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United States Environmental Protection Agency

Solid Waste and Emergency Response (5502G)

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EPA

Superfund At Work

Hazardous Waste Cleanup Efforts Nationwide

Lansdowne Radioactive Residence Site Profile

Site Description:
Three-story duplex dwelling, located in a residential area of Lansdowne, Pennsylvania, two miles from Philadelphia

Site Size: 1/2-acre

Primary Contaminants:
Radium and other radionuclides

Potential Range of Health Risks Without EPA Cleanup:
Increased risk of cancer from ingesting or inhaling radioactive dust and gases

Nearby Population Affected:
11,000 people within one mile of the site

Ecological Concerns:
Radioactive contamination of soil and air

Year Listed on NPL: 1985

Year Deleted from NPL: 1991

EPA Region: III

State: Pennsylvania

Congressional District: 7

Success In Brief

EPA Completes Cleanup of Nation's Only Residential Superfund Site

In 1991, the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (USACE), carefully dismantled and removed the country's only private residence Superfund site. The former home laboratory was used for radium refining and processing from 1924 to 1944. The history of the site is an intriguing one, and the cleanup exemplifies the Superfund program's effectiveness. Highlights of EPA actions at the site include:

- Destroying and removing an entire house, which was highly contaminated with radioactive gas and dust, with no adverse effects to cleanup workers or local residents;
- Completing the $11.6 million cleanup of the three-story brick house and adjacent soil within one year;
- Establishing the precedent for cleanup of radiation in residential areas;
- Maintaining strong community relations with the local residents of Lansdowne and keeping them informed of Superfund activities through meetings and personal visits by EPA staff; and
- Deleting the site from EPA's National Priorities List (NPL) in September 1991.

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This house was a Superfund site. A physics professor refined radium in the basement of this duplex for nearly twenty years, leading to high levels of radon gas in the structure and surrounding soil.

The Site Today

Today the former Lansdowne site is a cleared lot, replanted with grass. Six neighboring yards have been excavated and filled with clean soil, and two garages have been rebuilt. The site has been eliminated from the National Priorities List, the roster of the nation's most hazardous waste sites eligible for long-term cleanup. The site is considered to be complete in every respect, so it has been excused from the usual five-year review process.

A Site Snapshot

The former Lansdowne site consisted of a three-story duplex located at 105/107 East Stratford Avenue in the borough of Lansdowne, Pennsylvania, approximately two miles west of Philadelphia. The surrounding area is a densely-populated residential neighborhood that was established in the latter part of the 19th and early 20th centuries. Approximately 11,000 people live within a one-mile radius of the site.

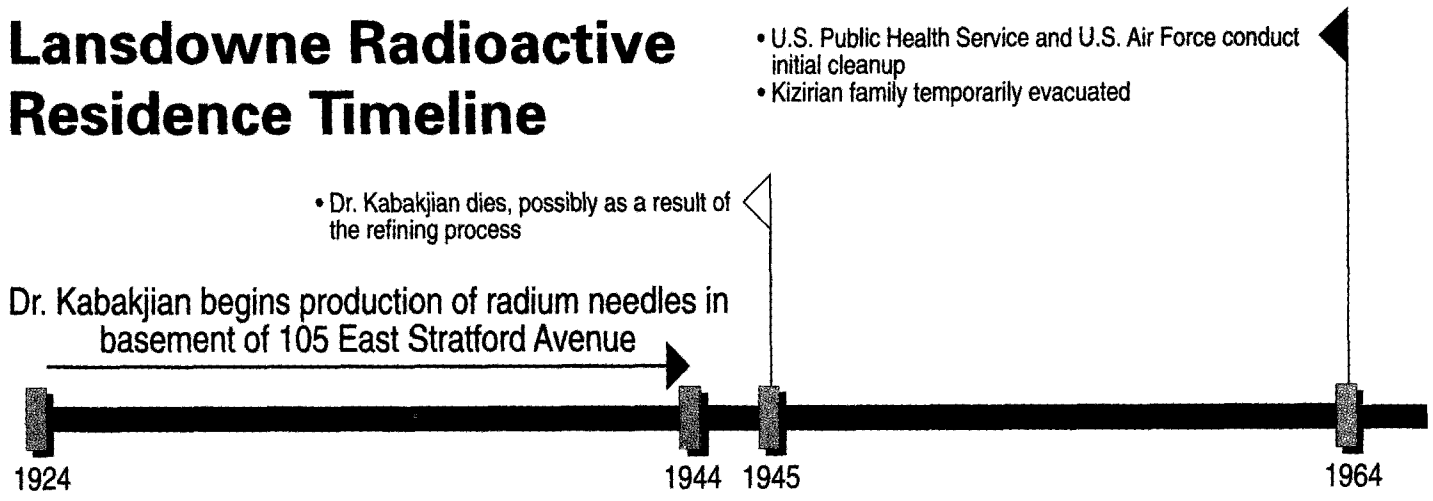
From 1924-1944, Dr. Dicran Hadjy Kabakjian, a physics professor at the University of Pennsylvania, operated an unregulated, "mom and pop" radium processing laboratory in the basement of 105 East Stratford Avenue. The professor's entire family was employed at least part-time in his business, supplying radium implant needles to local physicians and hospitals for the treatment of cancer patients. "I'd take the raw stuff and cook it until you get [sic] these radium crystals," said Alice Lewis, 74, the late professor's daughter (*Bucks County Courier Times*, 4/23/89). "No secret was made of the work we did here. If my dad knew all the trouble it caused, he'd be devastated," said Louise Treichel, another surviving daughter of the professor (*Delaware County Sunday Times*, July 31, 1988). It was not known then that radium, a refined product of uranium ore, decays and forms radon gas and other carcinogenic by-products.

"If my dad knew all the trouble it caused, he'd be devastated."
–Louise Treichel, scientist's daughter

Radiation contamination of the house and surrounding soil manifested itself in the form of radon gas (released during the decay of radium), and gamma radiation (a particulate by-product released during the decay of radon gas). Radon gas is approximately 20 times more hazardous than gamma radiation. Levels for both radon and gamma radiation found at the site were several times higher than federal standards permit. Further threats existed through the release of radon gas and gamma radiation particles into the air and soil.

Professor Kabakjian died in 1945 of emphysema, possibly connected to acid fumes released during the professor's radium refining process. When Dr. Kabakjian's body was exhumed for study in 1965, his skeleton registered the highest levels of radiation ever recorded in a human body. Certainly the primary threat at Lansdowne was to human health, through breathing or ingesting radioactive particles and fumes. No other Lansdowne residents have suffered health effects as a result of the site. The worst potential effects of the radiation were inside the house itself.

Lansdowne Radioactive Residence Timeline



Success in Brief

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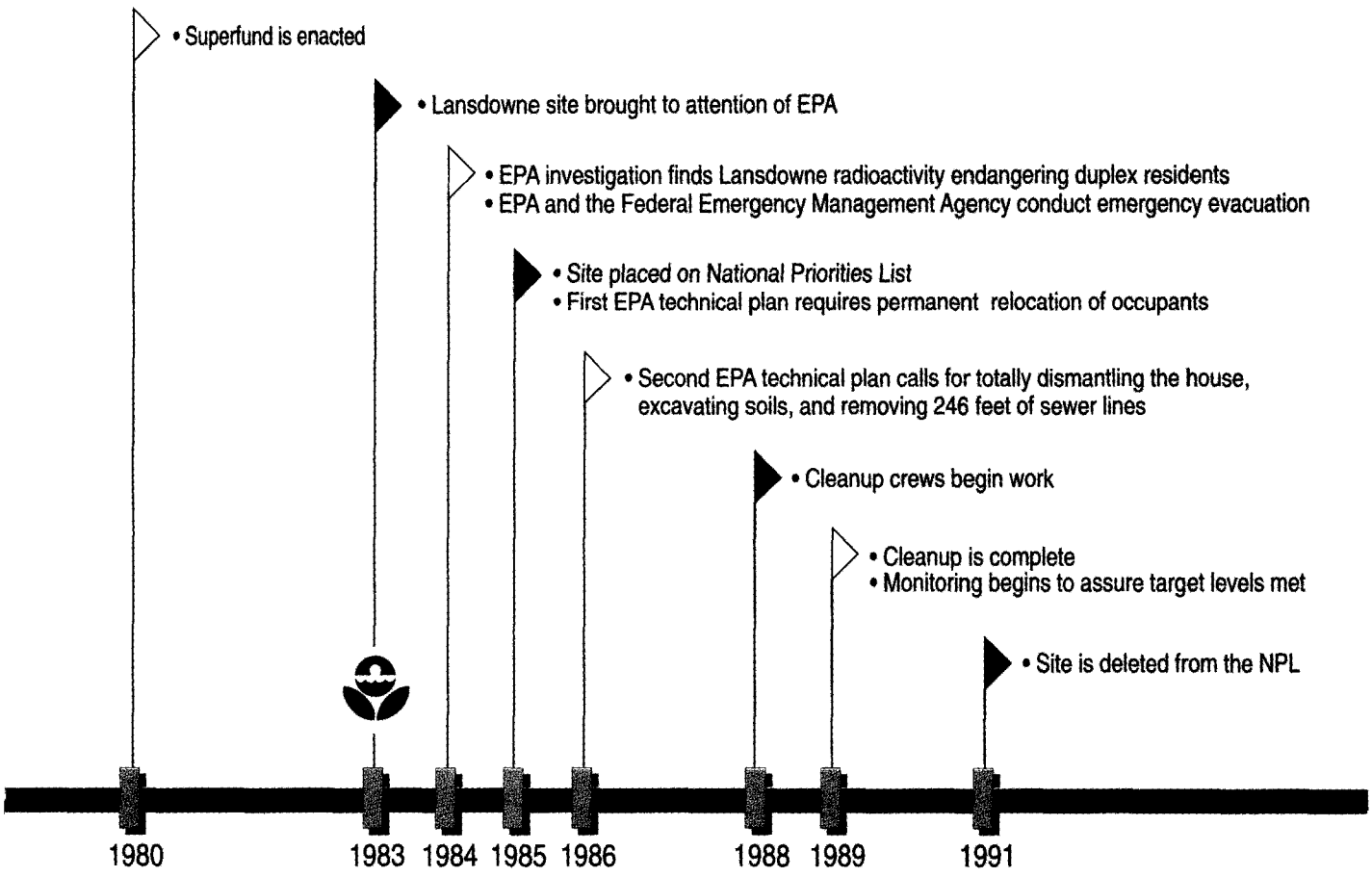
The Superfund cleanup team, comprised of EPA, USACE and their contractors, thoroughly eliminated all radiation-contaminated debris and soil at the site. The Lansdowne Radiation case is a classic example of how the Superfund program was intended to work in situations where an owner or operator of a hazardous waste site cannot fund the cleanup.

EPA Sets Two Precedents for Radiation Cleanup

EPA encountered and resolved two unique regulatory problems at the site. In 1986 there was no existing federal safety standard for levels of radiation in residential communities. At Lansdowne, EPA set the precedent for addressing radiation levels in residential areas. This involved imposing even more stringent levels than those set forth by the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), which only applies to radioactive material at processing or depository sites. The Lansdowne site was the first test case for establishing safety standards for radiation in urban areas.

The Lansdowne site helped set yet another precedent for the Superfund program. Generally, radiation sites tend to be federally owned facilities and are handled under the Atomic Energy Act of 1954. As a result of Lansdowne's proposal to the NPL in 1985, EPA expanded the criteria sites must meet to qualify for Superfund cleanup. One of these criteria was the issuance of a public health advisory, as occurred in Lansdowne. The expanded criteria have allowed other such cases to be included on the NPL.



EPA Cleanup of "Hot House" Eliminates Radiation Contamination

From 1924 to 1944, refined radium ore was delivered to the garage of the residence in a sandy form. Dr. Kabakjian refined the ore using an acid process. As a result of this mishandling of radium, acid fumes released during the purification process permeated both halves of the duplex. Waste liquids were poured down sinks and toilets, contaminating 246 feet of sewer lines. Wearing nothing more protective than kitchen-style aprons, the professor and his wife routinely worked over a workbench covered only by newspapers, and burned contaminated papers in the chimney. By tracking the wastes around on their shoes, the Kabakjian's unintentionally but extensively contaminated the house and grounds. Broken laboratory apparatus, empty chemical bottles and tailings from the operation were buried on the grounds of the professor's property as well as neighboring properties. What began as one professor's humanitarian research to help cancer patients became a nightmare for Lansdowne residents.

1964 Cleanup Partially Reduces Radiation Threat

The 1988-89 Superfund cleanup was preceded by an attempt in the early 1960s to purge the East Stratford Avenue home. In 1963, the Pennsylvania Department of Health inspected the house and found extremely high levels of radioactivity. In 1964, the U.S. Public Health Service and the Pennsylvania Department of Health made a joint attempt to decontaminate or stabilize the existing radiation of the 105 residence, which had since passed into the ownership of Harry and Mary Kizirian.

The U.S. Air Force performed the physical cleanup from early May to September, 1964. This effort involved removing and disposing of the contaminated interior, including furniture, rugs, walls, and floors. Air Force personnel tore apart concrete floors and walls to remove radiation. They sanded, vacuumed, and scraped off the extreme "hot spots," sealed contaminated fireplaces, and fixed areas of lesser contamination under several layers of paint or stucco. This eliminated the radiation contamination levels by approximately 90%, and the house was considered to be safe for habitation once again, with one provision — that the occupants not spend more than 16 hours per day in the house. With that knowledge, the Kizirians — who were temporarily evacuated — moved back into 105 East Stratford Avenue. However, radiation levels still exceeded federal limits.

A significant portion of radium — one gram, the weight of a paperclip — remained behind.

Once Is Not Enough: Radiation Continues to Plague the Duplex

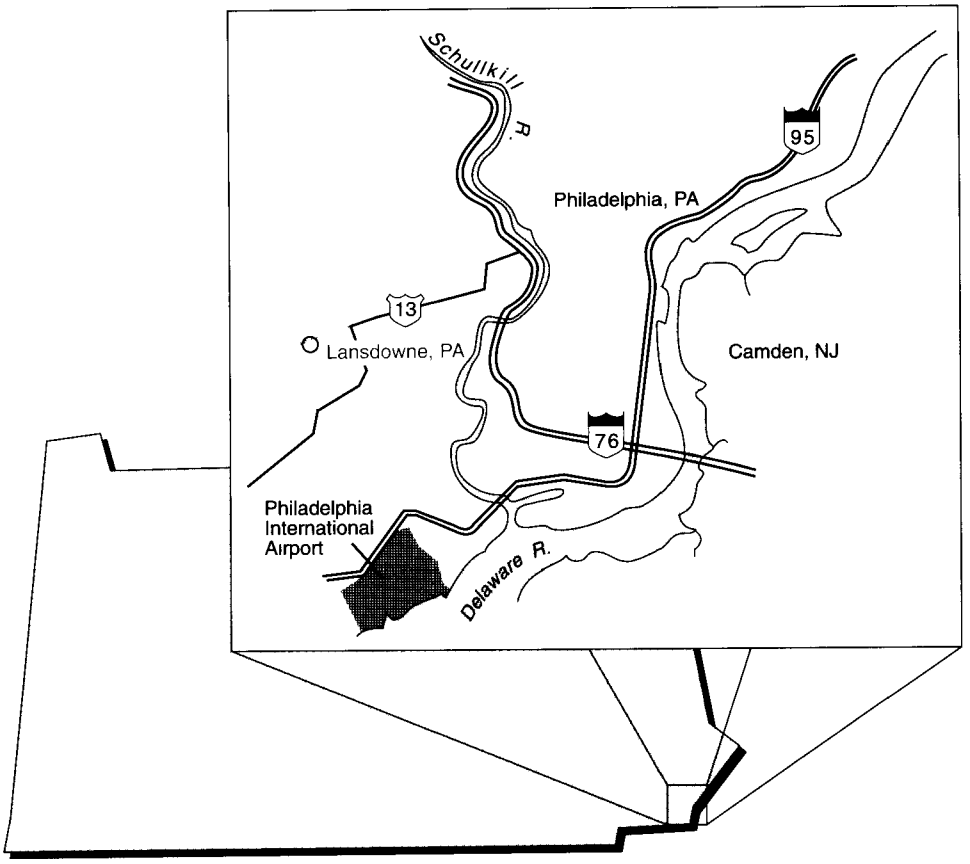
The 1964 cleanup did not address contamination of the "107" half of the residence, the twin garages, the soil or sewer lines. Nor did the initial cleanup address off-site contamination, such as neighbors' garages, yards, driveways, and area vegetation. However, a significant portion of radium — one gram, the weight of a paperclip — remained behind. This amazingly small amount of radiation was sufficient to fully permeate the entire duplex structure, a formidable illustration of the contaminant's potency.

Superfund Program Created to Address Hazardous Sites

The legislation creating the Superfund program was passed by the U.S. Congress in 1980. The primary intent of Superfund is to compel companies or individuals responsible for hazardous waste sites to fund cleanups, such that federal and state expenditures are minimized. However, in the event that owners and operators have abandoned a site, or if they are deceased — as in the case of Lansdowne — a mixture of federal and state funds covers the costs of cleanup. Congress thus established a revolving Trust Fund to be used in such events, with the provision that EPA take all steps possible to recover these costs from responsible parties. In the case of Lansdowne, however, no such party could be held liable, so the Fund was used.

During the course of an EPA national survey of potential radioactive sites in 1983, the Lansdowne site was brought to the Agency's attention by the State of Pennsylvania's Department of Environmental Resources. EPA officials also learned that the owners of the duplex were planning to sell the property. William Belanger, radiation specialist for the Agency's regional office responded, "I do not see a risk to the public at large, but if the house is sold, the new occupants would be getting into a potentially unhealthful situation."

EPA visited the site in 1983 and found radon levels exceeding federal limits by as much as seven to ten times. Having discovered these elevated levels, EPA contacted Argonne National Laboratory (a Department of Energy facility near Chicago) to assist in determining the extent of the contamination.



EPA's Emergency Actions Safeguard Residents

In July 1984, the Centers for Disease Control (CDC) advised EPA that long-term residents of the duplex were endangered by the elevated gamma-radiation and radon levels in the house. Argonne National Laboratory's findings agreed with those of EPA and CDC, so in September 1984, EPA authorized an emergency action to evacuate the two owners occupying 105 and 107 East Stratford Avenue.

Generally, sites contaminated with radiation are not addressed by Superfund authority, but by other federal statutes. However, the danger to health posed by radiation led EPA to amend its NPL ranking system to allow for such cases. Thus, the site was placed on the NPL in September 1985, making it eligible for federal funding under the Superfund law. EPA immediately issued its first technical plan, calling for the occupants' permanent relocation. However, that action proved unnecessary, because the resident of 105 died, and the resident of 107 remarried and moved elsewhere.

In the winter of 1985, EPA installed a sprinkler system on all three floors to extinguish potential fires. This system was boosted by an on-site, 1,000-gallon water tank. Heavy, reinforced plastic sheets also sealed off all the windows of the house, thereby minimizing leakage of radioactive dust or gas. In the event of a fire, which would pose an imminent hazard to local residents because of radioactive fallout, EPA and the local fire department designed a contingency plan for evacuating hundreds of people in the surrounding neighborhood. Fortunately, this contingency plan did not need to be exercised.

New EPA Plan Calls for Removal of "Hot" House

In the aftermath of these activities and in light of the 1964 cleanup, EPA decided to eliminate any future threat of exposure by removing the duplex structure itself. Toward that end, a second technical plan was signed in September 1986, outlining the procedure for dismantling the entire duplex, excavating contaminated soil, removing contaminated sewer lines, and disposing radium-contaminated materials off-site. After issuing

this plan, EPA entered into an inter-agency agreement with the U.S. Army Corps of Engineers (USACE) to manage the cleanup.

While cleanup designs for the site were underway, the U.S. Congress reauthorized the Superfund legislation in 1986, and appropriated $8.5 billion to continue the program nationwide. Although the second technical plan for Lansdowne had been approved in 1986, funds were not obligated until April, 1988.

The Cleanup Begins

Cleanup crews arrived at the site on August 1, 1988, and worked for the next 10 months. An 8-foot chain link fence was erected around the perimeter of the site and 24-hour security installed to prevent accidental exposure to the site. In addition, the area was continuously lighted. Through these actions, EPA deterred public access to the site, but certainly not public interest concerning the peculiar Lansdowne home and its Superfund status.

EPA Stresses Safety First

Before the actual dismantling of the duplex began, Superfund workers secured the site structure to prevent the release of radioactive particulates into the environment. The house itself was used as a containment area: all windows, chimneys and doors were sealed with flexible plastic sheeting. A ventilation system, consisting of air ducts and pumps running from the top to the bottom floors, assured that any possible contaminants escaping would be drawn back into the house. Workers wore protective gear with built-in ventilation systems, and had to abide by strict safety guidelines to avoid contacting or spreading radium contamination.

Having established complete security at the site, the house was dismantled from the top down — from the shingles on the roof to the basement. "We're going to take it down stone by stone, brick by brick, nail by nail. There will be no bulldozers making it crash down in a puff of dust, that's not the case. It's going to be picked apart, piece by piece," said Vic Janosik, EPA's on-site Remedial Project Manager (*Delaware County Sunday Times*, 7/31/88). Janosik was referring to the painstaking method used to dismantle the duplex and twin garages, without dispersing radioactive dust — the most dangerous form of the contaminant. Two neighboring garages were also found to contain high levels of radiation, and were also dismantled and replaced.

After dismantling the entire house, EPA found there remained only one and a half bricks that were *not* contaminated with radiation...

Materials were carefully removed, packed into specialized containers, and transported to a radiation waste disposal site in Utah. After dismantling the entire house, EPA found there remained only one and a half bricks that were *not* contaminated with radiation beyond safety levels. Approximately 1,430 tons of contaminated rubble were generated, filling 460 shipping boxes (each with a 90 cubic foot capacity) and 77 tractor trailers.

EPA Addresses Radioactive Soil and Sewer Lines

Contaminated soil was found in an area of nearly 40,000 square feet, at depths ranging from one to 11.5 feet. In addition to the duplex, approximately 4,109 tons of radium-contaminated soil from the property, as well as from six neighboring yards, were excavated and packed into shipping containers for disposal. This was enough to fill 878 metal shipping boxes and to load 212 tractor trailers. The excavations began at the 105/107 property as the dismantlement reached the first floor and continued until after the house was completely removed.

Some 246 feet of sewer line also had to be excavated and replaced. This last phase proved the most difficult, requiring rapid exposure, removal, replacement and re-connection of the East Stratford Avenue sewer line. Finally, 6,776 tons of clean soil were hauled in to backfill all the excavated areas. The former duplex's lot, as well as the six neighboring yards, were regraded and planted with new vegetation. EPA then initiated monitoring, to ensure that cleanup safety levels had been met.

Community Supports EPA Cleanup

The Lansdowne community lent EPA their support and cooperation throughout the process, due largely to a highly personalized approach by Superfund staff. This included regular visits to neighboring homes by EPA staff to inform them of on-going

progress at the site. In addition, EPA staff conducted an active campaign to ensure that the extended community, local governments and the State of Pennsylvania were well-informed about the activities related to the site. Community relations efforts involved public meetings, neighborhood meetings, press conferences, circulation of fact sheets and a tour of the site facilities by Lansdowne officials. To commemorate this accomplishment, EPA held a public ceremony on June 19, 1989.

Site is Deleted from NPL

On September 10, 1991, the Lansdowne site was deleted from the National Priorities List, follow-

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Site Deletion from National Priorities List

Sites may be deleted from the NPL if all appropriate cleanup activities have been implemented. Cleanup activities are considered "complete" when: actions restore ground or surface water quality to a level that assures protection of health and the environment; measures restore ground or surface water to such a point that reductions in contamination concentrations are no longer significant; or ten years have elapsed, whichever occurs first.

If no further cleanup actions are needed, a Superfund site is removed from the NPL. This process requires that EPA provide the state in which the site is located 30 working days to review the deletion notice before its publication in the *Federal Register*. Once the notice is published, the public may respond with comments and new data to refute or support the proposed deletion. Once the final deletion is published, the notice is placed in a local public information repository. To date, 40 Superfund sites have been deleted from the NPL, including Lansdowne.

A Major Excavation

Nearly three-hundred tractor trailers were needed to haul away 1,338 metal shipping boxes containing 5,539 tons of contaminated rubble and soil to a secure radium disposal site in Utah. After totally dismantling the house, EPA found there remained only one and a half bricks that were not contaminated.

Cleanup of "Hot House"

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ing a 30-day public comment period. The EPA determined that its target safety levels had been achieved, and no further actions were deemed necessary. There are no site access or use restrictions in place, and EPA is confident that the former radioactive site now contains "the cleanest dirt in southeastern Pennsylvania."

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Success at Lansdowne

All of EPA's cleanup objectives were met, and the Lansdowne site, which had been contaminated since the 1920s, is now completely safe and unrestricted for future use. The former occupants and their families may now sell the vacant lot, at fair market value, for use as a residential site.

Throughout the cleanup, EPA demanded that the safety of residents and workers came first. With this guiding principle, EPA not only eliminated all future threats posed by the Lansdowne site, but established the first safety guidelines for cleaning up radiation contamination at residential sites.

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