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Attention: Peter J. Gross, Director  
Technical Services Division

Subject: Bechtel Job No. 14501, FUSRAP Project  
DOE Contract No. DE-AC05-81OR20722  
Revised Letter Characterization Report for the  
George Herbert Jones Chemical Laboratory at the  
University of Chicago Site, Chicago, Illinois  
Code: 7330/WBS: 131

Dear Mr. Gross:

Radiological characterization and remedial action activities were performed by Bechtel National, Inc. (BNI) at George Herbert Jones Chemical Laboratory (hereinafter referred to as Jones Laboratory) at the University of Chicago site from July through October of 1987. A letter characterization report was transmitted to you on August 23 summarizing characterization activities and findings. The revised characterization report that follows reflects comments provided by Jim Berger of ORAU (CCN 055775).

### Introduction

Jones Laboratory is located on the campus of the University of Chicago in Chicago, Illinois. Figure 1 shows the regional setting of the university, and Figure 2 shows the location of Jones Laboratory on the university campus. The laboratory consists of six levels: a basement, four above-ground floors, and an attic referred to as the fifth-floor attic. Figures 3 through 18 are various plan views of the laboratory.

Jones Laboratory was suspected to be radioactively contaminated based on surveys performed for DOE by Argonne National Laboratory (ANL) in 1976 and 1977 (Ref. 1). The primary radionuclides suspected to be present at Jones Laboratory were

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various isotopes of uranium, plutonium, thorium, and radium. Because other radioactive isotopes such as americium-241 and neptunium-237 are still handled in the laboratory, selected samples were also analyzed for these isotopes. DOE residual contamination guidelines governing the release of the property for unrestricted use are listed in Table 1. The guidelines in the table apply primarily to surfaces such as walls, floors, ceilings, roofing tiles, and ductwork. The remedial action guideline for uranium-238 in soil at the University of Chicago site is 150 pCi/g, which is the limit derived by ANL for the Illinois National Guard Armory, another FUSPAP site in Chicago (Ref. 2). Although DOE has not established a remedial action guideline for plutonium-239 in soil, a value of 25 pCi/g has been adopted by the Nuclear Regulatory Commission to be used as a guideline in the decommissioning of nuclear facilities (Ref. 3). Remedial action guidelines for surface contamination at the University of Chicago are 100 alpha dpm/100 cm<sup>2</sup>, average, and 300 alpha dpm/100 cm<sup>2</sup>, maximum; 0.2 mrad/h beta-gamma, average, and 1.0 mrad/h beta-gamma, maximum; and 20 alpha dpm/100 cm<sup>2</sup> for removable contamination (Ref. 4). Guidelines for radionuclide concentrations in water to be released to uncontrolled areas at the University of Chicago site are contained in a DOE memorandum issued in 1986 (Ref. 5).

#### Characterization Activities and Results

Radiological characterization activities were conducted in several types of areas in which contamination was suspected to be present based on the surveys performed by ANL. Procedures used to conduct the characterization activities were based on the FUSPAP Health Physics Operational Procedures Manual prepared by Thermo Analytical/Eberline (Ref. 6). In addition, to protect the health and safety of remedial action workers, certain areas were tested for asbestos-containing material (ACM) and perchloric and picric acid salts so that if present, these materials could be removed prior to remedial action. Characterization activities and associated results are briefly described below.

Ducts. Based on a review of historical information, it was determined that there was a potential presence of perchloric and picric acids salts in the ducts. Perchloric and picric acid salts are explosive; they can be detonated by shock, impact, heat, or friction. Before work was performed on the ducts, field tests were performed to determine whether these salts were present. Where positive results were received, these results were verified by laboratory analysis. Results of these laboratory analyses are presented in Table 2.

Based on visual inspection of the work areas, ACM was suspected to be present in the construction materials. A survey was performed to determine whether ACM was present, and the presence of ACM was confirmed.

Sixty-four ducts in the Jones Laboratory were suspected to be radioactively contaminated. One of these ducts (Duct 19) was never located even though it appeared on the original drawings retained by the university. The 63 ducts that were located were radioactively characterized to support remedial action planning. Measurements were taken at several elevations on the north, south, east, and west faces of each duct. These measurements are given in Table 3. The column in the table labeled "Average" contains measurements that were averaged over the entire length of the respective duct. In cases where the average measurement for a specific 1-m<sup>2</sup> area on a given duct exceeded guidelines, the entire duct was removed, even if the overall average for the duct was within guidelines. It was determined that four ducts contained radioactive contamination in concentrations exceeding existing guidelines.

Chimneys. The ducts in Jones Laboratory terminate on the roof as chimneys, each of which was surveyed for radioactive contamination. The locations of the stacks and associated ducts are shown in Figure 19. Eleven air vents in the chimneys were found to be contaminated above remedial action guideline levels. The findings of this survey are summarized in Table 4. In cases where the average measurement for a specific 1-m<sup>2</sup> area of a given chimney exceeded guidelines, the entire chimney was remediated, even if the average overall measurement for the chimney was within guidelines.

Roof. The roof of the Jones laboratory was radiologically surveyed to determine whether it had become contaminated by the deposition of stack exhaust. Figure 10 is a plan of the laboratory roof. The results of this survey are summarized in Table 5. The direct alpha readings for the roof tiles were elevated. The tiles were sampled, and analyses were performed to determine the concentrations of plutonium-239, uranium-238, thorium-230, radium-226, and thorium-232. The results of these analyses are summarized in Table 6. It was determined that the tiles were made from materials containing naturally occurring radioactive materials.

Floor Areas. During the steam cleaning operations conducted prior to the start of pre-remedial action characterization activities, a number of steam leaks occurred. The floor areas where the leaks occurred were surveyed to determine whether they had become contaminated. A total of 266 direct alpha measurements, 258 direct beta-gamma, and 68 transferable alpha measurements were taken. The direct alpha measurements ranged from less than 5 dpm/100 cm<sup>2</sup> to

85 dpm/100 cm<sup>2</sup>. The direct beta-gamma measurements ranged from less than 0.01 to 0.04 mrad/h. The transferable alpha measurements ranged from less than 1 dpm/100 cm<sup>2</sup> to 6 dpm/100 cm<sup>2</sup>. All measurements were below remedial action guideline levels. In addition, several other floor areas were radiologically surveyed to guide remedial action planning.

Drains and Sewers. Sediments in the drains inside the laboratory building were sampled based on findings of the ANL survey conducted for DOE in 1984. Analysis results are presented in Table 7. All results were below remedial action guideline levels. To determine whether contamination had reached the public sewer system, water samples were collected at points both above and below the inlet from Jones Laboratory. Figure 20 shows sampling locations for the sewers and manholes. Analysis results are presented in Table 8; all results were below remedial action guideline levels.

Fans and Blowers. The fans and blowers in the duct system were surveyed for radioactive contamination. A total of 28 direct alpha, 28 direct beta-gamma, and 7 transferable alpha measurements were taken. The direct alpha measurements ranged from less than 5 dpm/100 cm<sup>2</sup> to 106 dpm/100 cm<sup>2</sup>. Direct beta-gamma readings ranged from less than 0.01 mrad/h to 0.02 mrad/h. The transferable alpha measurements ranged from less than 2 dpm/100 cm<sup>2</sup> to 22 dpm/100 cm<sup>2</sup>. The maximum of 22 dpm/100 cm<sup>2</sup> was measured at a single location on a fan blade. Since measurements taken on the other blades of the same fan were all below 20 dpm/100 cm<sup>2</sup>, it was determined that remedial action was not required. All other measurements were below remedial action guideline levels.

#### Summary

Based on the characterization findings summarized above, remedial action was performed at the University of Chicago from July through October of 1987. If you have any questions regarding characterization activities or findings, please contact me at 576-3998 or Mark Kaye at 576-5912.

Very truly yours,



R. R. Harbert  
Project Manager - FUSRAP

AMF/amf

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