
EXECUTIVE SUMMARY

The Formerly Utilized Sites Remedial Action Program (FUSRAP) was instituted by the Atomic Energy Commission (AEC) in 1974 following authorization by the United States Congress. The objective of FUSRAP is to control radioactive and associated chemical contamination at sites used for the former Manhattan Engineer District (MED) project. Some of these sites were inadvertently contaminated during the process of refining uranium ores and related production processes. The Linde Site was used during the MED project and was designated in 1980 for remedial action under FUSRAP. FUSRAP was transferred to the Department of Energy (DOE) after its creation as one of the two successor agencies to the AEC. In October 1997, management of FUSRAP was transferred from the DOE to the United States Army Corps of Engineers (USACE).

The Linde Site was used from 1942 through 1946 to separate uranium from ores obtained from Colorado and Africa. Five buildings were used in the separation process: Buildings 14, 30, 31, 37, and 38. Building 14 was built by Union Carbide in the mid-1930s, while the others were built by MED. Building 14 was used primarily as a research laboratory and pilot plant to support full-scale production in the rest of the facility.

In October 1995, a categorical exclusion determination under the National Environmental Policy Act was issued for the removal and disposal of radioactive materials from the Linde Site; this determination authorized the removal action in Building 14. The generic guidelines for surface and soil contamination in DOE Order 5400.5 were adopted as the remedial action criteria in conjunction with the site-specific standard of 60 pCi/g for total uranium in soil, which had been established in 1992. In keeping with DOE Order 5400.5, supplemental limits were developed for surface contamination if some areas of contamination could not be adequately decontaminated to the generic guideline levels. Because the remedial action was in progress when FUSRAP was transferred to USACE, the remedial action criteria established under DOE were retained, and the use of DOE orders and guidelines was continued.

The remedial action was initiated in 1996 under a work instruction developed in accordance with FUSRAP project procedures. Delineation was initiated by Bechtel National, Inc. (BNI), the FUSRAP project management contractor to DOE, and Area 20A East was remediated and released by the independent verification contractor (IVC). As the delineation work progressed, it became evident that the extent of contamination was greater than previously expected, so the remediation approach was altered to that of a turnkey remedial subcontract. IDM, Inc. was contracted to handle most facets of the remedial action under the supervision of BNI. The scope of work of both the work instruction and the IDM contract was restricted to interior surfaces of Building 14 and subsurface soil within the footprint of Building 14 as it existed during MED operations.

The remedial action by IDM was initiated in January 1997. The work was completed and equipment and personnel demobilized in August 1998. The principal elements of the subcontractor's work were the delineation surveys and sampling, remedial activities, and verification surveys and sampling. The subcontractor was also responsible for waste management, area restoration, and implementation of the project radiological protection and health and safety plans. A notable exception to their responsibilities was the disposal of radiological and mixed waste. Wastes of these types were turned over to BNI for disposal with other stockpiled radiological waste.

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Building 14 is a large building with a footprint of about 210 feet by 220 feet. It is a single-story structure except for a partial second floor of offices on the west side. The building has three roof levels of 18 feet on the west side, 30 feet on the east side, and 55 feet in the high bay in the southeastern corner. The exterior walls are composed of three courses of brick. Some of the rooms are joined in groups identified as areas, and building remediation proceeded from area to area. Within each area, the work progressed in the same sequence: preparation, delineation, remediation, verification, and restoration. This sequence of initiating and completing work in an area before progressing to a new area was necessary to minimize impact on the tenant, who continued to occupy and use the building during the remedial action. It also facilitated the inspection and release of each area by the IVC before any restoration activities. However, at times work was conducted in several areas simultaneously by separate crews to expedite the process and maximize the use of equipment and personnel.

The major areas where the remedial action was conducted included Areas 2 and 3; Area 4; the Large Hallway; the First Floor Offices and Small Hallway; the Second Floor; Areas 8, 10, and 11; the Corridor; Area 9; Areas 12 and 13; Area 14 North; Area 14 South; Area 15; Area 20A West; Area 20A East; and Area 21. Area 21 is now located outside the footprint of the building walls, but during MED operations it was enclosed within an attached room and therefore was included within the scope of this remedial action. Area 20A East was remediated by BNI before involvement by IDM. Two other elements of the remedial action, a process piping survey and a radon survey, were conducted building-wide.

The results of the investigation can be summarized as follows. The most elevated levels and greatest extent of surface and soil contamination were found in Areas 12, 13, 14 North, and 14 South. These areas were a single contiguous room during MED operations and are believed to have housed ore digestion vats and other processing equipment. The surface contamination found in these areas is probably the result of acidic mist from the ore digestion process and the aerial deposition of ore dust. Subsurface soil contamination in these areas appears to be the result of leaks of process fluids through floor cracks and wall/floor joints. Moderate to extensive levels of surface contamination were found in the Corridor and Area 9. The remaining areas typically contained lower levels of contamination over less extensive surface areas. Structural steel beams in the overheads and along the walls, and in some areas the crane rails and crane assemblies, tended to have the most elevated and extensive areas of contamination. Significant areas of the concrete floors were also contaminated but at lower levels than the steel. The brick walls were the least contaminated surfaces, and contamination was often localized around contaminated sections of adjoining floor surfaces or steel beams. Several pits or sumps were contaminated and remediated or removed, including the Steam Return Pit in the Corridor, the Cylinder Test Pit in the Large Hallway, and the Settling Basins in Area 21. Delineation of subsurface or in-bed drainlines suggested that parts of the existing drainline system could be contaminated in excess of generic guidelines.

The contamination found in the building is summarized in Table ES-1, which is organized by building area and surface. Locations where residual contamination exceeds the remedial action criteria are shown in bold type.

After IDM completed remediation and verification surveying and sampling in each area, the IVC conducted its own investigation of the surfaces and subsurface soil. The IVC reviewed the contractor data, performed additional surveys, and collected additional soil samples as needed to provide an adequate basis for determining whether an area met the remedial action criteria. On occasion, the IVC identified minor areas of residual contamination, and additional decontamination and verification surveys were performed in those

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areas. Once sufficient information was available to demonstrate that an area met applicable criteria, the IVC issued a letter to serve as a preliminary evaluation of the remedial action and to provide a basis for deciding whether to initiate restoration activities. The IVC will issue its own report documenting its inspections and recommendations at a later date.

A number of locations were identified where residual contamination exceeding the remedial action criteria remained after decontamination efforts. These locations occur in Areas 9, 12, 13, 14 North, 14 South, 15, 20A East, and 21. Contamination exceeding the criteria was left in place only after all best efforts at decontamination were made and the criteria for supplemental limits were carefully evaluated. These locations fall into several categories. The first category includes areas of soils underlying building walls in Areas 12, 13, 14 North, and 14 South where further removal would undermine the walls and place the structural integrity of the building at risk. A second type, which occurred at five locations in Area 14 South, is on the sill of a beam adjacent to walls where limited access by remediation equipment prevented complete decontamination. Similarly, on the crane rails in Areas 12, 13, and 14 North, restricted access prevented full decontamination around bolt heads. Four floor locations in Areas 9, 14 South, and 15 were inaccessible because of the presence of large equipment. Based on data from surrounding floor measurements, these locations were estimated to exceed guidelines. Interior wall contamination exceeding remedial action criteria in the south wall of Area 14 South was discovered. Several subsurface drainpipes in Area 9, the Area 12 stairwell sump, Area 20A East, and the existing in-bed drainline system contained contamination exceeding remedial action criteria that was left in place. This determination was based on survey measurements obtained at locations where drainlines were exposed during remediation of sumps or pipes. Portions of the drainline were removed during the remedial action, but most of the potentially contaminated drainline system remains in place.

Through an extensive delineation phase and review of previously collected delineation data, the remedial action in Building 14 identified, with a high degree of confidence, interior surface and subsurface locations within the building footprint that exceeded the remedial action criteria. These surfaces, subsurface features, and subsurface soils were successfully decontaminated or removed during the remediation phase except for some clearly identified locations. Contamination in locations that could not be adequately remediated, or where removal would compromise the structural integrity of the building, was left in place and fully documented.

Table ES-1 (Page 1 of 2)
Summary of Contamination in Building 14

Area	Floors^a	Ceiling/Overheads^a	Walls^a	Soil^a	Other^a
Areas 2 and 3	Minor contamination	Several pipes and a steam valve contaminated	Lower walls (<1 meter), north wall footer contaminated	Not contaminated	Drains not contaminated
Area 4	Entire floor contaminated	One pipe contaminated	Bottom 1 foot contaminated around all rooms	Not contaminated	None
Large Hallway	Entire floor contaminated	Two pipes/conduits contaminated	Entire south wall contaminated. Footer at east end of south wall contaminated 3 feet below grade. Contaminated brick removed at base of south wall – center	Not contaminated	East trench and soil removed. Cylinder Test Pit decontaminated and underlying/adjacent soil removed. Drainpipe at north end of Cylinder Test Pit removed.
First Floor Offices and Small Hallway	Marginal contamination with hotspot in hallway	Not contaminated	Two locations at base of wall contaminated	Not contaminated	None
Second Floor	Not contaminated	Majority of steel contaminated	Minor contamination only next to beams	Not applicable	Steel tank stand in HVAC room contaminated
Areas 8, 10, and 11	Contaminated along some wall edges, several larger areas	One steam valve contaminated	Only lower one foot where floor contamination present	Not contaminated	Some sediment removed from trench and one section of trench decontaminated.
Corridor	Floor and floor cracks widely contaminated	Steel highly contaminated, creteplank moderately contaminated; over entire area	North wall: lower brick, steel contaminated. West wall: all steel, half of brick contaminated. East wall: steel contaminated.	Not contaminated	Steam Return Pit decontaminated. Drainpipe at north end of C Steam Return Pit removed.
Area 9	Most of floor contaminated. Surface under two fumehoods above guidelines	All steel but no creteplank contaminated	Wall in room 9B removed, one spot on south wall contaminated.	Not contaminated except around trenches	Drainpipe at south end removed; section left in place at west end above guidelines. Contaminated trench network removed. Drainpipe under fumehood suspected to be above guidelines.
Areas 12 and 13	Floor contaminated	Some steel contaminated Center crane rail bolts above guidelines	Minor contamination on north, south, east walls. West wall footer highly contaminated above/below grade.	Contaminated soil removed to 1 to 4 foot depth; left in place under west, south center walls.	Trenches and subgrade concrete pedestal removed. Stairwell and sump contaminated. North sump drainpipe contaminated above guidelines.

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**Table ES-1 (Page 2 of 2)
Summary of Contamination in Building 14**

Area	Floors ^a	Ceiling/Overheads ^a	Walls ^a	Soil ^a	Other ^a
Area 14 North	Some contamination, floor removed	All steel but no creteplank contaminated. Center, east crane rail bolts above guidelines	Steel on east, west walls contaminated. Minor brick contamination on all walls. West wall footer above guidelines.	All soil contaminated and removed to 2 to 4 feet below grade. Soil above criteria left in place under north wall.	Trenches, sumps removed. Subgrade concrete pedestals contaminated and removed or decontaminated.
Area 14 South	Some floor removed, moderate contamination. Floor under column above guidelines.	All steel beams, crane, and crane rails contaminated. Creteplank not contaminated.	All steel on walls contaminated, minor brick contamination. Five beam locations above guidelines. South wall footer and interior brick above criteria.	Soil in west part removed to 2 to 4 feet below grade.	Footer under west wall above guidelines.
Area 15	Moderate contamination over one half of floor. Floor under large tank above guidelines.	All steel beams, crane contaminated	Vertical beams contaminated, minor brick contamination.	Not contaminated	Cable pit lip on east wall contaminated. Hidden steel beam in east wall severely contaminated.
Area 20A West	Not contaminated	Minor steel and adjacent brick contamination	Not contaminated	Not contaminated	Contaminated east-west trench was decontaminated in-place.
Area 20A East	Minor contamination near north, east walls	Only an overhead electrical unit contaminated	Minor contamination found at wall/floor interface and on electrical boxes.	Not contaminated	Contaminated east-west trench was removed. North-south pipe contaminated above guidelines left in place.
Area 21	Minor contamination adjacent to south building wall	Not contaminated	Minor contamination on south building wall	Not contaminated	Contaminated surface of settling basin concrete was removed. One section of concrete under pipes left in place, above guidelines. Pipe stand and valve removed.
Process Piping	Not applicable	Not applicable	Not applicable	Not applicable	External and internal piping and ducts were contaminated in some areas; all were removed or decontaminated.
Radon Survey	Not applicable	Not applicable	Not applicable	Not applicable	Air measurements all below guidelines
In-Bed Drainlines	Not applicable	Not applicable	Not applicable	Not applicable	Trench drainline system assumed to be contaminated above criteria based on delineation of system endpoints.

Notes:

a Bold type indicates a location where residual contamination remains in excess of the remedial action criteria.