

**Remedial Action Report**  
**Record of Preparation, Review, and Approval**

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**Austin Avenue Superfund Site**  
**Operable Unit One (OU1)**  
**Homes**

This report has been prepared in accordance with EPA OSWER Directive 9320.2-09A and will be used as the basis for the development of the site Final Close Out Report.

<b>RA Report Prepared By:</b>	U.S. Army Corps of Engineers:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"><u>Signature</u></td> <td><i>[Handwritten Signature]</i></td> </tr> <tr> <td><u>Name/Title</u></td> <td><i>Project Engineer</i></td> </tr> <tr> <td><u>Date</u></td> <td><i>5/31/00</i></td> </tr> </table>	<u>Signature</u>	<i>[Handwritten Signature]</i>	<u>Name/Title</u>	<i>Project Engineer</i>	<u>Date</u>	<i>5/31/00</i>
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<b>Approved By:</b>	EPA Region 3 Approving Official:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"><u>Signature</u></td> <td><i>[Handwritten Signature]</i></td> </tr> <tr> <td><u>Name/Title</u></td> <td><i>Peter Schan, Chief</i></td> </tr> <tr> <td><u>Date</u></td> <td><i>6/15/00</i></td> </tr> </table>	<u>Signature</u>	<i>[Handwritten Signature]</i>	<u>Name/Title</u>	<i>Peter Schan, Chief</i>	<u>Date</u>	<i>6/15/00</i>
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# REMEDIAL ACTION REPORT

## AUSTIN AVENUE RADIATION SUPERFUND SITE

Delaware County, PA

EPA CERCLIS ID NUMBER - PAD987341716

Homes (OU1)



**Contract Administered by the U.S. Army Corps of Engineers**  
**Remedial Action:**  
**Contract No. DACW31-95-C-0092**

## **Introduction:**

During the early 1900s, a University of Pennsylvania professor, Dr. Dicran Kabakjian, developed a crystallization process for the refining of radium and sold the process to the W. L. Cummings Chemical Company (Cummings). At the time, medical professionals used radium in the treatment of cancer. From the years 1915 to 1922, Cummings processed radium using Dr. Kabakjian's process. The actual chemical process used by Cummings was a trade secret, so the details are uncertain. It was known, however, that the type of ore used was a yellowish shale-like material known as carnotite ore. This ore was mined from deposits in Utah and Colorado. It is believed that the first steps in the process were crushing and acid extraction. One ton of carnotite ore could produce approximately one-tenth of a grain of radium. During Cummings' years of operation, its radium output was estimated at three grams per year. A by-product of the refining process was fine, well-graded sandlike tailings. Approximately 210 tons of tailings were generated during the seven-year period. These tailings contained two residual radionuclides, radium-226 and thorium-230. As alpha radiation emitters, radium-226 and thorium-230 are considered a health hazard when inhaled or ingested.

Local masonry and building contractors used the sandlike tailings as aggregate for the following work activities:

- Laying mortar between brick and stone masonry,
- Pointing mortar on stone or brick masonry,
- Applying stucco on building exteriors,
- Applying plaster to building interiors, and
- Laying concrete for sidewalks and basement slabs on grade.
- The tailings were also used as fill under basement slabs, exterior perimeter foundation walls and other miscellaneous applications.

The EPA proposed the site to the National Priorities List (NPL) on February 7, 1992 (57FR4824) and added it to the final list on October 14, 1992.

The ROD for OU1 was signed on June 27, 1994.

## **Operable Unit Background:**

There are two operable units at this Superfund site. The subject of this report is Operable Unit One (OU1) - Homes.

**Operable Unit One (OU1) - Homes:**

The Austin Avenue Radiation Superfund Site (OU1) is located on and near approximately twenty-two parcels in Lansdowne Borough, Aldan Borough, East Lansdowne Borough, Darby Borough, and Upper Darby Township, Delaware County, Pennsylvania. These parcels, all within a two-mile radius of the former W. L. Cummings radium refining operation, which was located at the intersection of Austin Avenue and South Union Avenue in Lansdowne, PA, have been contaminated with radium and thorium-contaminated tailings which were generated by the Cummings' radium refining process.

All property parcels associated with this operable unit have been contaminated with radium-226 and thorium 230 wastes except for the warehouse property which was also contaminated with uranium-238 wastes. Twenty-two (22) properties, in five (5) municipalities, are addressed in this operable unit of the ROD. The parcels, sorted by municipality, with their area numbers (in parenthesis) and addresses follow:

Lansdowne Borough

- (1) 216 Wayne Avenue
- (2) 218 Wayne Avenue
- (3) 219 Wayne Avenue
- (4) 237 North Lansdowne Avenue
- (5) 6 East Plumstead Avenue
- (6) 10 East Plumstead Avenue
- (7) 16 East Plumstead Avenue
- (8) 42 South Union Avenue
- (9) 44 South Union Avenue
- (10) Site of the former radium refining facility at South Union and Austin Avenues  
(Warehouse Site)

Upper Darby Township

- (11) 500 Harper Avenue
- (12) 346 Owen Avenue
- (13) 310 Shadeland Avenue
- (14) 3723 Huey Avenue

Aldan Borough

- (15) 64 South Clifton Avenue

East Lansdowne Borough

- (16) 34 Lewis Avenue
- (17) 211 Penn Boulevard

(18) 151 Lexington Avenue

Darby Borough

(19) 617 Pine Street

(20) 619 Pine Street

(21) 621 Pine Street

(22) 623 Pine Street

The remedy described in the ROD for OU1 includes:

1. The removal of contaminated components from the residential structure located at 346 Owen Avenue and the repair of the structure.
2. The removal of contaminated structural components where practicable, or the complete dismantlement of residential structures on eighteen other properties followed by either repair of the structures, replacement of the structures on those properties, or relocation of the residents to an offsite location. The property owners would select repair (where practicable), structure replacement, or offsite relocation after the ROD was issued. The United States would acquire title to each property where the residents had selected offsite relocation. At the end of the remedial action, title to each such property would be transferred to the Commonwealth of Pennsylvania.
3. The dismantlement of an addition at the rear of 42 South Union Avenue and the repair of the building and the adjacent structure at 44 South Union Avenue, as necessary.
4. Temporary relocation of property residents during contamination removal and structural restoration or replacement. Building tenants would be relocated.
5. Removal and offsite disposal of radiation-contaminated soils at permitted facilities.
6. Offsite disposal of radioactive and demolition wastes at permitted facilities.
7. Backfilling and revegetation of remediated properties.
8. Replacement of the storage building that at one time was 135 Austin Avenue.
9. Provision of an offsite structure or equivalent to replace the building formerly located at 133 Austin Avenue.

10. Provision of institutional controls in those instances where soils cannot be removed to a level where the property is available for unrestricted use and unlimited access.

The remaining properties associated with the site were addressed through removal actions. EPA conducted CERCLA Removal Actions at seventeen properties. Removal actions were selected for those properties that posed an immediate endangerment and/or which could be addressed using removal authorities within the constraints of available finding. These removal actions included the temporary relocation of residents of several of the properties; complete dismantlement of the warehouse at South Union and Austin Avenues; dismantlement of the structure at 133 Austin Avenue; soil removals at a number of the properties; and removals of plaster, stucco, concrete and soils at selected properties.

Removal actions were performed on affected properties during the period July 1991 through October 1995 at a total cost of \$22 million.

### **Operable Unit Two (OU2) - Groundwater:**

In the spring of 1994, a study of site groundwater was conducted. EPA conducted a more extensive sampling of soils and groundwater in the vicinity of the former Cummings facility. A report on the study was finalized in mid 1995. On September 27, 1996, the Regional Administrator signed a Record of Decision (ROD) documenting a no action remedial action for OU2.

## **Chronology of Events**

1986: The location of the contaminated tailings became an issue as the Government suspected that the tailings would contain residual radiation contamination. No records related to the ultimate disposition of the tailings were available.

May of 1991: The Pennsylvania Department of Environmental Resources, PADER, (now the Pennsylvania Department of Environmental Protection) visited the warehouse property located at Austin/Union Avenues to monitor for radon because radiation contamination had previously been discovered in the back yard of 133 Austin Avenue, the property adjacent to the warehouse property. During this visit, radiation instruments indicated the presence of significant levels of radioactive contamination at the site.

June 7, 1991: PADER notified the USEPA of its findings during the visit and requested assistance. A joint PADER-USEPA site assessment confirmed the presence of radiological contamination at 133 Austin Avenue at levels that warranted immediate action.

Using special radiation detecting equipment, a team of USEPA radiation specialists conducted a 12.5 square mile search in Delaware County and a small portion of the adjacent city of Philadelphia. The testing showed that approximately 40 properties within a two-mile radius of the warehouse site had become contaminated with radium 226 and thorium 230. The selected Removal Actions were based on those properties that posed an immediate endangerment and/or which could be addressed using Removal Action authorities within the constraints of available funding.

July 1, 1993: The EPA issued a Proposed Remedial Action Plan describing five alternatives considered as possible remedial actions for twenty-one of the parcels subject to the pending Record of Decision. The July 1, 1993 Plan also designated EPA's preferred alternative for each of the properties. EPA requested comments on the Plan and opened a public comment period. In response to that Plan, EPA received numerous letters from citizens and public officials requesting that EPA reconsider its preferred alternatives for several of the parcels. In addition, EPA gathered additional information useful in the evaluation of remedial alternatives for the properties.

March 2, 1994: Following consideration of the responses to the first Proposed Remedial Action Plan, the EPA issued a Revised Proposed Remedial Action Plan for twenty-two parcels which were subject to the pending Record of Decision.

June 27, 1994: Peter H. Kostmayer, Regional Administrator, EPA – Region III signed the RECORD OF DECISION which states he has determined that the remedial action described, together with proper operation and maintenance constituted a remedy which will mitigate and minimize damage to public health, welfare and the environment.

July 28, 1995: U.S. Army Corps of Engineers, Baltimore District awards Contract Number DACW31-95-C-0092 to Severson Environmental Services of Niagara Falls, NY for \$13,685,414.00, for remediation and construction.

September 5, 1995: U.S. Army Corps of Engineers, Baltimore District issues the Notice to Proceed to Severson Environmental Services to begin remedial action.

September 15, 1995: U.S. Army Corps of Engineers, Kansas City District issues a Delivery Order to a Pre-placed Indefinite Quantity contract to Envirocare of Utah Inc for the Disposal of Radioactive Contaminated Material for \$3,576,429.30.

## **Performance Standards and Construction Quality Control:**

**Warehouse Site Staging Activities:** The former warehouse site, located at the corner of Austin and Union Avenues, was used for stockpiling, bagging, and loading of contaminated materials. This decision was made for two basic reasons: 1) It is centrally located in relation to all the properties involved; and 2) It has adequate space (app. 120' X 110'). This area was used by the contractor to construct a concrete pad, used for contaminated soil stockpiling; an adjacent "bag line", which consisted of a hopper-conveyor type system for the loading of one-cubic yard bulk bags; a decontamination pad, used for the decontamination of the contaminated-soil bearing trucks prior to their

exit from the warehouse site; two Baker tanks, used to contain the collected waste water from the decontamination pad prior to sampling and release; decontamination trailer for personnel; and bulk bag loading area.

Quality Control measures taken at the warehouse site included: Daily record keeping of personnel entering and exiting the site, inspection of personal protective equipment, dust and noise monitoring, separation of site into regulated zones (support, contamination reduction, restricted), daily coverage of the contaminated soil pile with 6-mil polyethylene sheeting, continuous oversight of work by a radiation technician, scanning of personnel and equipment by a radiation technician prior to exit from the restricted areas, wipe sampling of bulk bags, weighing of individual bulk bags prior to off-site loading, and 24 hour site security.

**Pre-Demolition Survey:** Before beginning actual dismantlement and removal activities at each property, the contractor conducted pre-work property surveys to:

- Confirm property surveys as shown on contract drawings.
- Confirm Radiation Containing Materials (RCM), i.e., contamination in soils and building components as shown on contract drawings.
- Confirm the existence of asbestos containing materials (ACM), existence of underground oil tanks, etc. as shown on the contract drawings.

These pre-work surveys also identified ACM and radiological contaminated areas in properties that were not identified by the designer and therefore not shown on the contract drawings.

The contractor surveyed the waste and characterized them as either radioactive, hazardous, mixed waste, asbestos containing material, or general debris.

*For soil*, the cleanup criteria were established as 5.0 or 15.0 picocuries/gram activity concentration of radium 226 in dry soil. The following criteria was used as a trigger mechanism to determine if cleanup to the 5.0 picocuries/gram criteria was required:

- 1) All soils in residential and potentially residential settings that have site-related radium 226 concentration more than 5.0 picocuries/gram (individual soil samples, including background).
- 2) For properties that were unlikely to become residential (i.e. streets, parks, railroad right-of-way, etc.).
  - a) Site-related radium 226 contamination more than 5.0 picocuries/gram (above background) in the top 15 centimeters, averaged over 100 square meters.

- b) Site-related radium 226 contamination more than 15 picocuries/gram (above background) in soils below 15 centimeters, averaged over 100 square meters.

*For building rubble and debris, the cleanup criteria were:*

- A. 5.0 picocuries/gram activity concentration of radium 226 in dry rubble and debris.
- B. 20 disintegrations/minute per 100 square centimeters removable alpha surface contamination.
- C. 300 disintegrations/minute per 100 square centimeters total alpha surface contamination (removable plus fixed).

Removed materials that exceeded the above limits were considered radioactive waste.

Quality Control measures taken during the pre-demolition surveys included: Preparatory and Initial inspections, daily record keeping of personnel entering and exiting the sites, review of contract drawings, inspection of personal protective equipment, sampling of suspected contaminated materials, documentation of quantities of non-RCM hazardous materials (asbestos, household wastes, etc.).

To insure that the contractor's Quality Control system was functioning properly and that the desired end product was realized, the U.S. Army Corps of Engineers was charged with the function of Quality Assurance on the project. Quality Assurance measures taken during the pre-demolition activities included: attendance at all phases of the inspection process, observation of contractor activities, review of drawings and comparison of actual vs. suspected areas of contamination (occasionally, areas of individual properties were delineated as contaminated because the designer, having no other means of non-destructive sampling, assumed that the construction materials within were contaminated).

Argonne National Laboratories (ANL), which is associated with the Department of Energy, supplemented the U.S. Army Corps of Engineers' Quality Assurance activities. During pre-demolition activities, ANL unofficially confirmed Severson's radiation surveys by performing radiation scan "spot checks" of the properties (materials and soil) themselves and comparing their findings with Severson's. In general, ANL performed radiation survey oversight activities and provided technical assistance to the USACE and the USEPA.

**Demolition Activities:** Because of the high visibility of the project and a general feeling of unease exhibited by residents of neighboring properties, strict Quality Control and Quality Assurance measures were taken during demolition activities. These measures not only included on-site engineering controls, such as misting for dust control and encapsulation of contaminated chimneys with plastic sheeting, off-site measures were also taken. Before performing any demolition at a property, a system was put in place to monitor the migration of dust particles off-site. Work areas were surrounded with air samplers, placed as near as possible to the four compass points in neighboring, “unaffected” properties, mounted in protective housings. (These air samplers and housings were placed at neighboring properties on a totally voluntary basis; USACE and contractor representatives would approach adjacent homeowners, explain the purpose of the monitors, power requirements, reimbursement procedures, etc. and if the homeowner was interested, the monitor would be placed on their property for the duration of the demolition activities). Two background samplers were also placed within the community – one was located at the site office complex and the other was located at the Lansdowne fire hall. All of the filters for all of the air samplers were collected on a weekly basis and analyzed for particulates. At no time did the samplers indicate an unacceptable level of dust migration off-site during the demolition process.



**Figure 1: 216 Wayne Avenue Demolition**

Quality Control for the Demolition Activities included the following: Preparatory and Initial Inspections held prior to the work and shortly after demolition began, establishment of restricted zones, separation of clean vs. contaminated materials (pre-demolition), verification of drawings, review of activity hazard analysis, review of demolition plan, on and off-site air monitoring and protection of existing structures.

During demolition, ANL continued to aid Severson in the delineation of contaminated vs. non-contaminated materials.

**Post-Demolition Survey:** Within 15 calendar days after completion of RCM removal at each property, the contractor was required to submit a “compliance report” to the USACE. This report documented that all contaminated soil and debris, above allowable “clean” criteria was removed from the property. The objective of the compliance report was to provide statistical assurances that the cleanup criteria met the established cleanup criteria (5 picocuries/gram of radium 226 in dry soil (or 15 picocuries/gram for properties that were unlikely to become residential).

The contractor was required to demonstrate a 95% or greater confidence level for the survey and sampling program for all materials. This 95% confidence level pertained to the overall sampling plan to identify the number and location of samples analyzed.

When analysis results were within +/- 1.0 picocurie/gram of the 5.0 picocurie/gram radium 226 release criteria, the relative uncertainty at a 95% confidence interval of any individual measurement could not exceed +/- 20%.

The contractor's sampling plan that had been developed and implemented throughout the course of the project provided the Government, with a 95% confidence, that each property had been remediated to either the 5 picocurie/gram or the 15 picocurie/gram level, whichever was appropriate. The review and approval of these compliance reports were conducted by the USACE and ANL.

Following the submission and approval of the compliance report, the Government's independent laboratory, ANL, performed their post-cleanup verification survey. The purpose of the verification survey was to provide independent verification that the remediation contractor decontaminated the individual properties to the levels stated in the Record of Decision and that the property is radiologically suitable for unrestricted use.

The verification survey consisted of a property scan for gamma activity, followed by the collection and analysis of soil samples. The total number of samples taken at each property was selected to demonstrate statistically that the cleanup criterion was satisfied at the 95% confidence level. Following collection, each soil sample was labeled relative to a fixed property coordinate system and analyzed to determine the activity concentration of radium-226. The analytical results were then compared with the soil cleanup criterion of 5 picocurie/gram for radium-226 to determine if the criterion had been achieved.

In-situ measurements of the radium-226 concentrations were used as supplemental data to support the results obtained from soil sample analyses. In addition, radiation exposure rate measurements were used as supplemental data to demonstrate that the mean exposure rate was typical of that found in uncontaminated areas of the community.

The results of the verification survey were described in a Post-Cleanup Verification Report that was provided to the USACE and the USEPA. The USEPA provided copies to the individual property owners as part of the final inspection.

### **Reconstruction of Homes and Restoration of Non-Rebuild Properties:**

The Record of Decision provided each individual property owner with the following options:

OPTION A: Building Dismantlement, Contamination Disposal, and Building Replacement.

OPTION B: Building Dismantlement, Contamination Disposal, and Offsite Relocation.

OPTION C: Building Repair.

Reconstruction/restoration of the properties began immediately following the post demolition survey and subsequent release of the individual property, by the USACE, to the contractor. After a non-rebuild property (OPTION B; 500 Harper Ave., 3723 Huey Ave., 151 Lexington Ave., 34 Lewis Ave., 617-623 Pine St.) was released to the contractor, the perimeter fence was removed, the property was backfilled, graded to allow for adequate runoff and seeded to provide erosion control.

Since complete demolition of three of the properties (OPTION C: 42 South Union Avenue, 44 South Union Avenue and 346 Owen Avenue) was not necessary due to the localization of the contamination, these structures were designated as partial reconstruction properties. The contractor was required to protect the unaffected areas of these properties while the partial demolition and reconstruction was taking place.

The remaining properties listed in the Introduction were designated for complete building replacement (OPTION A). These buildings were designed to retain the same architectural character and “curb appeal” as the existing structure using modern materials and methodologies.

Quality Control for the reconstruction and restoration of homes included the following: Preparatory Inspection prior to the reconstruction activities at each property, Initial Inspections held as a representative sample of each Definable Feature of Work had been completed, daily safety inspections, inspections performed by individual borough officials to insure code compliance (footings, framing, etc.). Daily follow-up inspections were also conducted to ensure proper materials were being used and installation was per contract specifications. At substantial completion of the individual properties, a series of pre-final inspections were held with Government and contractor personnel. During these inspections, deficient work was identified and a punchlist was generated by the contractor. At substantial completion of the punchlist, the homeowner was invited to the property, along with USEPA, USACE, and contractor personnel, to perform the final inspection.

Quality Assurance measures included: attendance at all phases of the inspection process, daily inspections of performed work (generation of deficiency list), conflict resolution between specifications and drawings, daily safety inspections, frequent correspondence with designer, homeowners and customer, attendance during

borough/township inspections, observation of materials testing and inspection (concrete slump, rebar size and spacing, etc.), and observation of construction activities.

**Contaminated Soils Removal at the Warehouse Property:** The warehouse property, approximately 120' x 110', and located at the corner of Union and Austin Avenues, was formerly occupied by the Cummings processing facility. The site includes a portion of the adjacent railroad right-of-way used by the South Eastern Pennsylvania Transportation Authority (SEPTA), and is bordered to the East and South by South Union and Austin Avenues respectively. Contamination of the soil was not uniform and reached to a maximum depth of approximately 25 feet (at the SE corner).

The contractor performed soil removal at the site by dividing the site into halves. While excavators and radiation technicians worked one half of the site, removing contaminated soil (and stockpiling non-contaminated soil), laborers and radiation technicians worked the other half of the site loading, weighing, packaging and preparing the bulk bags for transportation off-site. Some contaminated soils extended beyond the limits of the warehouse property and under South Union and Austin Avenues. These soils were remediated by either removing portions of the paving or chasing the contamination into the sidewall.

Because excavation was necessary to depths of up to 18 feet adjacent to the SEPTA railroad tracks, the contractor was required to prepare a shoring system which would not only protect the integrity of the tracks, but other adjacent structures as well. The contract originally required a system using interlocking sheet piles and driven H-Piles. After weighing the potential impact to the community, the Government decided to direct the contractor to redesign the shoring system to minimize installation noise and vibration.

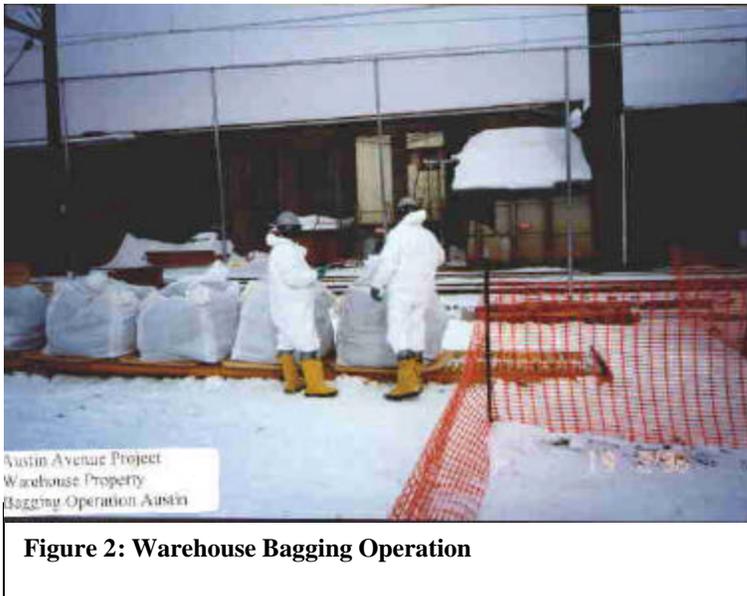
Quality Control for the Contaminated Soils Removal at the Warehouse property included the following: Preparatory and Initial Inspections, SEPTA track protective services (flagman) during shoring installation along the rail line, pre-excavation activity structural inspections at all properties to include the city block bound by Union, Austin, Nyack, and Maple Avenues, location of existing utilities, vibration monitoring (vibration monitoring was performed because of complaints by neighbors who stated that the contractor's excavation activities were causing structural damage to their properties. Seismic monitors were placed at various points in the construction/neighborhood area during excavation and it was shown that the vibrations caused by the warehouse activities, although perceptible, were well below those that could cause any structural damage), air monitoring, dust control, adjustment of acceptable working hours, homeowner notification (meeting to discuss excavation shoring design), observation of tieback strength testing (to 125% of design load), designation of restricted areas during tieback testing, grout testing, and personnel safety monitoring.

Quality Assurance included attendance at all phases of the inspection process, coordination of excavation areas/depths with the construction drawings, notification to

appropriate personnel that contaminated soils extended beyond contract limits, and observation of all activities and testing (including tieback testing).

## **Construction Activities:**

**Warehouse Site Staging Activities:** Typically, trucks carrying contaminated soil and debris from the affected properties would back into the warehouse site, unload the contents of the truck onto the contaminated soil stockpile, enter the decontamination area where it would be scrubbed down with water and brushes, and scanned by a radiation technician.



**Figure 2: Warehouse Bagging Operation**

Once the radiation technician had determined the truck to be clean, it would be released out to Union Avenue. The water which was generated during the decontamination activities was pumped to one of two holding tanks, sampled, and, if clean, transferred to an adjacent holding tank for release. The stockpiled contaminated materials were loaded into one-cubic yards bulk bags using a hopper and conveyer

system. During loading, care was taken to ensure that free airspace within the bags was minimal. Loaded bags were then gravity fed down a conveyor line and secured, weighed, and loaded onto a waiting truck for eventual transport to a Railroad siding located in Essington, PA. A crane was then used to load the bags into lined and covered gondola cars for shipment to Envirocare, in Utah.

**Pre-Demolition Surveys of Site/Structures:** Before demolition activities, Severson personnel would perform a property by property survey to document all contaminated materials (RCM and ACM). This survey included documentation of other items of concern (USTs, household wastes, etc.).

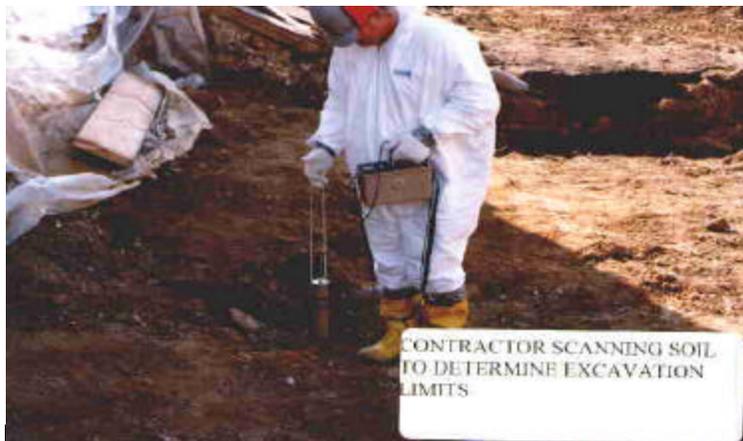
Before an actual survey sampling event, the contractor for each property prepared separate RCM sampling plans. The plans were developed based on the materials of construction found at each property. For example, it was determined that wood floors would be sampled with direct readings and large area (1 square meter) wipes and that stucco or lath and plaster walls and ceilings would be sampled by taking a five point composite sample to determine activity concentration. Soils were surveyed using a count rate meter with a 2" X 2" NaI gamma scintillation detector. All of the surveys were scanned at a distance of approximately 6" from the exposed surface.

During the survey, each area determined to be RCM was identified with paint or warning ribbons to define the areas of contaminated materials removal. Using these methods, the contractor's radiation technicians were able to verify or discount those areas identified in the contract drawings as radiologically contaminated. This step was critical in the *separation of clean vs. contaminated materials* process.

**Separation of Clean vs. Contaminated Material:** The contractor initially assumed that for buildings and structures, the materials (debris-masonry/concrete rubble/other) identified on the contract drawings as contaminated, were actually contaminated, and therefore, would be removed as RCM. This was especially true for the foundation walls. The sampling program also assumed the potential for contamination in areas originally identified on the contract drawings as not being contaminated. This sampling program was required to verify contaminated vs. non-contaminated materials, and to characterize the materials in the following way:

- A. Contaminated Debris: As shown on contract documents, these materials were assumed to be contaminated and, therefore, required no further testing.
- B. Potentially Contaminated Debris: Shown on contract documents as non-contaminated. These materials had the potential to be contaminated (e.g., materials in contact with other materials identified as contaminated, building materials that could be contaminated by virtue of the original extraction process such as mortar, stucco, plaster, and concrete).
- C. "Clean" Debris: Those materials such as wood, roofing materials, etc., that were not in themselves contaminated nor in contact with contaminated or potentially contaminated materials.

The soil area locations and depths identified on the contract drawings as contaminated were only approximate. Therefore, comprehensive radiological surveys were required during the remedial process in order to minimize the volume of contaminated soils for disposal and to insure that all contaminated areas were removed.



**Figure 3: Scanning Soil**

The contractor's primary method of separating clean from contaminated materials was accomplished by performing concentrated removals. Contaminated wall material,

such as stucco, could be removed from the wall using hand tools and either loaded directly into bulk bags onsite or vacuumed into an onsite “vac-truck”. Contaminated soils were removed with an excavator and either loaded into bulk bags or directly loaded into waiting trucks. A radiation technician, using a scanning device, could accurately direct the operator’s excavation. Contaminated foundation walls were typically reduced to small manageable sections and loaded directly into awaiting trucks.

**Demolition Activities:** Prior to total dismantlement of a property, the contractor removed all of the RCM (excluding the foundation) from the individual structures, exterior and interior, using power assisted hand tools and equipment. The use of hand tools and equipment enabled the contractor to perform surgical-type removals that precisely controlled the amounts of contaminated materials removed. This method also allowed efficient separation of clean vs. contaminated materials. Where dust could be generated during interior removal, airtight poly-sheeted enclosures were constructed, similar to enclosures used in asbestos removal. Ventilation was provided with exhaust discharging through a HEPA filter unit to prevent dust from cross-contaminating other areas. To prevent dust migration during the removal of RCM from building exteriors, such as chimneys, scaffolding was erected and containment was accomplished using plywood and plastic sheeting. Fine misting of the surface area was another form of dust control utilized.

RCM was loaded directly into containers. It was then transported to the central staging/packaging area at the warehouse site.

After the removal of all contaminated materials within the property (excluding the foundation), the contractor would begin the demolition and dismantlement of the non-RCM structure. This work was typically done with an excavator with an attached demolition grapple. Clean construction materials were loaded directly into waiting trucks. A radiation technician scanned these “clean” trucks, at a location away from the affected properties, and released them for transport to the GROWS landfill or other non-hazardous disposal site.

Building foundations, which were typically constructed of laid-up stone and contaminated, were demolished using an excavator with a pulverizing attachment and loaded directly into containers for transport to the warehouse site. Contaminated construction materials were adequately downsized, before leaving the individual properties, for eventual loading into the one cubic yard bulk bags.

**Post-Demolition Surveys:** Following demolition of the structure and removal of all contaminated soils and material, post-demolition survey and sampling plans were implemented to confirm that each property had been cleaned to the requirements set forth in the Record of Decision.

The contractor’s typical sample collection procedures were as follows: each property was laid out into 100 square meter areas and 25 aliquots were collected per the

100 square meters. The aliquots from each 100 square meter area were composited into one sample, and counted in the on-site laboratory for its radiological activity. The composite sample was split with the Government's independent testing personnel, Argonne National Laboratory, to allow them the opportunity to analyze the sample and send part of the sample off-site for third party analysis. If a composite sample came up with a reading higher than the action levels, then that specific grid would be re-scanned until the "hot spot" was located, the material was removed, and the area was scanned again.

Argonne National Laboratory also performed an independent post-demolition survey and sampling regimen to verify the contractor's results and to confirm to the Government that the individual properties were, indeed, cleaned to the Record of Decision requirements. Argonne also used a grid coordinate system for soil sample collection identifying sample locations in terms of X, Y, and Z. The origin of the coordinate system was located at a property corner.

Argonne used a sample identification system to provide a unique identification code for each sample collected. The code typically incorporated the property, sample type, collection time, sample mode, and sample collection number.

Initially, the property was scanned, at near ground surface, with a sodium iodide detector to insure there were no localized areas of contamination. Soil samples were then taken at randomly selected locations, within the individual grids, and analyzed. The number of soil samples collected was selected to provide a 95% confidence that the cleanup criterion had been achieved.

The final step in Argonne's confirmation process involved the use of a gamma ray spectroscope. By performing in-situ gamma ray spectroscopy, with a high-resolution germanium detector, to determine the in-place average radium concentration at the properties, Argonne was able to confirm the results of their soil samples.

**Reconstruction of Homes and Restoration of Non-rebuild Properties:** Under OPTION A, the Government was responsible to replace the dismantled structures. Ten property owners selected this option. The USACE, Baltimore District Real Estate Division temporarily relocated these property owners and their families to a comparable dwelling for the duration of the structure dismantlement and reconstruction.

Through a series of meetings with the design engineer (Weston) and government personnel, each property owner participated in the selection of a building design, materials, and features for the respective property. Examples of homeowner involvement ranged from floor layout design to the selection of lighting fixtures. Weston documented all homeowner finish selections and provided a copy to the USACE. This document was used to review and approve contractor's submittals. Homeowners also had the opportunity to upgrade certain elements of the design through a direct arrangement with the contractor. Any costs for the upgrades were paid for by the homeowner.

After the property compliance report (clean-up verification - assuring that the property met the remediation clean-up criteria) was approved for a given property, reconstruction at that property could start. The contractor was responsible to secure the excavation voided by the dismantled structure during the remediation and to ascertain all necessary requirements and services for reconstruction and arrange for all interim inspections for code compliance.

The new buildings were constructed on the lots previously occupied by the razed building, within the approximate footprint and square footage of the original building using modern materials and methodologies. Certain interior and exterior changes were necessary in order to meet existing codes, and to accommodate modern construction materials and methods. For example, concrete masonry units replaced stone foundations.



**Figure 4: 10 and 16 East Plumstead**

Although a passive radon system, consisting of below slab piping and sidewall venting, was installed at each property, the contractor was required to perform a 48-hour radon test before substantial completion of each property. Any property, such as 211 Penn Boulevard, that showed radon levels above the recommended action level of 4 ppm, was equipped with an active radon venting system by installing a turbaxial fan within the vent line.



**Figure 5: Interior of 6 East Plumstead**

Upon completion of an individual property, the Government performed a final inspection which the homeowner was invited to attend. During the inspection,

a punchlist, consisting of unsatisfactory or incomplete work items, was generated for the contractor's action. The contractor was then responsible for satisfactorily addressing each

individual punchlist item and, upon completion, obtaining the Certificate of Occupancy for the property.

For those property owners who selected Option B, Permanent Relocation to a comparable dwelling, the contractor was responsible for the demolition of the structure, removal of all contaminated material and property restoration. Typical property restoration included grading, topsoil placement and seeding.

**Contaminated Soils Removal at the Warehouse Property:** Contaminated soils at the warehouse property reached to depths of up to twenty-five feet so a shoring system for the excavation was required.

The contractor's original design for the shoring system required that interlocking steel sheets be driven into the ground to a predetermined depth. Grouted tiebacks for internal support were to be drilled diagonally outward starting at a point 2 feet below the top of the shoring system. This would allow for unrestricted excavation.

However, the Government determined that installation of the shoring system in this fashion would create an unacceptable disturbance to the surrounding neighborhoods so the contractor was directed to propose an alternate method that would minimize the impact to the community.

Instead of interlocking sheet piles, a variation of the H-pile/soldier beam/lagging shoring system was proposed. Instead of *driving* H-Piles, 10 ¾ holes were augured (5'-8' centers) and extra strong pipe piles were screwed into the holes. As excavation



**Figure 6: Warehouse Excavation**

progressed, steel studs were welded onto the pipe to secure 3" thick wood lagging boards. Excavation continued to depths varying from 6 – 9 feet where grouted tiebacks for internal support were installed. The tiebacks were installed at a 30-degree angle, from horizontal, to an effective depth of app. 35 feet. The tiebacks were then grouted into place with 3000 lb. grout at 100-500 psi. Once the tiebacks were installed and tested, excavation could continue to the required depths.

The shoring system allowed the contractor to safely excavate approximately 225,000 cubic feet of soil from the excavation. Radiation technicians continuously monitored the soils being excavated and provided direction to the equipment operators so that contaminated and clean soils could be kept segregated. Per the ROD, there was an estimated 204,000 cubic feet of contaminated soils at the warehouse property that would require removal and disposal. The actual volume of contaminated soil removed from the property totaled 149,470 cubic feet.

In order to perform the soil removal in a manner that would prevent cross contamination most efficiently, the excavation was broken up into two halves, North and South. This allowed the contractor to effectively excavate the soil on one half of the site and perform bagging activities on the other half of the site simultaneously.

At the completion of contaminated soil removal, both the contractor and Government personnel had to confirm that the excavation was clean. Each party conducted surveys on the bottom of each half of the excavation. Argonne, as directed by the USACE, took additional measurements outside the limits of the excavation. The method used involved inserting tubes horizontally into the sidewall of the excavation. Tubes were placed approximately every four feet vertically from the surface, with a distance of approximately eight feet between columns of tubes. The tubes extended horizontally into the sides of the excavation approximately five feet. A radiation detector was placed into each tube for measurements. Four measurements were taken per tube at 0', 1', 3' and 4.5' horizontal distances. These extra measurements show that contamination did not extend beyond the limits of the warehouse property.

After the Government's survey was complete and the survey results confirmed that the warehouse site met the Record of Decision requirements, the property was released to the contractor for backfilling. The contractor backfilled the warehouse site with clean borrow material and existing clean soils. The finish elevation was graded to matched original conditions. Along Austin and S. Union Avenues, the fence was removed and new sidewalk was placed where necessary.

**Bag Loading Activities at the Rail Siding:** The contractor used the warehouse site as the central location for staging, waste consolidation, packaging, and shipment preparation.

All RCM handled at the warehouse site was packaged in DOT approved containers, weighed, and loaded into awaiting trucks for transportation to the rail siding located in Essington, Pennsylvania. Upon arriving at the rail siding, the individual containers were loaded onto rail cars (approximately 70 containers per rail car), and shipped to their final, approved disposal facility – Envirocare of Utah, Inc.

All wastes offered for disposal at the Envirocare facility were required to meet the following criteria:

- (1) All shipments reaching Envirocare must meet DOT packaging requirements for Low Specific Activity (LSA) shipments, even if the waste does not qualify as “radioactive material” per 49 CFR 173.403.
- (2) Bulk shipments (railcars) must be covered. The top must be completely enclosed with no open areas along the sides or openings in the top.
- (3) All containers must meet the standard of a “Strong, Tight Container” (49 CFR 173.24). Containers in a shipment must be loaded and braced securely to prevent shifting and damage during transport.



**Figure 7: Unloading Bags at Railyard**

In February 1996, the remediation contractor began making shipments of contaminated material to Envirocare. These shipments continued through October 1997. At project’s end, app. 18,400 one-cubic yard bulk bags had been loaded into rail cars and shipped to Envirocare.

### **Relationship with Envirocare:**

Since all radiologically contaminated materials (RCM soil, RCM debris and mixed waste) generated as part of remedial activities at the site, were to be disposed of, and were less than 2000 pCi/g of radium-226 and less than 15,000 pCi/g of thorium 230, the Government entered into a Disposal Contract with Envirocare of Utah, Inc. The USEPA was considered the generator of all waste materials from remediation and restoration activities at the site and all costs associated with the disposal of contaminated materials were borne by the Government. The cost of disposal was only that cost strictly for the receipt and disposal of contaminated material. The Government’s disposal contract with Envirocare originated in 1992 and the option for four additional years through 1997 had been exercised.

The contractor was responsible for all costs associated with removal of the contaminated materials from the site. Activities associated with the removal of the

contaminated material included; packaging, weighing, transportation to Envirocare facilities, sampling and testing to meet Envirocare's requirements.

### **Final Inspection:**

Due to the fact that the Austin Avenue site consisted of a number of individual sites, and that these sites were remediated and released at separate times over a two and one-half year period, a number of separate final inspections were required. In all cases, the final inspection was conducted on each individual property at a point in time when the USACE determined that the final inspection was appropriate. In addition, in all cases, representatives from the USEPA, USACE, and Severson were present. Others typically present included representative(s) of the homebuilder and the individual property owner(s).

During the Final Inspections, the Government personnel, along with the homeowner(s) and contractor's personnel, visited each room on each floor of the individual house pointing out defects or deficiencies in the workmanship to the contractor. The tour of the house interior was followed with a tour of the property to inspect such things as exterior finish and landscaping. All deficiencies, defects in workmanship, etc., were pointed out to the contractor as they were identified. The contractor was required to compile the list of deficient items into a "punchlist". The punchlist was then used by the contractor as a working list and by the Government as a record-keeping device to insure that all observed deficiencies were adequately addressed by the contractor.

Once the Government determined that the punchlist items had been sufficiently completed to allow the homeowner(s) to relocate back to their property, the homeowner(s) were notified by personnel from the USACE' Real Estate Division and arrangements were made for the relocation.

### **Certification that Remedy is Operational and Functional:**

Remedial activities were completed at each property by the remedial contractor, Severson Environmental Services. The remedial activities included the removal of contaminated soil and structural materials from each property.

Following remedial activities and acceptance of the contractor supplied compliance report for each individual property, an independent verification survey was conducted by Argonne National Laboratory. The primary objective of the survey was to provide independent verification that the remedial contractor decontaminated the individual properties such that they complied with the EPA cleanup criterion for radium-226 in soil and that the property is suitable for unrestricted use.

**Operation and Maintenance:**

A Warranty of Construction Clause included in the Contract Solicitation required the remedial action contractor to warrant all work performed for one year after final acceptance. Since the final inspections were held on a property-by-property basis, individual warranties will expire at various times. For those properties where a new home was not built, the contractor was required to maintain the appearance of the property, i.e. cutting the grass, during the life of the contract.

**Summary of Project Costs:**

Contract No. DACW31-95-C-0092 original bid price was \$13,685,414.00 and the final modifications will result in a final cost of \$15,152,402.24

<u>Change Letter</u>	<u>Mod Number</u>	<u>Change Description</u>	<u>Change Amount</u>	<u>Change Days</u>
AA	P00001	Revise Payment Office	\$0.00	0
AB	P00002	Additional Air Monitoring	\$90,000.00	0
AC	P00003	Correct Duplicate Mod P00001	\$0.00	0
AE	P00004	Wage Decision Adjustment	\$39,454.00	0
AF	P00005	Drum/Pole/UST Removal	\$2,280.25	0
AD	P00006	Change to Wayne Ave. Props	\$27,819.00	0
AB	P00007	Reduction to P00002 Amount	\$(19,956.00)	0
AI	P00008	Lansdowne Borough Insp.	\$40,125.00	0
AJ	P00009	218 Wayne Ave Dental Lab	\$67,668.00	0
AG	P00010	Wage Decision Adj. II	\$61,257.00	0
AM	P00011	Misc. Housing Changes	\$6,062.00	0
AH	P00012	New Housing Revisions	\$133,340.00	0
AK	P00013	346 Owen Structural Changes	\$5,316.00	0
AN	P00014	Quantity Revisions	\$710,789.01	0
AP	P00015	Drain and Sewage Pumps	\$19,565.00	0
AQ/AT	P00016	Rainleader Discharge and Tub - 10 East Plumstead Ave.	\$3,942.00	0
AS	P00017	Revised Warehouse Shoring	\$96,692.00	0
AO	P00018	346 Owen Misc. Changes	\$50,750.00	0
AR	P00019	New Warehouse Shoring Des.	\$70,655.00	0
AU	P00020	64 South Clifton Garage	\$39,800.00	0
AL	P00021	216 Wayne Single Home Rev	\$2,836.00	0
BA	P00022	Addl. Owen Ave. Changes	\$62,167.00	0
AV/AY	P00023	310 Shadeland Ave Third Flr. Mods and 211 Penn AC	\$228.00	0
AW/BC	P00024	218 Wayne Garage Slab and SEPTA Flagman	\$9,834.00	0
AX	P00025	310 Shadeland UAA Revision	\$42,046.00	0
AZ	P00026	218 Wayne Refrigerator Door	\$2,875.00	0
BE	P00027	Admin Change, Change of Name Agreement	\$0.00	0
BD/BF	P00028	211 Penn Bilco Door and 310 Shadeland Retaining Wall	\$10,226.00	0
BH	P00029	64 S. Clifton Revisions	\$10,000.00	0
BI	P00030	Constructive Housing Revs. I	\$40,000.00	0

BJ	P00031	Constructive Housing Revs. II	\$50,000.00	0
BG	P00032	Miscellaneous I	\$12,870.00	0
BL	P00033	Correct Name on P00027	\$0.00	0
BP	P00034	District Admin Mod	\$0.00	0
BM	P00035	Add. Landscaping and Fireplace	\$28,600.00	0
BN	P00036	Revise Vol/Wgt Ratio - Unclassified Debris	\$94,000.00	0
BO	P00037	Admin Mod to change P00034 to P00037	\$0.00	0
BK	P00038	Warehouse Dewatering	\$94,000.00	0

Total Paid for Settled Modifications \$1,905,240.26

Net amount for Overruns/Underruns \$295,032.15

Current Modification Value \$2,200,272.42

Summary:

Original Contract	\$13,685,414.00
Contract Overruns	\$41,955.98
Contract Underruns	\$(480,208.00)
Modifications	\$2,200,272.42
Pending Change for Modification Overruns	\$12,909.25
Pending Change for Modification Underruns	\$(307,941.40)
Final Construction Contract Value	\$15,152,402.24

Other Costs:

Petrographic Analysis for Grout Claim	\$ 2,500.00
Architect-Engineer Services	\$549,847.00
Waste Disposal	\$3,013,117.96
Interagency Support & Design Services	\$3,203,046.52

Total \$6,768,511.48

Construction Contract \$15,152,402.24

Other Costs \$6,768,511.48

Current Estimated Project Value \$21,920,913.72

### Cost Summary

Cost Item	Rod Estimate (1994 \$\$) Option A	Rod Estimate (1994 \$\$) Option B	Actual Cost (1995 \$\$)
RA Capital Cost	\$36,642,250.00	\$38,521,200.00	\$22,000,000.00
Difference between total project cost and total ROD cost estimate.		-\$14,642,250.00 or -38.01%	

The difference between the project cost and the ROD estimate is largely attributable to the former Cummings Facility property (soils). Furthermore, the Severson Environmental costs were based on a best value competitively negotiated contract.

### **Contact Information:**

This project was a federal lead, with the U. S. Army Corps of Engineers providing design and construction management in accordance with an Interagency Agreement (IAG).

#### Primary Contact for Construction Management:

U.S. Army Engineer District, Baltimore  
 James P. Moore, Resident Engineer, Construction Division  
 Tobyhanna Army Depot  
 Building 1010, McDonough Street  
 Tobyhanna, PA 18466

Phone Number: 570-895-7052

#### Primary Contact for Project Management:

U.S. Army Engineer District, Baltimore  
 Jared Olsen, Programs and Project Management Division  
 P.O. Box 1715  
 Baltimore, MD 21203-1715

Phone Number: 410-962-6745

Prime Contractor for Remediation:

Sevenson Environmental Services  
ATTN: John C. Robbins III  
4 Lakeview Drive  
Chadds Ford, PA 19317

Phone Number: 610-388-0721

The following companies analyzed samples:

For the contractor (QC Samples):

Sevenson Environmental Services performed their own sampling on-site. See above for contact.

For the Government (QA Samples):

Argonne National Laboratories  
ATTN: Marc Robinet  
9700 South Cass Avenue  
Argonne, IL 60439

Phone Number: 708-972-3325

EPA Project Manager:

Dave Turner  
U.S. EPA Region III  
1650 Arch Street  
Philadelphia, PA 19107

Phone Number: 215-814-3216

Waste Disposal was via a separate contract through the Kansas District of the U.S. Army Corps of Engineers.

Primary Contact for the disposal contract management:

U.S. Army Engineer District, Kansas City  
ATTN: Rebecca S. McNeiley  
757 Federal Building  
601 E. 12<sup>th</sup> Street  
Kansas City, MO 64106-28966

Phone Number: 816-426-6484

Primary Contact for the disposal contractor:

Envirocare of Utah, Inc.  
ATTN: Sue Rice  
46 West Broadway, Suite 240  
Salt Lake City, UT 84101

Phone Number: 801-537-1330