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Section 5

## SUMMARY AND CONCLUSIONS

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### 5.1 SUMMARY OF WORK PERFORMED

This section provides a summary of the remedial action in Building 14. The delineation and remedial activities as they occurred in each area of the building are summarized, as are building-wide activities such as the radon or process piping surveys.

#### 5.1.1 Scope and Objective

The remedial action in Building 14 was conducted under the authority of a categorical exclusion in accordance with the National Environmental Policy Act. This categorical exclusion permits the removal action to proceed without the preparation of an environmental assessment or environmental impact statement.

The scope of the work was limited to the interior surfaces of the building and subsurface soils within the footprint of the building and focused on MED-generated radiological and chemical contamination. The generic guidelines in DOE Order 5400.5 for surface and soil contamination were used as the remedial action levels. Site-specific criteria for soil were developed and used in conjunction with the generic guidelines. As authorized under DOE Order 5400.5, supplemental limits were developed for areas where it was not practical to meet the generic guidelines or site-specific criteria. These guidelines and criteria were developed to ensure that personnel working in the building would not receive radiation doses beyond an acceptable level.

This post-remedial action report documents as completely as possible the activities conducted during the remedial action and to presents the post-remedial verification data of the building surfaces and subsurface soil. Those locations where the generic guideline or site-specific criteria could not be achieved are identified and extensively documented.

#### 5.1.2 Methodologies and Work Execution

Standard industrial techniques appropriate for this type of work and consistent with FUSRAP procedures were used during the remedial action for the radiological surveys and decontamination efforts.

Grids were established on 1-meter centers for the delineation and verification surveys of all floors, ceilings, and walls. Delineation scan surveys were performed using a large area gas flow detector and a Geiger-Mueller (G-M) pancake detector. For delineation surveys, 1-minute point measurements were taken for direct  $\alpha$  and  $\beta/\gamma$  activity at biased locations. Delineation surveys included the same measurements taken on a systematic basis. Swipe samples were collected to evaluate the presence of removable contamination. Samples of soil and other solid material were collected and analyzed by gamma spectroscopy using a high-purity germanium detector.

The building was decontaminated with conventional equipment and tools. Blastrac shot blasting machines were the primary tool used to decontaminate concrete floor surfaces, and sponge blast equipment was widely used to decontaminate steel and brick surfaces. Hand-operated tools such as grinders, wire wheels, needle guns, and jackhammers were used where appropriate. Large volumes

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of soil were removed with backhoes and other earthmoving equipment, while hand tools were used for small volumes and areas with restricted access.

Contaminant control measures and monitoring were also used to ensure compliance with applicable laws and regulations, to prevent the accidental spread of contamination, and to ensure the protection of workers' health.

### 5.1.3 Description of Delineation and Remedial Activities

This section provides a concise summary of the delineation and remedial activities conducted within each area. Locations are noted where residual surface contamination or soil contamination left in place exceeded the generic surface guidelines or site-specific soil criteria. These locations are shown in Figure 5-1 and summarized in Table 5-1.

#### 5.1.3.1 Areas 2 and 3

Areas 2 and 3 are believed to have been used as storage in support of laboratory operations and also contained restrooms in the western portion. Portions of the floor contaminated above criteria were decontaminated. No contamination was found in the subsurface soil and floor drains. The lower walls (1 meter above the floor) were generally contaminated, and limited contamination was found on the upper north wall. The walls were decontaminated, including the latter location where soil was removed to a depth of 3 feet to permit access to the wall footer. Delineation of the overheads showed limited contamination of several pipes and a steam valve. The contaminated structures were either removed (i.e., the pipe insulation or steam valve) or decontaminated.

#### 5.1.3.2 Area 4

Area 4 is split into several rooms: the western half is identified in this report as Area 4-Main, and two smaller rooms on the east end as Areas 4A and 4B. Area 4 appears to have been used as an ore preparation room. The entire floor was found to be contaminated, so the floor tiles were removed and the concrete floor surface decontaminated. Soil borings were drilled to investigate the subsurface soil, which was all found to be below the site-specific soil criteria. Delineation of the overhead surfaces identified only a steel pipe located in the south end of the wall dividing Areas 4-Main and 4B. The surface of the pipe was decontaminated. Contamination on the walls was limited to the lower 1 foot, or less, next to the floor and extended uniformly around the rooms.

#### 5.1.3.3 Large Hallway

The Large Hallway is located south of Area 9. Currently there is a wall dividing Area 9 and the Large Hallway, but historical drawings suggest that it was not present during MED operations. The concrete floor was surveyed by removing the floor tiles. The areas under the tiles were found to exceed surface guidelines, so the entire floor was decontaminated. A trench and adjoining soil in the east end of the hallway were found to be contaminated and were removed. Soil was removed adjacent to the south wall at the east end to permit access to the wall footer but, except for the limited amount of that soil immediately adjacent to the wall, that soil was generally within the site-specific criteria. A pit, identified as the Cylinder Test Pit, was located near the west end of the hallway. The walls of the pit were remediated by removing several inches of concrete. The concrete bottom was removed entirely, and about 6 inches of underlying soil was excavated. Soil

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on either side of the pit was removed to a depth of about 1 foot and over a 1 to 2 foot width. A drainpipe connected to the northwest corner of the pipe was removed, along with a minimal amount of adjoining soil, from within the pit. Soil borings installed over the remainder of the hallway indicated no additional soil contamination. Overhead contamination was limited to a conduit and an insulated pipe, which were readily decontaminated. The south wall was found to be widely contaminated above guidelines and therefore was completely decontaminated. Several layers of brick were removed from the base of the south wall towards the middle, and the east end of the south wall footer was decontaminated to 3 feet below grade. The only additional wall contamination noted was at the north floor/wall interface.

### 5.1.3.4 First Floor Offices and Small Hallway

The first floor offices are located along the west side of the building. This area includes the stairwells, restrooms, locker rooms, and the small hallway that divides the offices from Area 9. These offices appear to have been constructed at the same time as the rest of the building. The floors are contaminated marginally above criteria within the offices and along the east wall of the small hallway. These floor areas and a small hotspot area in the hallway were decontaminated. The soil beneath the floor was thoroughly investigated and found to be below criteria. No remediation of soil or other subsurface features was required. The ceiling and walls did not require remediation other than two small sections of the lower walls at the north end and next to the floor hotspot in the hallway.

### 5.1.3.5 Second Floor

The second floor consists of offices and the former HVAC room and is constructed above the first floor offices on the west side of the building. The floors were found to be below surface guidelines as was most of the walls. A large area of the overhead structural steel was contaminated with the higher levels on the east and north sides. The steel was fully decontaminated, as were localized sections of the wall where the steel joined the wall. A tank stand made of steel beams located in the HVAC room also required decontamination.

### 5.1.3.6 Areas 8, 10, and 11

These areas were used as laboratory support areas for the larger production bays. Floor contamination was limited primarily to areas along the walls and several larger areas at the south end; these areas were fully decontaminated. Investigation of the subsurface soil did not reveal any contamination. Some sediment was removed from the trenches, and one section of trench was decontaminated. No contamination was detected in the overheads, except for a steam valve, which was decontaminated. The lower 1 foot of the walls was routinely decontaminated wherever adjacent floor contamination was detected, but no further contamination was detected at higher elevations or at other locations.

### 5.1.3.7 Corridor

The corridor is located west of Area 12. The east wall of the corridor is of post-MED construction, which accounts for the higher levels and greater extent of contamination found in the corridor. The floors and floor cracks were extensively contaminated and fully remediated. The investigation of the subsurface soil did not reveal any contamination. The steam return pit was decontaminated by removing several inches of concrete and was then rebuilt. A drainline leading

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from the pit to the in-bed drainline system was investigated, and the 4-foot length adjacent to the pit was removed. The remaining portion was delineated and plugged with concrete. Both the structural steel and creteplank ceiling were widely contaminated, but the creteplank was contaminated at lower levels than the steel. Both the steel and creteplank were successfully decontaminated to below criteria, although certain areas of the steel required multiple passes and highly aggressive techniques. The north wall required decontamination on the lower 1 meter of the brick and on the structural steel, metal piping, and doorframe. The south wall appeared to be of post-MED construction, and all survey results were within background levels. The east wall was also of post-MED construction, and only the structural steel required decontamination. On the east wall, all of the structural steel and about half of the brick surface were decontaminated.

### 5.1.3.8 Area 9

Area 9 was used during MED operations as part of the main ore processing areas within the building. The floor tiles were removed and the concrete floor slab decontaminated over the entire area. Two large banks of fume hoods along the west wall were not moved, and the floor area underneath them was designated as locations exceeding remedial action criteria.

A network of abandoned trenches in the area had been filled with sand, a drainpipe in it had been abandoned in place, and the trenches had been overpoured with concrete. The concrete surfaces of these trenches exceeded guidelines, so the entire trench network and adjacent soil were removed.

A drainpipe in the south end of the area was removed except for a short section left in place because it could not be removed from the concrete encasing it without risking damage to the wall. This pipe segment is designated as a location exceeding remedial action criteria. A contaminated floor drain underneath one of the two above-mentioned fume hoods was removed, but the receiving pipe was not delineated. This pipe was assumed to be contaminated based on the survey measurements of the floor drain and was designated as a location exceeding remedial action criteria. A series of soil borings drilled into the subsurface demonstrated that the remainder of the soil is below the generic and site-specific soil criteria. The overhead structural steel was decontaminated over the entire ceiling area, but the creteplank did not require decontamination. Delineation of the walls revealed only two areas requiring decontamination in Room 9B: an area where a portion of the north wall was removed, and a spot on the south wall of the main room.

### 5.1.3.9 Areas 12 and 13

Areas 12 and 13 appear to have housed large process vessels that may have been used to digest the uranium ore. The floor of this area is about 4 feet beneath that of the adjacent corridor and Area 9. Delineation data showed that much of the floor was contaminated, but nearly all of the concrete floor slab was removed to allow the underlying soil to be excavated. About 1 foot of the slab was left in place next to the south, east, and center walls to provide structural support. These remaining sections of floor were decontaminated.

The soil was excavated to a depth of 4 feet in Area 12 and to a depth of 1 to 4 feet in Area 13. Soil exceeding criteria was left in place underneath the west knee wall, south wall, and center walls. These segments of soil have been identified as locations exceeding remedial action criteria. The soil underneath the east wall of Area 13 was below criteria. Several trenches and a pedestal in

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the areas were removed, and the trenches were replaced. Portions of the overhead structural steel were decontaminated. The north, east, and south walls required only minimal decontamination. The footer of the west wall, beginning about 4 feet above the slab and extending below grade to the horizontal concrete slab housing the electrical conduit, was extensively decontaminated and required the removal of at least several inches of concrete.

The crane rails showed evidence of contamination similar to the overhead structural steel, most of which was decontaminated to below guidelines. On the center crane rails (the east crane rail in Area 12 and west crane rail in Area 13), the area around the steel bolts connecting the crane rails to cross members could not be decontaminated to levels below the guidelines; these areas are therefore designated as locations exceeding remedial action criteria. In a stairwell in Area 12 leading to the utility tunnel, parts of the floor, walls, and stairs and a sump at the base of the tunnel were decontaminated. A drainpipe leading from the sump to the tunnel was surveyed and identified as exceeding surface guidelines; this drainline was designated as a location exceeding remedial action criteria.

### 5.1.3.10 Area 14 North

Area 14 North was used for ore digestion during MED operations in a common area that also included Areas 12, 13, and 14 South. The north wall of Area 14 North was built after the conclusion of MED operations and was only marginally contaminated. Most of the concrete floor slab was removed to allow excavation of the subsurface soil. Several feet of the concrete slab and the underlying soil were left in place next to the west and north walls to provide structural support. This remaining floor was decontaminated. The soil was excavated over the entire area to depths ranging from 2 feet on the east side to 4 feet on the west side. In several locations, soil exceeding site-specific criteria was left in place underneath the north wall. Several sections of the west knee wall below grade also exceeded generic surface guidelines after decontamination. Several trenches and sumps were removed and replaced, and subgrade concrete pedestals were decontaminated or removed.

The structural steel in the overheads exceeded criteria over most of the area and was fully decontaminated, but the creteplank ceiling required no remediation. The center and east crane rails were decontaminated, but residual levels around the bolts joining the crane rails to the cross members exceeded generic surface guidelines. Contamination on the walls was primarily limited to the structural steel with minimal brick contamination. All elevated areas were remediated.

### 5.1.3.11 Area 14 South

Area 14 South was used for ore digestion during MED operations in a common area that included Areas 12, 13, and 14 North. Slightly more than half of the floor on the west side was removed primarily to permit access to the soil. Some additional floor areas were decontaminated. The floor underneath one process column could not be accessed and, based on estimated activities, was designated as locations exceeding remedial action criteria. The soil was removed over the western half to depths of 2 to 4 feet. Minor amounts of soil and concrete surface of the knee wall that exceeded site-specific criteria and generic surface guidelines were left in place underneath the knee wall. Several sumps were removed and replaced.

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The structural steel throughout the overheads, in the crane rails and crane assembly, and along the walls was widely contaminated. The steel was decontaminated to below generic surface guidelines except for five inaccessible beam locations adjacent to the walls. Brick contamination on the walls was relatively minor and readily decontaminated. Contamination was found inside the south brick wall at several locations, including along the footer/brick wall interface and within a bricked-over window. Based on these findings, three locations on the south wall were identified as exceeding remedial action criteria.

### 5.1.3.12 Area 15

Area 15, on the east side of the building, was apparently used to prepare uranium ore for processing during MED operations. About one third of the floor in Area 15 required decontamination. The floor underneath the large tank near the south end was inaccessible but was estimated to exceed generic surface guidelines. The cable pit on the east wall was contaminated, and the metal lip supporting the lid contained rust exceeding criteria and was decontaminated. The subsurface soil was investigated by drilling a series of soil borings, but no soil contamination was encountered. The structural steel in the ceilings and crane rails required decontamination, as did the vertical beams next to the walls. A steel beam in the header over a walkway from Area 15 to Area 15B-1 was severely contaminated and required extensive remedial efforts to reduce the contamination to below guidelines.

### 5.1.3.13 Area 20A West

Area 20A West contained a pinch-roll press for processing ore during MED operations. Delineation efforts showed that no contamination was present above applicable guidelines and criteria on the floor or in the subsurface soil. The east-west trench required decontamination as did minor parts of the overhead steel beams/brick wall interface along the west wall.

### 5.1.3.14 Area 20A East, 20B, 20B-1, and 20C

These areas are believed to have housed furnaces used to calcine the acid leach cake generated elsewhere in the building. The areas were delineated and remediated in 1996. Floor contamination was detected and removed in two small areas along the north wall and in the southeast corner. A trench running east to west through the center of the area was removed, and a subsurface pipe near the trench was detected and investigated. The interior of the pipe exceeded the remedial action criteria. Minor contamination was found on the wall in association with the floor contamination, and several electrical panels or units on the west wall or in the overhead were found to be contaminated and were removed. The overheads were otherwise below surface guidelines.

### 5.1.3.15 Area 21

Area 21 contained a former settling basin used during MED operations to receive and treat drainage from the trench system within the building. The settling basin had since been filled in with rock and soil and paved over. The basin was excavated, and the surface of the walls and floor was found to be contaminated. The concrete structure was broken up and most of it removed along with the minimal amount of soil necessary to permit the excavation. A small section of the concrete floor set on a packed rock bedding, supporting some waterpipes encased in concrete, was left in place. The remaining concrete surface is believed to exceed surface criteria based on levels

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of contamination found on adjacent concrete. A pipe valve stand and valve north of the basin were removed, and minor decontamination was conducted on the north wall and ground surface next to the wall.

### 5.1.3.16 Process Piping

A separate cohesive investigation of the process piping in Building 14 was performed independent of the individual area delineation and remedial activities. The surveyed systems include heating and ventilation systems, electrical conduits, water lines, steam lines, and gas lines (e.g., nitrogen). External and internal contamination was removed at all locations where it was detected, and no locations were left that exceeded the generic surface guidelines.

### 5.1.3.17 Radon Survey

A sampling program for radon was implemented within the building to demonstrate compliance with the DOE regulations (Order 5400.5) regarding airborne concentrations of radon decay products. Sample results for all monitoring locations were well below the applicable guidelines.

### 5.1.3.18 In-Bed Drainlines

Several drainline systems are known to exist in the subsurface beneath Building 14 and receive flow from the trenches, sumps, roof, and restrooms within the building. The drainlines were encountered in multiple areas during the remedial activities, typically where a sump or trench was being investigated. Delineation information obtained at these locations suggested that at least portions of the drainlines were contaminated, but further investigation was impractical because of obstructions within the lines and the lack of usable access points. Some segments of the drainlines were removed where possible, and the remaining drainline segments are designated as potentially exceeding the remedial action criteria.

## 5.2 SUMMARY OF RESULTS

This section presents a brief discussion of the results of the remedial action. Since the purpose of the remedial action was to reduce contamination to below applicable criteria, rather than to conduct a stand-alone characterization of the building, the delineation data are not discussed here.

### 5.2.1 Verification Surveys and Samples

Following completion of the remedial activities, IDM conducted verification surveys on the floors, walls, and ceiling throughout each area. Structural steel beams were normally included as part of the wall or ceiling surveys, and shallow trenches were included as part of the floor surveys. Additional features that were distinct from these surfaces and verified separately included crane rails and crane platforms, and vertical beams and beam footers within the interior portion of an area. On several occasions during field verification activities, the IVC identified locations requiring additional decontamination. This work was performed and a post-IVC verification survey conducted by IDM in these locations. These verification data then superseded existing data at these locations.

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These surveys included direct  $\alpha$  and  $\beta\gamma$  activity measurements and swipe samples analyzed for removable  $\alpha$  and  $\beta\gamma$  activity. These data are presented in Section 4 of this report in figures for each surface within each area of the building. The size of the data set does not permit a graphical presentation in a summary format within this section, but it can simply be noted that, except for the supplemental limit locations, all surface verification measurements were below the DOE Order 5400.5 generic guidelines of 5,000 dpm/100 cm<sup>2</sup> for average fixed contamination and 1,000 dpm/100 cm<sup>2</sup> for removable contamination. The supplemental limit locations are discussed in the following section.

At locations where soil exceeded the site-specific criteria, verification samples were collected from the base of the excavation. The results of these samples are presented in tables in Section 4 and demonstrate that remaining soil did not exceed the site-specific criterion of 60 pCi/g of total uranium or the generic guidelines of 5 or 15 pCi/g (as described in Section 2) for radium-226, radium-228, thorium-230, and thorium-232. At locations where soil exceeding the site-specific criteria was left in place, samples were collected to characterize the remaining soil. Those sample results are also reported in Section 4, but those samples are not considered verification samples.

### 5.2.2 Locations Exceeding Remedial Action Criteria

DOE Order 5400.5 states that under certain circumstances, guidelines or authorized limits established for a given property may not be appropriate and therefore supplemental limits or an exception may be requested. Before the start of remedial activities, the potential need for supplemental limits was identified because some remedial efforts could be prohibitively expensive, difficult to implement, or disruptive of operations within the building. Supplemental limits were therefore developed for the remedial action, as discussed in Section 2.

Throughout the remedial action, every effort was made to remediate surfaces and soils to within the applicable guidelines and criteria. Whenever guidelines or criteria could not be met, a best effort was made to reduce the contamination levels as much as possible in keeping with the ALARA approach. Those areas were then identified and documented. These locations are summarized in Table 5-1 and their locations within Building 14 shown in Figure 5-1.

### 5.3 COST

The total cost for this remedial action was \$5,765,000. The work performed and reflected in this total includes all delineation, remediation, verification, and restoration activities.

### 5.4 CONCLUSIONS

The interior surfaces and subsurface soils of Building 14 were extensively delineated and decontaminated during the remedial action. Except for locations specifically identified, as discussed in the previous section, all surfaces and subsurface soils were successfully remediated to meet the DOE generic guidelines and site-specific criteria. All areas exceeding these remedial action guidelines have been clearly identified. Residual contamination in excess of the remedial action criteria was left in place only after evaluating all remedial options and attempting to remediate to the extent possible in keeping with ALARA principles.

**Table 5-1 (Page 1 of 5)  
Summary of Locations Exceeding Remedial Action Criteria**

Location No. (Area)	Description <sup>a</sup>	Rationale for Residual Contamination Exceeding Criteria
<p><b>LEC-B14-1</b> (Building 14 subsurface)</p>	<p><b>IN-BED DRAINLINES.</b> <u>Description:</u> Includes an estimated 543 linear feet of the trench drainline system left in place (191 feet were removed) beneath Building 14. The drainlines were delineated at seven locations where exposed and limited remedial actions were taken on certain sections. Drainlines are estimated to be up to 8 feet below grade and pass underneath load-bearing walls. <u>Remedial Actions:</u> Exposed sections of drainline were removed or plugged in the Area 12 stairwell, the Corridor, Area 9 and the Large Hallway. <u>Contamination Levels:</u> Direct <math>\beta\gamma</math> activity measurements ranged from 5,480 to 160,000 dpm/100 cm<sup>2</sup> in the accessible sections. <u>Data References:</u> IDM Surveys 217, 373, 403, 687, 747, 1040, and 1670. IDM Sample 268.</p>	<p>Contaminated drainlines are inaccessible and remediation not cost-effective.</p>
<p><b>LEC-9-1</b> <b>LEC-9-2</b> (Area 9)</p>	<p><b>FLOOR UNDERNEATH FUME HOODS.</b> <u>Description:</u> Floor under two banks of fume hoods near the east wall. Each fume hood covers an area of about 2 m by 5 m or about 107 square feet for a total of 214 square feet. <u>Remedial Actions:</u> Floor inaccessible except in the northeast corner, which were decontaminated and a drain removed and plugged. <u>Contamination Levels:</u> Adjacent concrete direct <math>\beta\gamma</math> activity — 15,620 to 19,015 dpm/100 cm<sup>2</sup> — was assumed representative of fume hood floor. <u>Data References:</u> IDM Surveys 1032 and 1033.</p>	<p>Floor inaccessible without removal of fume hoods. Estimated cost was ~\$250,000.</p>
<p><b>LEC-9-3</b> (Area 9)</p>	<p><b>DRAINPIPE.</b> <u>Description:</u> A 10-foot-long section of a 4-inch-diameter cast iron drainpipe was left in place. Pipe was encased in concrete block which went underneath the south wall of Area 9. Pipe appears to be MED-era drainpipe from Linde drawing A63726. <u>Remedial Actions:</u> The remainder of the drainpipe and surrounding soil was removed up to the eastern wall. <u>Contamination Levels:</u> Direct <math>\beta\gamma</math> activity was 21,000 to 73,000 dpm/100 cm<sup>2</sup> at west end of drainpipe. <u>Data References:</u> IDM Survey 1500.</p>	<p>Removal of remaining drainpipe and subgrade concrete block would affect the structural integrity of the south wall.</p>
<p><b>LEC-9-4</b> (Area 9)</p>	<p><b>DRAINPIPE.</b> <u>Description:</u> A drainpipe is present underneath the fume hood designated at LEC-9-1. The pipe is presumed contaminated based on the connecting contaminated floor drain removed from underneath the northeast corner of this fume hood. The direction of the pipe run is believed to be north-to-south but could not be confirmed. <u>Remedial Actions:</u> The floor underneath the northeast corner of the fume hood, the only part accessible, was decontaminated and a floor drain removed as part of the floor decontamination. The drain passed through an elbow beyond which the drainpipe could not be observed. No further remedial action was taken on the elbow or drainpipe. <u>Contamination Levels:</u> A direct <math>\beta\gamma</math> measurement taken on the floor drain showed activity at 21,000 dpm/100 cm<sup>2</sup>. <u>Data References:</u> IDM Survey 1670.</p>	<p>Removal of the drainpipe would require removal of the fume hoods which has already been deemed not cost-effective.</p>

Location No. (Area)	Description <sup>a</sup>	Rationale for Residual Contamination Exceeding Criteria
<b>LEC-12/13-1</b> <b>LEC-12/13-2</b> (Areas 12/13)	<p><b>SOIL UNDERNEATH WEST WALL.</b> <u>Description:</u> Soil was left underneath the horizontal concrete slab which encases the electrical conduit down to the base of the excavation and back to the concrete footer supporting the west wall. LEC-12/13-1 is estimated to be 18 feet long by 1 foot wide by 1.5 feet deep for a total volume of 27 cubic feet. LEC-12/13-2 is estimated to be 24.5 feet long by 1 foot wide by 1.5 feet deep for a total volume of 37 cubic feet. <u>Remedial Action:</u> The adjacent soil in Area 12 was excavated to a depth of 4 feet. Soil was excavated in spots beneath the horizontal slab. <u>Contamination Levels:</u> Soil samples collected underneath the horizontal slab had total uranium activities ranging from 35.83 to 17,910 pCi/g. <u>Data References:</u> IDM Survey 3001. IDM Samples 344, 346, 352, 357, 365, 417, and 429.</p>	Removal would compromise the structural integrity of the building.
<b>LEC-12/13-3</b> <b>LEC-12/13-4</b> (Areas 12/13)	<p><b>SOIL UNDERNEATH CENTER WALL.</b> <u>Description:</u> Soil was left underneath the center wall dividing Areas 12 and 13 extending out 1 foot from each side. LEC-12/13-3 is estimated to be 16 feet long by 2.5 feet wide by 1 foot deep for a total volume of 41 cubic feet. LEC-12/13-4 is estimated to have the same dimensions for a total volume of 41 cubic feet. <u>Remedial Action:</u> Soil was excavated on both sides of the walls up to within a foot of either side. The soil on the Area 12 side was removed to a depth of about 4 feet and on the Area 13 side to a depth of about 3 feet. <u>Contamination Levels:</u> Eight samples were collected from the sides of the walls containing total uranium activities of 8 to 4,297 pCi/g. <u>Data References:</u> IDM Surveys 3002 and 3003. IDM Samples 338, 345, 350, 354, 355, 356, 359, 364, 366, 411, 412 and 418.</p>	Removal would compromise the structural integrity of the building.
<b>LEC-12/13-5</b> <b>LEC-12/13-6</b> (Areas 12/13)	<p><b>SOIL UNDERNEATH SOUTH WALL.</b> <u>Description:</u> Soil was left underneath the south wall of Areas 12 and 13 extending out 1 foot from each side. LEC-12/13-5 is estimated to be 41 feet long by 2 feet wide by 1 foot deep for a total volume of 82 cubic feet. LEC-12/13-6 is estimated to be 6.5 feet long by 2 feet wide by 1 foot deep for a total volume of 13 cubic feet. <u>Remedial Action:</u> Soil was excavated up to within a foot of the wall. The depth of excavation ranged from 4 feet in Area 12 to 2 feet in Area 13. <u>Contamination Levels:</u> Seven samples collected from the sides of the excavation contained total uranium concentrations of 38 to 3,614 pCi/g. <u>Data References:</u> IDM Surveys 3004 and 3005. IDM Samples 337, 353, 360, 362, 363, 367, and 368.</p>	Removal would compromise the structural integrity of the building.
<b>LEC-12/13-7</b> (Areas 12/13)	<p><b>STAIRWELL SUMP NORTH DRAINLINE.</b> <u>Description:</u> This drainline connects the sump at the base of the stairwell to the trench in the utility tunnel to the north. The drainline is about ten feet long. <u>Remedial Action:</u> The sump floor and walls were decontaminated and rebuilt. The drainline was not decontaminated. <u>Contamination Levels:</u> Direct <math>\beta\gamma</math> activity within the drainline ranged from 9,600 up to 54,000 dpm/100 cm<sup>2</sup>. A sample of scale material removed from the pipe contained total uranium at 6,573 pCi/g. <u>Data References:</u> IDM Surveys 810 and 1260. IDM Sample 790.</p>	Conventional decontamination methods judged ineffective. Alternative removal methods destructive or not cost-effective. The potential for recontamination from utility tunnel should be addressed before pipe decontamination is considered.

Location No. (Area)	Description <sup>a</sup>	Rationale for Residual Contamination Exceeding Criteria
<b>LEC-12/13-8</b> <b>LEC-12/13-9</b> (Areas 12/13)	<b>CENTER CRANE RAILS.</b> <u>Description:</u> Channel steel (cross members) connect center crane rails to each other. Area surrounding bolts connecting cross members to the crane rails remains contaminated above surface guidelines following decontamination. Total area estimated at 17 ft <sup>2</sup> . <u>Remedial Action:</u> Crane rails and cross members at these locations were decontaminated repeatedly by sponge blasting. Confined space (2 to 3 inches clearance) prevented decontamination to below guidelines around bolts. <u>Contamination Levels:</u> Post-decontamination direct $\beta\gamma$ activity was 8,300 to 19,000 dpm/100 cm <sup>2</sup> . <u>Data References:</u> IDM Survey 404.	Removal of contamination is not feasible due to inaccessibility with conventional decontamination equipment.
<b>LEC-14N-1</b> <b>LEC-14N-2</b> <b>LEC-14N-3</b> (Area 14N)	<b>WEST KNEE WALL:</b> <u>Description:</u> Concrete on knee wall below grade remains contaminated above criteria. LEC-14N-1 –2 and –3 total 5.5, 1.3, and 0.5 square feet, respectively. <u>Remedial Actions:</u> The knee wall was aggressively decontaminated with only these locations remaining above surface guidelines. <u>Contamination Levels:</u> Direct $\beta\gamma$ activity after decontamination was 600 to 19,062 dpm/100 cm <sup>2</sup> . <u>Data References:</u> IDM Survey 1267.	Further decontamination or removal of the knee wall would affect the structural integrity of the building.
<b>LEC-14N-4</b> <b>LEC-14N-5</b> <b>LEC-14N-6</b> (Area 14N)	<b>SOIL UNDERNEATH NORTH WALL:</b> <u>Description:</u> Soil underlying wall left in place to support wall. LEC-14N-4 comprises 12 ft <sup>3</sup> of ash 4 to 8 inches beneath slab. LEC-14N-5 contains 12 ft <sup>3</sup> of ash and 12 ft <sup>3</sup> of clay soil 4 to 20 inches beneath slab. LEC-14N-6 contains 9 ft <sup>3</sup> of ash 4 to 8 inches beneath slab. <u>Remedial Actions:</u> Concrete floor slab and underlying soil were excavated as close as practical to the wall. <u>Contamination Levels:</u> LEC-14N-5 and -6 at 247 pCi/g total uranium (Sample 877). LEC-14N-4 measured at 14.9 pCi/g total uranium (Sample 876), but contamination on Area 12 side of wall makes this a supplemental limit location. <u>Data References:</u> IDM Samples 876 and 877, IDM Survey 1267.	Further removal of the soil would affect the structural integrity of the building.
<b>LEC-14N-7</b> <b>LEC-14N-8</b> (Area 14N)	<b>CRANE RAIL CROSS MEMBERS:</b> <u>Description:</u> Channel steel (cross members) connect center crane rails to each other and east crane rail to wall. Area surrounding bolts connecting cross members to the crane rails remains contaminated above surface guidelines following decontamination. Total area estimated at 15 ft <sup>2</sup> . <u>Remedial Actions:</u> Crane rails and cross members at these locations were decontaminated repeatedly by sponge blasting. Confined space (2 to 3 inches clearance) prevented decontamination to below guidelines around bolts. <u>Contamination Levels:</u> Post-decontamination direct $\beta\gamma$ activity was 4,600 to 27,000 dpm/100 cm <sup>2</sup> . <u>Data References:</u> IDM Surveys 1131 and 1139.	Removal of contamination is not feasible due to inaccessibility with conventional decontamination equipment.
<b>LEC-14S-1</b> <b>LEC-14S-2</b> (Area 14S)	<b>WEST WALL FOOTER AND SOIL.</b> <u>Description:</u> LEC-14S-1 contains 1 ft <sup>3</sup> of soil beneath the knee wall which exceeds criteria and 2 ft <sup>2</sup> of subgrade knee wall which exceeds guidelines. At LEC-14S-2, 1 ft <sup>2</sup> of knee wall concrete exceeds guidelines. <u>Remedial Actions:</u> Soil was excavated as close to the knee wall as practical and underneath it at some locations, and the concrete surface was aggressively decontaminated. <u>Contamination Levels:</u> Soil at 78.9 to 87.8 pCi/g, knee wall at 600 to 5,215 dpm/100 cm <sup>2</sup> . <u>Data References:</u> IDM Samples 878 and 879. IDM Survey 1267.	Further decontamination or removal of the knee wall and soil would affect the structural integrity of the building.

Location No. (Area)	Description <sup>a</sup>	Rationale for Residual Contamination Exceeding Criteria
LEC-14S-3 (Area 14S)	<p><b><u>SOUTH WALL CONCRETE FOOTER/BRICK WALL INTERFACE.</u></b> <u>Description:</u> Interface between concrete south wall footer and the brick remains contaminated above surface guidelines. Extends about 42 feet underneath the outermost brick, or two bricks, at the east end. Total area impacted about 13 ft<sup>2</sup>. <u>Remedial Actions:</u> First two layers of inner two courses of brick removed from interior wall and footer surface decontaminated. <u>Contamination Levels:</u> Pre-decontamination direct βγ activity of footer ranged from 10,164 dpm/100 cm<sup>2</sup> to 132,492 dpm/100 cm<sup>2</sup>. Assumed direct βγ activity average is 30,769 dpm/100 cm<sup>2</sup>. <u>Data References:</u> IDM Survey 1752 (pre-remedial data) and 1737 (post-remedial data).</p>	Further removal of the brick wall would affect the structural integrity of the building.
LEC-14S-4 LEC-14S-5 LEC-14S-6 LEC-14S-7 LEC-14S-8 (Area 14S)	<p><b><u>HORIZONTAL I-BEAMS (SOUTH, NORTH, AND EAST WALLS).</u></b> <u>Description:</u> These are structural steel beams which are adjacent to the walls in Area 14 South. Locations are on the upper surface of the lower lip of each I-beam on the side of the beam closest to the wall. Access to this surface by decontamination equipment was difficult, but the vertical and upper surfaces of the same side of the beams were successfully decontaminated below criteria. Total area = 7.3 ft<sup>2</sup> per I-beam and 36.5 ft<sup>2</sup> total. <u>Remedial Actions:</u> All surfaces of the beams were decontaminated by sponge blasting. Repeated attempts were made to remove contamination on these locations. <u>Contamination Levels:</u> Residual direct βγ activity levels ranged 3,000 to 36,000 dpm/100 cm<sup>2</sup> (south wall), 5,000 to 10,000 dpm/100 cm<sup>2</sup> (east wall) and 6,000 to 9,000 dpm/100 cm<sup>2</sup> (north wall). <u>Data References:</u> IDM Surveys 1347, 1351, 1354, 1374, and 1498.</p>	Removal of contamination is not feasible due to inaccessibility with conventional decontamination equipment
LEC-14S-9 LEC-14S-10 (Area 14S)	<p><b><u>FORMER WINDOW CONCRETE LEDGE AND BRICK ON SOUTH WALL.</u></b> <u>Description:</u> Two areas with brick installed in former window locations. Removal and installation of a mandoor and rollup door at the west end of the wall detected elevated levels of contamination on the former window ledges and within the brick mortar. These two areas are conservatively assumed to be potentially similarly contaminated. Total areas are estimated at 100 and 250 ft<sup>2</sup> for LEC-14S-9 and LEC -14S-10, respectively. <u>Remedial Actions:</u> Interior wall surfaces were decontaminated as needed, and verification surveys were performed. Minor decontamination was performed on exterior of wall within Area 21 footprint. <u>Contamination Levels:</u> Surveys from the rollup door installation indicated direct βγ activity within the wall ranging from 31,000 up to 805,000 dpm/100 cm<sup>2</sup>. Three samples of mortar from the wall contained total uranium at concentrations of 1,566, 2,088, and 27,566 pCi/g. <u>Data References:</u> IDM Surveys 1031 and 1041. IDM Samples 802, 803, and 804.</p>	Further removal of the brick wall would affect the structural integrity of the building.
LEC-14S-11 (Area 14S)	<p><b><u>FLOOR UNDERNEATH COLUMN 1.</u></b> <u>Description:</u> The floor underneath the concrete pad supporting Column 1, at grid cell E-13, is inaccessible and is estimated to exceed surface guidelines. The size of the affected floor area is approximately 5 feet by 8 feet for a total area of 40 square feet. <u>Remedial Actions:</u> The floor areas around and up to the concrete pad were decontaminated or removed. <u>Contamination Levels:</u> The estimated activity of this floor area is 5,245 dpm/100 cm<sup>2</sup>. <u>Data References:</u> Surveys are described in "Direct Surface and Transferable Contamination Survey," BNI CCN No. D-28336 (1997).</p>	Decontamination is not cost-effective as it would require removal of process column.

Location No. (Area)	Description <sup>a</sup>	Rationale for Residual Contamination Exceeding Criteria
LEC-15-1 (Area 15)	<b>FLOOR UNDER TANK.</b> <u>Description:</u> A large 20-foot-diameter process tank located near the south end of Area 15. The tank rests on what is presumably the original concrete slab. <u>Remedial Actions:</u> Surrounding floor was delineated and decontaminated where necessary. <u>Contamination Levels:</u> The floor underneath the tank is believed to have levels of contamination similar to those found on the surrounding floor at direct $\beta\gamma$ activity up to 27,000 dpm/100 cm <sup>2</sup> with the highest levels present west of the tank. <u>Data References:</u> IDM Survey 355.	Relocation of tank and two other columns judged not economically feasible at \$375,000 and would have impacted owner operations.
LEC-20AE-1 (Area 20A East)	<b>DRAINPIPE.</b> <u>Description:</u> An abandoned drainpipe leading south from the center trench is present in the western trench. Historical drawings suggest it is a 4-inch diameter MED-era pipe. Pipe appears to run out of the building and likely leads to the sanitary sewer. <u>Remedial Actions:</u> The plug appeared to have been capped to prevent flow and trench removed. No further remedial actions implemented on drainpipe. <u>Contamination Levels:</u> The drainpipe was surveyed by TNU in 1996. Measurements were taken up to 22 feet from the trench with the maximum direct $\beta\gamma$ activity of 41,094 dpm/100 cm <sup>2</sup> measured at 12 feet from the trench. <u>Data References:</u> TNU Survey 129DT032, sheets 12900975.xls and 12900976.xls.	Removal of pipe would require excavation under north wall of Room 20B-1 and removal of footer of the south wall of the building, which would compromise the structural integrity of the building.
LEC-21-1 (Area 21)	<b>SETTLING BASIN CONCRETE FLOOR BENEATH PIPES.</b> <u>Description:</u> A former settling basin, used during MED operations, was buried beneath the slab within the current footprint of the Butler Building. Several water pipes ran through the basin and were supported in the west section by a tightly compacted rock and gravel mixture with concrete encasing the pipes on the top. The rock covers an area of 10 feet by 2 feet or a total of 20 ft <sup>2</sup> . <u>Remedial Actions:</u> The fill material within the settling basin was excavated and removed. The concrete walls and floor of the basin were removed with the exception of the floor beneath the pipes and rock supporting the pipes. <u>Contamination Levels:</u> The concrete surface of the settling basin floor adjacent to the remaining rock which supports the pipes was surveyed with direct $\beta\gamma$ activity of 26,000 to 39,000 dpm/100 cm <sup>2</sup> . <u>Data References:</u> IDM Survey 1185.	Removal of concrete and rock supporting water supply pipes may risk damage to the pipes.

Note:

- a Additional details on the description and locations of each location exceeding the remedial action criteria can be obtained in the Section 4 text and summary figures of this report.