	Residue from floor surface by railroad track	**79.7**	**2,100**
23C[2]	Residue from floor surface	**138**	**3,600**
23C[2]	Residue from floor surface	**25.2**	**573**
23D[1]	Residue from concrete block	5.7	**102**
23D[1]	Residue from lower wall	**12.9**	**279**
23D[1]	Residue from I-Beam	**3.1**	**15.4**
23D[1]	Exterior (old storage shed area) concrete rubble	**1,620**	**23,400**
23D[1]	Residue from crane beam	4.4	**94**
23D[1]	Concrete Paint/ Dust	**29.7**	**538**
23D[1]	Concrete Paint/ Dust	4.4	**48**
23D[1]	Soil sample	3.5	**72.4**
23D[1]	Soil sample	2.3	**42.8**
23D (exterior SW corner) [1]	Soil Sample	1.1	**22.1**
23D (exterior SW corner) [1]	Soil Sample	3.5	**74.4**
23D (old storage shed) [1]	Soil Sample (0"-6")	**26.7**	**628**
23D (old storage shed) [1]	Soil Sample (6"-12")	2.7	**58.5**
23D (old storage shed) [1]	Soil Sample	**19.2**	**413**
23D[2]	Residue from upper surface	5.6	**158**
23E[2]	Residue/dust from I-Beam	**12**	**345**
23E[2]	Residue/dust from I-Beam	**8.7**	**181**
23E[2]	Residue/dust from I-Beam	**9.7**	**239**

[1]ORISE 21 May 2001
[2]ORISE 18 September 2003

Table 2

Surface Activity Levels Building 23 Complex

Location[a]	Surface[b]	Total Beta Activity[c] (dpm/100 cm^2)
23A	F	7,400
23A	LW	16,000
23A	F	8,000
23B	US	16,000
23B	F	6,900
23B	LW	27,000
23B	F	17,000
23B	LW	7,000
23B	F	63,000
23B	LW	5,500
23B	LW	100,000
23B	F	130,000
23B	LW	7,500
23B	LW	8,200
23B	F	22,000
23B	F	13,000
23B	F	31,000
23C	F	140,000
23C	F	86,000
23C	F	74,000
23C	F	18,000
23C	F	44,000
23C	F	8,400
23C	F	33,000
23D	US	11,000
23D	US	15,000
23D	F	7,300
23D	F	6,600
23D	F	44,000
23D	LW	6,900
23D	F	6,500
23E	US	6,800
23E	US	6,100
23E	US	7,200
23E	US	5,500
23E	F	6,900
23E	F	9,200
23E	F	6,100
23E	LW	12,000
23E	F	13,000

[a]Data taken from ORISE 18 September 2003 survey
[b]F = floor, LW = lower wall, and US = upper surface
[c]Measurements were all assumed to be from beta particles only due to the dust/residue on the measured surfaces

Table 3

Uranium Isotopic Concentrations in Soil Samples

Uranium Isotopic Concentration (pCi/g)		
U-234	U-235	U-238
150 ± 13	6.4 ± 0.9	149 ± 13
625 ± 52	28.6 ± 3.3	637 ± 53
34.9 ± 3	1.8 ± 0.3	33.1 ± 2.9
11.6 ± 1	0.6 ± 0.1	11.9 ± 1
100.5 ± 8.8	5.7 ± 0.9	97.4 ± 8.6

* Uncertainties represent the 95% confidence levels based on total propagated uncertainty.