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# RESULTS OF THE RADIOLOGICAL SURVEY at the former HERRING-HALL-MARVIN SAFE COMPANY (3rd Floor) 1550 Grand Boulevard, Hamilton, Ohio (HO001)

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# Results of the Radiological Survey at the former Herring-Hall-Marvin Safe Company (3rd Floor), 1550 Grand Boulevard, Hamilton Ohio (HO001)

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## ACKNOWLEDGMENTS

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# ABSTRACT

At the request of the U.S. Department of Energy (DOE), a group from the Oak Ridge National Laboratory conducted a radiological survey at the former Herring-Hall-Marvin Safe Company (third floor), 1550 Grand Boulevard, Hamilton, Ohio (HO001) in August 1993. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally $^{238}U$, derived from the former Manhattan Engineer District project. The survey included gamma scans; direct and transferable measurements of alpha, beta, and gamma radiation levels; and debris sampling for radionuclide analyses.

Results of the survey demonstrated $^{238}U$ surface contamination in excess of the DOE criteria for surface contamination. The third floor was generally contaminated over 25 percent of its area with isolated spots in the remaining area. Although three isolated spots of contamination were found in areas other than on the third floor (in the same southeastern corner of the facility), they were remediated by sampling. Based on the survey results, this site is recommended for remediation.

# RESULTS OF THE RADIOLOGICAL SURVEY AT THE FORMER HERRING-HALL-MARVIN SAFE COMPANY (3rd FLOOR), 1550 GRAND BOULEVARD, HAMILTON OHIO (HO001)*

## INTRODUCTION

Under jurisdiction of the Army Corps of Engineers in the early 1940s, the Manhattan Engineer District (MED) was established as the lead agency in the development of nuclear energy for defense-related projects. Raw materials containing uranium ores were procured, stored, and processed into various uranium oxides, salts, and metals. Fabricators were contracted as needed to form (roll and machine) the metal into various shapes. At contract termination, sites used by contractors were decontaminated according to the criteria and health guidelines then in use. The radiological criteria for releasing the site for unrestricted use were generally site specific and clearly defined. In some instances, however, documentation was limited or nonexistent and conditions at these sites were unknown. Therefore, it was necessary to reevaluate the current radiological conditions at these sites under the U.S. Department of Energy (DOE) Formally Utilized Sites Remedial Action Program (FUSRAP).

Intermittently from the 1940s to the early 1950s, the Herring-Hall-Marvin Safe Company in Hamilton, Ohio, machined uranium slugs from rolled stock under subcontract to the MED. This commercial property was later purchased by the Diebold Safe Company, the present owner. The facility is a large industrial building ($\approx$300,000 $ft^2$) built in stages as evidenced by the many types of construction materials and architectural styles.

In August 1988 and April 1989, radiological surveys were conducted, at the request of DOE, by members of the Measurement Applications and Development Group of the Oak Ridge National Laboratory (ORNL). Those surveys covered portions of the exterior grounds, roof sections, and interior sections where the company management understood the uranium work to have taken place.[1] Very little uranium was found (small fragments of uranium metal were left from the machining operations), and after removal of these samples, no beta or gamma radiation above background could be detected and the building was dismissed from any additional DOE restrictions.[2]

During the spring of 1993, public attention was drawn to this facility by former workers who stated that the earlier radiological surveys did not include that part of the structure which contained the third floor (located in the southeastern corner of the building (Fig. 1) where a portion of the actual machining work was conducted. On August 5 and 6, 1993, the third floor was surveyed by the ORNL group to determine whether fixed surface contamination could be found that might exceed the DOE guidelines. The primary focus of the survey was the third floor, the elevator (including the shaft) and the stairwell leading to the third floor, all of which are in the southeastern corner of the structure. This section of the building is constructed almost entirely of concrete and concrete blocks. The third floor is ~ 9000 $ft^2$, including the stairwell, the elevator, and a washroom (out of service). There are currently no operations in the facility and the entire building is devoid of equipment.

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* The survey was performed by members of the Health Sciences Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

## SURVEY METHODS

The radiological survey of the third floor included: (1) a gamma scan of the floors and walls using NaI detectors; (2) a beta-gamma scan of the walls and overhead structures with "pancake" GM detectors; (3) a comprehensive scan of the floor surface for beta-gamma activity, using large area gas flow proportional detectors; and 4) smear sampling to determine whether there was any transferable contamination.

The stairwell, elevator, elevator shaft, areas on the first and second floors leading to the elevator and stairwell, and selected areas on the second floor were surveyed for contamination. Selected spots were characterized in detail for alpha, beta, gamma and transferable activity. A pressurized ion chamber was used to accurately determine the gamma exposure rate at one meter above the floor surface. Debris samples were collected to verify that the contamination was $^{238}U$ and whether or not it had been enriched. Survey methods generally followed procedures outlined in Reference 3. Figures 1-4 are diagrams of the building and the areas surveyed.

To assist in defining the locations of contaminated areas, the third floor was divided into 30 grid blocks (see Fig. 2), delineated by the southwest column in each block (e.g., columns numbers 1, 2, 7, and 8 represent block 1). Results of the survey were noted on grid block maps and data sheets.

## SURVEY RESULTS

Applicable DOE residual radioactivity guidelines for protection of the general public are summarized in Table 1.[4, 5]

The third floor contained many areas of contamination as shown on Figure 3. Because of the amount of contamination, not all spots were marked in blocks 20 and above. Thirteen spots were characterized in detail (see Table 2) and are located on Figure 3 by smear number (S#). The maximum direct measurement for gamma was 81 μR/h, for beta/gamma was 1,500,000 dpm/100 $cm^2$ and for alpha was 1750 dpm/100 $cm^2$. Seven PIC measurements ranging from 7 to 9 μR/h were taken.

Very little contamination was found on the overhead structures on the third floor (see Figure 2). Two fans were contaminated above guidelines, with maximum beta-gamma values of 12000 dpm/100 $cm^2$ measured. Two fire protection sprinkler pipes in block 22 were beta-gamma contaminated at maximum values of 9000 dpm/100 $cm^2$.

The north wall was generally contaminated above guidelines and the east wall was spottily contaminated. Most of the contamination was covered with paint, and therefore many of the values on Figure 3 may be low.

No radiation measurements were distinguishable from background levels in the elevator and elevator shaft (Fig. 4). One spot (<100 $cm^2$) was found in the stairwell and was removed by sampling. Another spot (≈300 $cm^2$) was found in the second floor restroom and was likewise removed. The only other spot found apart from the third floor was on the first floor in a floor crack about 15 feet from the stairwell. This spot was also removed (these spots are not shown).

An area above the elevator and stairwell, accessible only by ladder, had several spots and small areas which were above the surface contamination guidelines. See Figure 4 for radiation measurements and locations.

Along the bottom of each wall were floor drains (there were eight), which lead directly to the outside (see Fig. 2). All of the drains were plugged with debris and "paint sealed" from the outside. The drains in blocks 1, 28, and 30 were contaminated with beta-gamma levels of 31,000, 51,000, and 45,000 dpm/100 $cm^2$, respectively. The outside walls and structures below the drains were surveyed and no contamination was found.

Three miscellaneous debris samples were collected to verify the contaminant as uranium and to ascertain whether the material was enriched or depleted. All three samples indicated normal uranium having a $^{238}U$ to $^{235}U$ activity ratio of 21.

## SIGNIFICANCE OF FINDINGS

Radiological assessments in this survey demonstrated that radioactive residuals were in excess of DOE guidelines for surface contamination on over 25% of the third floor. Spotty contamination was also present on the remaining area of that floor. The contaminant was definitely identified by gamma spectroscopy as normal uranium, which was the material handled by the Herring-Hall-Marvin Safe Company. The current owner, Diebold, was advised of the survey results, and because of the contamination, restricted access to the third floor was recommended.

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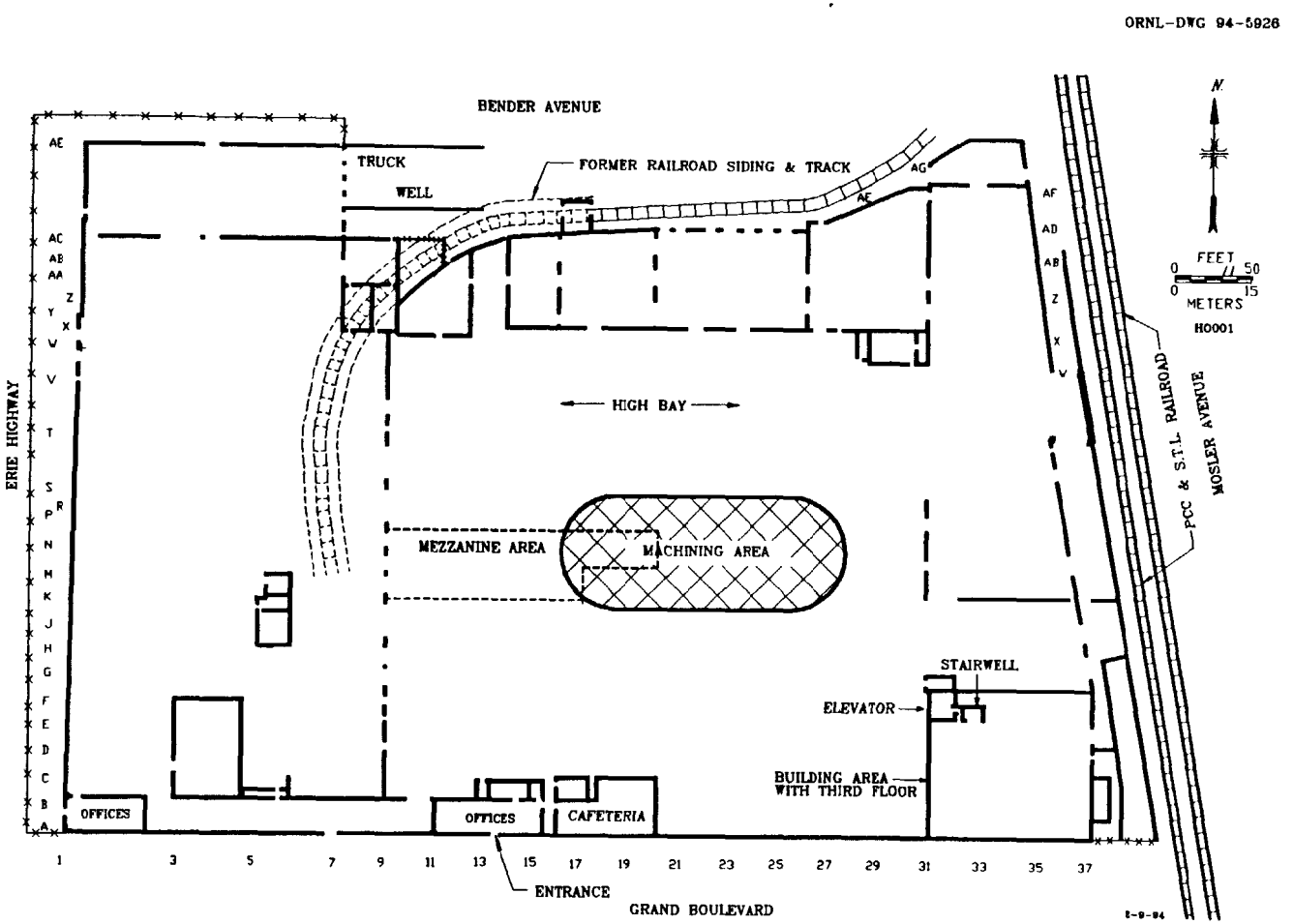


**Fig. 1. Diagram showing the general facility layout at the former Herring-Hall-Marvin Safe Company, 1550 Grand Boulevard, Hamilton, Ohio.** The area in the southeast corner is the part of the facility containing the third floor where the survey was conducted.

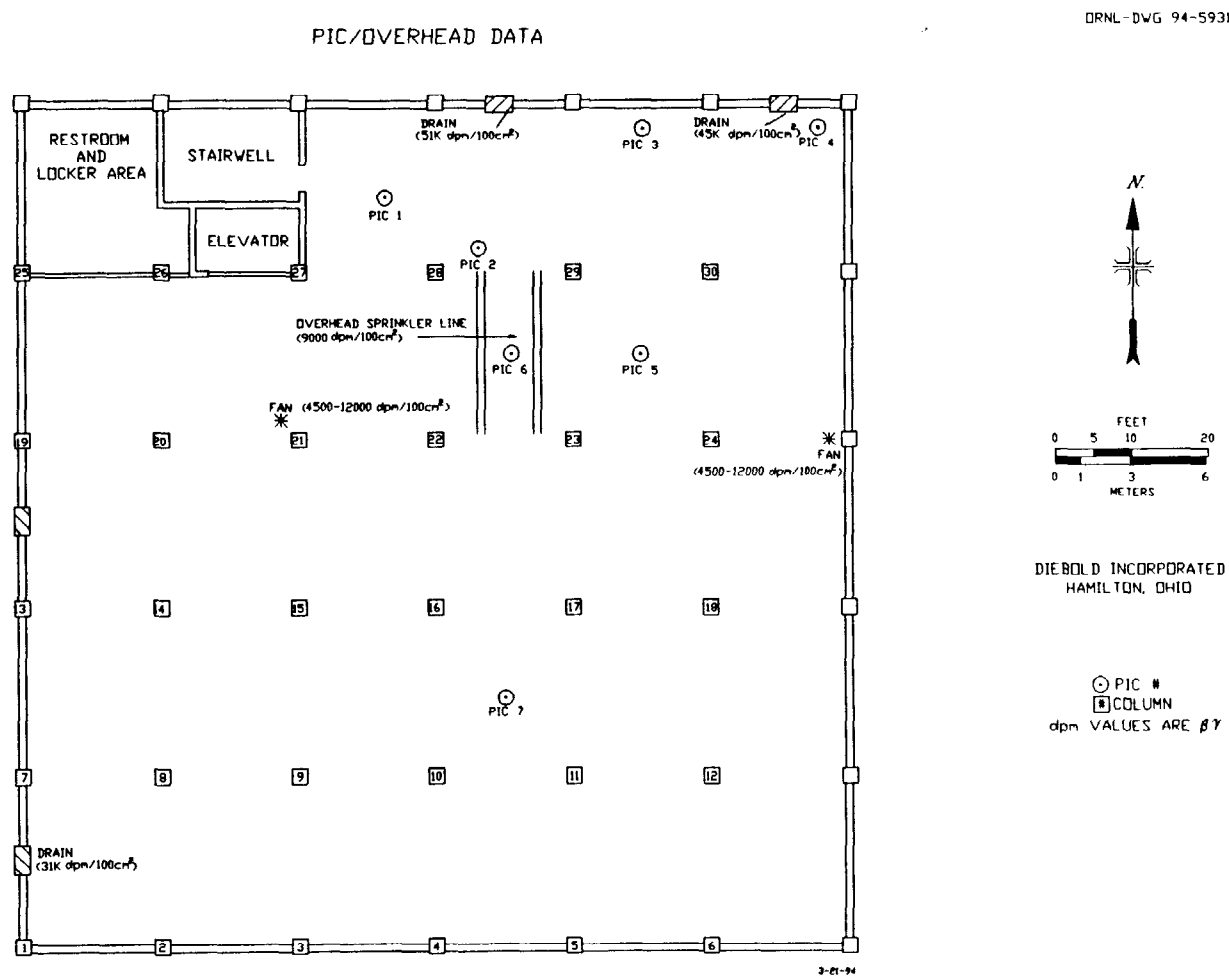


**Fig. 2. Diagram of the third floor of the former Herring-Hall-Marvin Safe Company facility showing the numbered columns and grid blocks in the area surveyed.** Locations of the PIC and overhead data are shown.

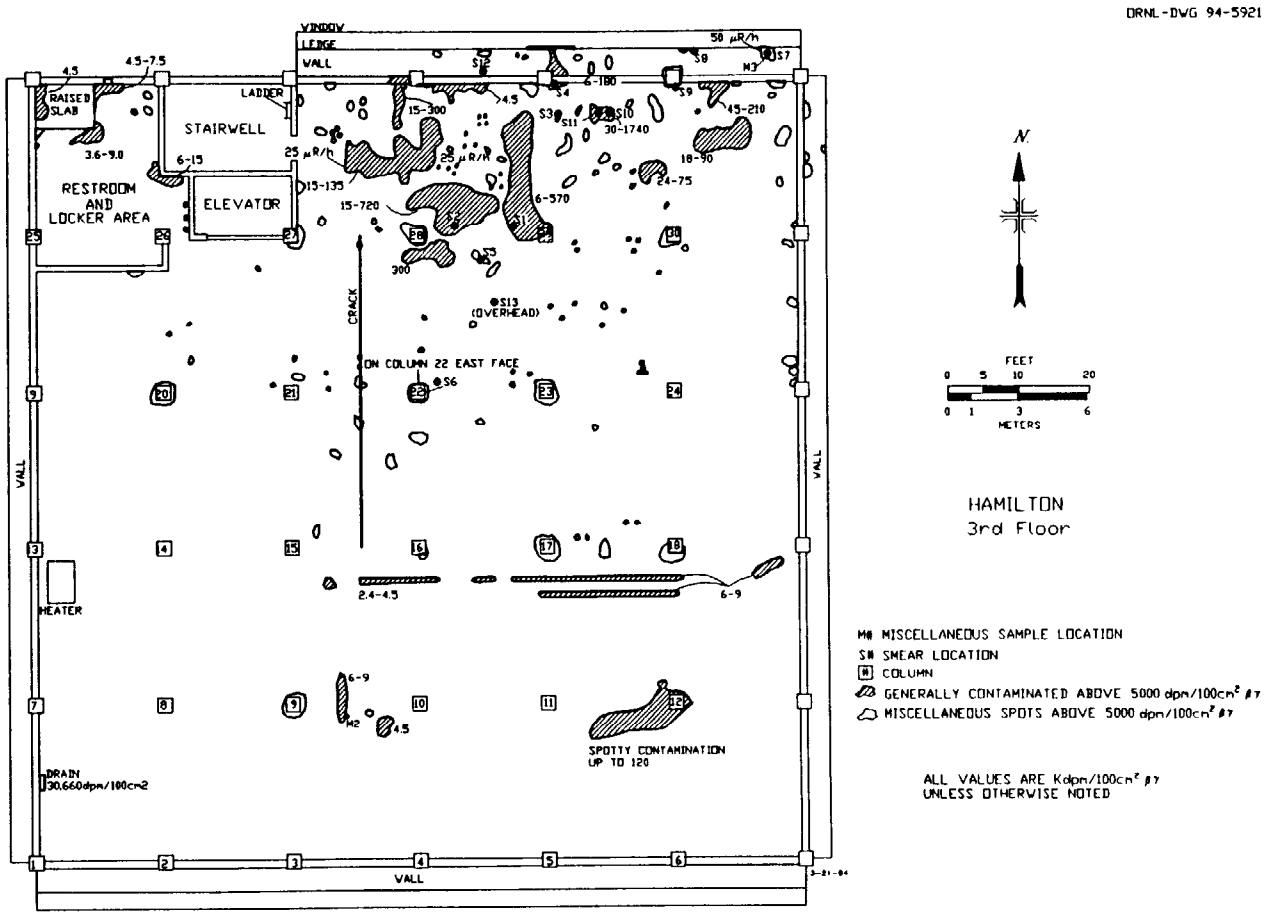


**Fig. 3. Diagram of the third floor of the former Herring-Hall-Marvin Safe Company facility showing the smear locations and the areas of contamination relative to the grid blocks.**

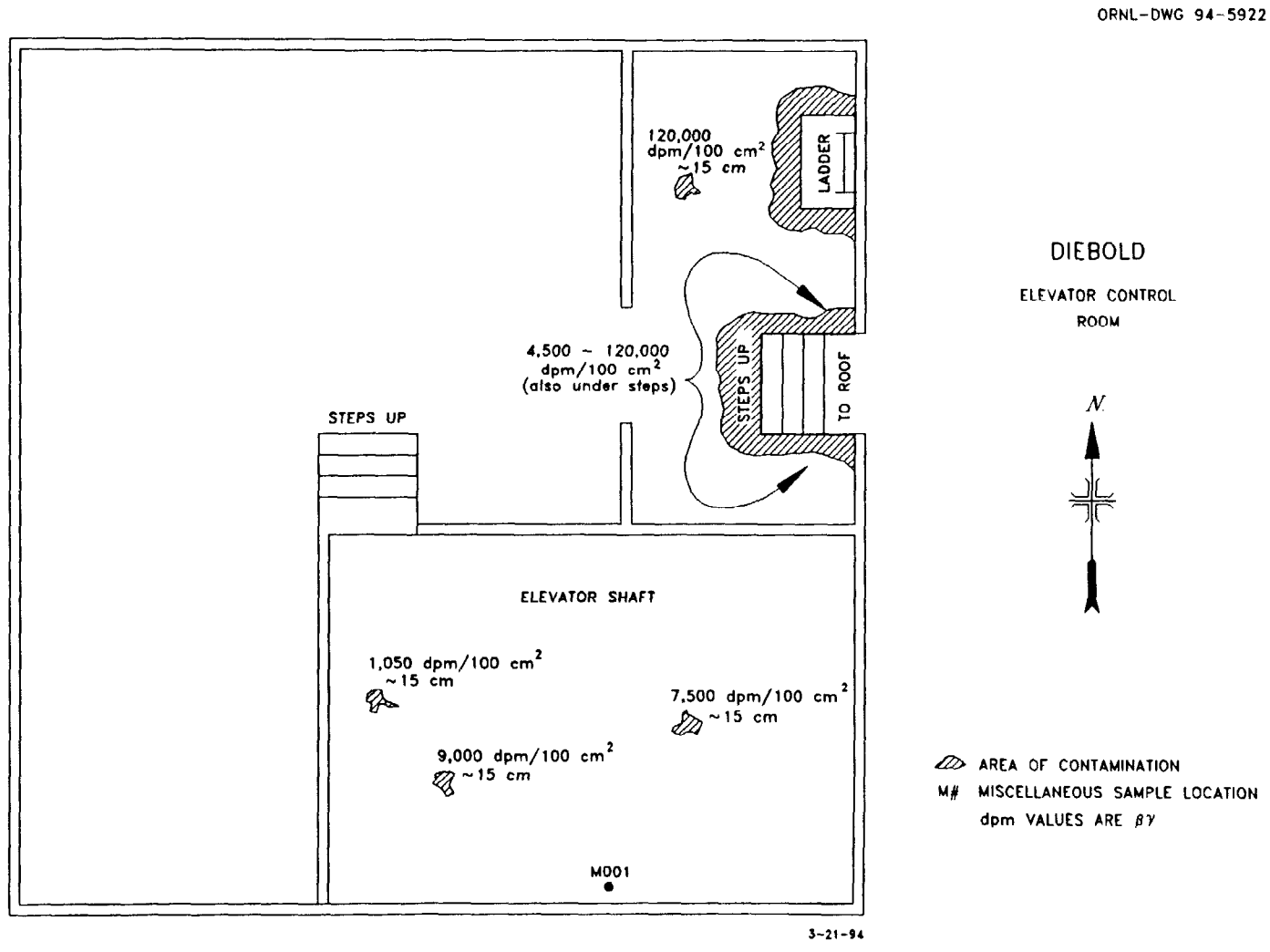


**Fig. 4. Diagram of the third floor area above the elevator shaft in the former Herring-Hall-Marvin Safe Company facility, showing the locations of the aeas of contamination.**

**Table 1. Applicable guidelines for protection against radiation**
(Limits for uncontrolled areas)

| Mode of exposure | Exposure conditions | Guideline value |
|---|---|---|
| Gamma radiation | Indoor gamma radiation level (above background) | 20 μR/h[a] |
| Total residual surface contamination[b] | $^{238}U$, $^{235}U$, U-natural (*alpha emitters*) or Beta-gamma emitters [c] | |
| | Maximum | 15,000 dpm/100 $cm^2$ |
| | Average | 5,000 dpm/100 $cm^2$ |
| | Removable | 1,000 dpm/100 $cm^2$ |
| Beta-gamma dose rates | Surface dose rate averaged over not more than 1 $m^2$ | 0.20 mrad/h |
| | Maximum dose rate in any 100-$cm^2$ area | 1.0 mrad/h |

[a]The 20 μR/h shall comply with the basic dose limit (100 mrem/yr) when an appropriate-use scenario is considered.

[b]DOE surface contamination guidelines are consistent with *NRC Guidelines for Decontamination at Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source, or Special Nuclear Material*, May 1987.

[c]Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except $^{90}Sr$, $^{228}Ra$, $^{223}Ra$, $^{227}Ac$, $^{133}I$, $^{129}I$, $^{126}I$, $^{125}I$.

*Sources*: Adapted from U.S. Department of Energy, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5, April 1990, and U.S. Department of Energy, *Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, March 1987; and *U. S. Department of Energy Radiological Control Manual*, DOE N 5480.6 (DOE/EH-256T), June 1992.

**Table 2. Total and removable alpha and beta-gamma activity levels and radionuclide concentrations in smear samples from selected locations at the former Herring-Hall-Marvin Safe Company**

| Location & Smear number | Gamma[a] exp rate 1 m (μR/h) | Gamma[a] exp rate surface (μR/h) | Direct activity levels[b] (dpm/100cm2) | | Removable activity levels[c] (dpm/100cm2) | | Location[d] |
|---|---|---|---|---|---|---|---|
| | | | Beta/gamma | Alpha | Beta/gamma | Alpha | |
| 1 | 7 | 39 | 639000 | 630 | 120 | 61 | Floor, 10 ft E of column #28 |
| 2 | 7 | 18 | 645000 | 70 | 94 | 16 | Floor, 5 ft E, 1 ft N of column #28 |
| 3 | 7 | 8 | 18000 | 0 | 94 | 3 | Floor, 14 ft N, 1 ft E of column #29 |
| 4 | 7.5 | 11 | 156000 | 140 | 94 | 19 | Floor, NW corner of block 29 |
| 5 | 8 | 21 | 891000 | 1750 | 1010 | 748 | Floor, 14 ft N, 10 ft E of column 22 |
| 6 | | 15 | 279000 | 280 | 94 | 45 | E side of column #22, 1.5 ft above floor |
| 7 | 9 | 52 | 1494000 | 350 | 94 | 13 | Wall, 1 ft below ledge, 4 ft W of NE corner block 30 |
| 8 | 7 | 11 | 138000 | 70 | 94 | 3 | Wall, 2 in below ledge 6 ft E of NW corner of block 30 |
| 9 | 8 | 18 | 246000 | 280 | 94 | 10 | Floor, NW corner of block 29 |
| 10 | 8 | 81 | 306000 | 70 | 160 | 142 | Floor, 13 ft N, 10 ft E of column #29 |
| 11 | 8 | 61 | 1551000 | 350 | 150 | 161 | Floor, 13 ft N, 8 ft E of column #29 |
| 12 | | 7 | 42000 | 0 | 110 | 6 | Drain at base of N wall, block 28 |
| 13 | | | 12000 | 0 | 94 | 3 | Overhead, fire sprinkler pipe, center of block 22 |

[a]Gamma radiation levels measured on contact with the floor's surface and at 1 m above the surface.
[b]Directly measured alpha and beta-gamma activity levels on the selected area prior to smearing.
[c]Results of analysis of smears collected from the surface.
[d]Locations of the smears are shown on Fig. 3.

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