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Characterization Report for the Demolition and Remodel of B151 Rooms 1318, 1322 and 1326

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Disclaimer

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Interdepartmental Letter
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MEMORANDUM

To: George Kan, Project Manager

From: Jenna Sexton, Geoffrey Won

Subject: *Characterization Report for the Demolition and Remodel of Building 151 Rooms 1318, 1322, and 1326*

Purpose

In support of a remodel for rooms 1318, 1322, and 1326 in building 151, the Environmental Safety and Health (ES&H) team has worked to develop a detailed characterization of contaminants in each room. This report serves as a summary of the results for all radioactive material and Industrial Hygiene (IH) metals sampling performed of accessible areas.

Background

ES&H has performed and supported minor demolition of cabinetry and casework in B151 rooms 1318, 1322, and 1326. Sampling and monitoring for radioactive material and IH metals was performed. In addition to surveying cabinetry, casework, and various laboratory equipment removed from the room, detailed swipe sampling and monitoring of the twelve fume hoods and ventilation ducts for these three labs have been performed.

Currently, all casework, cabinetry, hoods and ventilation ducts in rooms 1318 and 1322 have been swipe sampled and/or directly monitored for various contaminants. Only the fume hoods and ventilation ducts have been sampled and/or directly monitored in room 1326. Since historically all three laboratories have been used for various similar research activities, the results from the casework and cabinetry in 1318 and 1322 can be assumed to closely represent room 1326 as well.

Results

Radioactive Material Characterization

For detection of radioactive material in the laboratories, the following sampling plan was performed:

- Cabinetry and casework
  - 100% direct contamination (i.e. total contamination) for alpha and beta was performed for rooms 1318 and 1322.
  - Composite swipe samples (i.e. removable contamination) for alpha, beta and tritium was performed representing approximately 100% of surfaces for rooms 1318 and 1322.
- Fume Hoods and duct work
  - Large area wipes (i.e. removable contamination) for alpha and beta were performed on the hoods in 1318, 1322, and 1326.
  - Composite swipe samples for alpha, beta, and tritium were performed to represent 100% of accessible areas in the hoods for 1318, 1322, and 1326.
    - Spectroscopy was performed for isotopic identification on elevated swipe results.
  - Direct contamination surveys for alpha and beta were performed on majority of the accessible areas of the hoods in 1318, 1322, and 1326. Survey emphasis was given to areas where large area wipes indicated removable contamination.
  - Two inch holes were cut from each ventilation duct for each hood. A swipe was taken on the inside of the ductwork. Direct contamination readings for alpha and beta were performed on the discs removed from the duct work.
    - Spectroscopy was performed for isotopic identification on elevated swipes and removed metal discs.

Results from all swipe samples, direct readings and isotopic analysis are given below by room and summarized in Table 1:

- Room 1318
  - Floors and walls were not surveyed. However, removable contamination results from cabinetry and casework are indicative of the levels that could be found on the surface of the walls and floors. Based on the history of the room, there is known americium-241 contamination fixed in the floor in front of hood FHE-25. The maximum current fixed contamination level reading is 14,176 dpm alpha. These levels are possibly higher when floor is removed.
  - Majority of the cabinetry and casework surveys indicated little to no contamination. However, two spots were identified with a maximum removable contamination level of 14 dpm/100cm^2 alpha, 46 dpm/100cm^2 beta and a direct contamination reading of 1,928 dpm/100 cm^2 alpha. These items have been removed from room 1318 and properly disposed.
  - As expected, contamination was found in hoods FHE-24 and FHE 25 in room 1318. Figure 1 shows a typical hood with labeled areas to help identify where contamination was found. The main isotope found in these hoods was identified to be americium-241 based on spectroscopy results.

Figure 1: Typical hood for rooms 1318, 1322, and 1326

Below is a breakdown of maximum contamination levels found:

- Fume Hood FHE-25
  - Large area wipe on the bottom plenum indicated 8,183 dpm alpha and 17,219 dpm beta. A follow up swipe indicated 1,270 dpm/100cm^2 alpha and 1,200 dpm/100cm^2 beta.
  - Maximum direct contamination readings in accessible areas was found to be 229 dpm/100cm^2 alpha on the middle plenum and 5,532 dpm/100cm^2 beta on the bottom plenum. It is important to note that direct alpha contamination measurements in inaccessible areas (eg. plenums) could be lower than actual levels.
  - Removable contamination levels on the ductwork were 158 dpm/100cm^2 alpha and 204 dpm/100cm^2 beta.
- Fume Hood FHE-24
  - Large area wipe on the top plenum indicated 320 dpm alpha and 834 dpm beta on the left wall. A follow up swipe indicated 23 dpm/100cm^2 alpha and 183 dpm/100cm^2 beta.
  - Maximum direct contamination readings in accessible areas was found to be 2,032 dpm/100cm^2 beta on the bottom plenum. It is important to note that direct alpha contamination measurements in inaccessible areas (eg. plenums) could be lower than actual levels.
  - Removable contamination levels on the ductwork were 86 dpm/100cm^2 alpha and 133 dpm/100cm^2 beta.
- Fume Hood FHE-26 and FHE-27
  - No detectable activity was found for these two hoods or ductwork.

- Room 1322
  - Floors and walls were not surveyed. However, removable contamination results from cabinetry and casework are indicative of the levels that could be found on the surface of the walls and floors.
  - Majority of the cabinetry and casework surveys indicated little to no contamination. However two spots were identified with a maximum removable contamination level of 8 dpm/100cm^2 alpha and 23 dpm/100cm^2 beta. A direct contamination reading of 74 dpm/100 cm^2 alpha and 3,261 dpm/100 cm^2 was detected. These items have been removed from room 1322 and properly disposed.
  - Contamination was found in the hoods in room 1322. The main isotopes found in these hoods were identified to be americium-241, plutonium-239 and possibly uranium 235 based on spectroscopy results. Below is a breakdown of maximum contamination levels found:

    - Fume Hood FHE-34
      - Large area wipe on the bottom plenum indicated 850 dpm alpha. Swipe results indicated 412 dpm/100cm^2 alpha and 971 dpm/100cm^2 beta.
      - Removable contamination levels on the ductwork were 177 dpm/100cm^2 alpha and 76 dpm/100cm^2 beta.
    - Fume Hood FHE-35
      - Maximum removable contamination was found to be 3,140 dpm/cm^2 tritum in the trough.
      - Removable contamination levels on the ductwork were found to be 36 dpm/100cm^2 tritium.
    - Fume Hood FHE-33
      - Large area wipe on the top plenum indicated 2,176 dpm alpha and 1,968 dpm beta. Swipe results on the trough indicated 1,180 dpm/100cm^2 alpha and 1,480 dpm/100cm^2 beta.
      - Maximum direct contamination readings in accessible areas was found to be 111 dpm/100cm^2 alpha on the bottom plenum. It is important to note that direct alpha contamination measurements in inaccessible areas (eg. plenums) could be lower than actual levels. Significant visible residue also could attenuate any radioactive material present.
      - Removable contamination levels on the ductwork was 21 dpm/100cm^2 alpha.
    - Fume Hood FHE-32
      - Swipe results on the bottom plenum indicated 9 dpm/100cm^2 alpha and 13 dpm/100cm^2 beta.
      - Maximum direct contamination readings in accessible areas was found to be 797 dpm/100cm^2 beta on the shelf. It is important to note that direct alpha contamination measurements in inaccessible areas (eg. plenums) could be lower than actual levels.
      - No detectable activity was found on the ductwork for this hood.

- Room 1326
  - Floors, walls and cabinetry were not surveyed for this room. As previously stated, results for rooms 1318 and 1322 will be used to represent the levels of contamination.
  - Contamination was found in all four hoods in this room. High levels of contamination were found in hood FHE-45. The trough, plenum, and back wall were not surveyed due to high levels. The main isotopes found in these hoods were identified to be americium-241and plutonium-239:

    - Fume Hood FHE-42
      - Swipe results indicated 10 dpm/100cm^2 alpha and 5 dpm/100cm^2 beta on the back wall.
      - Removable contamination levels on the ductwork was 53 dpm/100cm^2 alpha.
    - Fume Hood FHE-43
      - Swipe results indicated 3 dpm/100cm^2 alpha and 4 dpm/100cm^2 beta on the trough.
      - Removable contamination levels on the ductwork was 7 dpm/100cm^2 alpha.
    - Fume Hood FHE-44
      - Large area wipes indicated 634 dpm alpha on the hood floor. Swipe results indicated 9 dpm/100cm^2 alpha and 18 dpm/100cm^2 beta on the back wall.
      - Removable contamination levels on the ductwork was 12 dpm/100cm^2 alpha.
    - Fume Hood FHE-45
      - Large area wipes indicated 86,588 dpm alpha and 10,599 dpm beta on the upper ledge of the left wall. Swipe results indicated 13,500 dpm/100cm^2 alpha, 7,390 dpm/100cm^2 beta, and 2,900 dpm/100 cm^2 tritium on the same location.
      - Maximum direct contamination readings in accessible areas before surveying stopped were 10,641 dpm/100cm^2 alpha on the left wall and 4,770 dpm/100cm^2 beta on the back wall.
      - Removable contamination levels on the ductwork were 1,900 dpm/100 cm^2 alpha and 2,030 dpm/100 cm^2.

Table 1: Summary of radioactive contamination results for hoods and ductwork.

	Contamination Levels								
	Alpha			Beta			Tritium		
	Large Area Wipe (dpm)	Swipe (dpm/100 cm^2)	Total (dpm/100 cm^2)	Large Area Wipe (dpm)	Swipe (dpm/100 cm^2)	Total (dpm/100 cm^2)	Large Area Wipe (dpm)	Swipe (dpm/100 cm^2)	Total (dpm/100 cm^2)
Room 1318									
Hood FHE-24	320	23	bkgd	834	183	2,032	bkgd	bkgd	bkgd
Ductwork	bkgd	86	bkgd	bkgd	133	bkgd	bkgd	bkgd	bkgd
Hood FHE-25	8183	1270	229	17219	1200	5532	bkgd	bkgd	bkgd
Ductwork	bkgd	158	bkgd	bkgd	204	bkgd	bkgd	bkgd	bkgd
Hood FHE-26	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Ductwork	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Hood FHE-27	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Ductwork	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Room 1322									
Hood FHE-32	bkgd	9	bkgd	bkgd	13	797	bkgd	bkgd	bkgd
Ductwork	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Hood FHE-33	2176	1180	111	1968	1480	bkgd	bkgd	bkgd	bkgd
Ductwork	bkgd	21	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Hood FHE-34	850	412	bkgd	bkgd	971	bkgd	bkgd	bkgd	bkgd
Ductwork	bkgd	177	bkgd	bkgd	76	bkgd	bkgd	bkgd	bkgd
Hood FHE-35	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	3140	bkgd
Ductwork	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	36	bkgd
Room 1326									
Hood FHE-42	bkgd	10	bkgd	bkgd	5	bkgd	bkgd	bkgd	bkgd
Ductwork	bkgd	53	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Hood FHE-43	bkgd	3	bkgd	bkgd	4	bkgd	bkgd	bkgd	bkgd
Ductwork	bkgd	7	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Hood FHE-44	634	9	bkgd	bkgd	18	bkgd	bkgd	bkgd	bkgd
Ductwork	bkgd	12	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd	bkgd
Hood FHE-45	86588	13500	10641	10599	7390	4770	bkgd	2900	bkgd
Ductwork	bkgd	1900	bkgd	bkgd	2030	bkgd	bkgd	bkgd	bkgd

Industrial Hygiene Metals Characterization

- Room 1318
  Wood casework:
  - For some wood casework (four out of twelve sampling batches), lead contamination above the Lead Equipment Release Limit of 0.21 ug/ cm^2 was detected. The levels ranged from 0.21 to 5.6 ug/ cm^2.

  Fume Hood FHE 24, 25, 26 & 27:
  - Lead contamination above the Lead Equipment Release Limit of 0.21 ug/ cm^2 was detected on the fume hood ducting interior and most trough and plenum surfaces and the levels ranged from 0.21 to 1.5 ug/ cm^2. Inside of the fume hood FHE-26 trough, beryllium contamination above the release criteria is possible.

- Room 1322
  Wood casework:
  - For several of the wood casework (one out of seventeen sampling batches), lead contamination above the Lead Equipment Release Limit of 0.21 ug/ cm^2 was detected. The levels ranged from 0.21 to 0.27 ug/ cm^2.

  Fume Hood FHE 32, 33, 34 & 35:
  - Lead contamination above the Lead Equipment Release Limit of 0.21 ug/ cm^2 was detected on the fume hood ducting interior and most trough and plenum surfaces. The levels ranged from 0.22 to 1.9 ug/ cm^2.

- Room 1326
  Wood casework:
  - For most wood casework (six out of nine sampling batches), lead contamination above the Lead Equipment Release Limit of 0.21 ug/ cm^2 was detected. The levels ranged from 0.22 to 0.65 ug/ cm^2.
  - North lower casework drawers #23 and 25 are considered as contaminated with beryllium above the Release Criteria and were properly disposed.

  Fume Hood FHE 42, 43, 44 & 45*:
  - Lead contamination above the Lead Equipment Release Limit of 0.21 ug/ cm^2 was detected on the fume hood ducting interior and most trough surfaces. The levels ranged from 0.22 to 0.61 ug/ cm^2.
  - Cadmium levels of 5.2 ug/ cm^2, above the cadmium Screening Criteria for Metals Reference Values were detected on the fume hood FHE-42 centrifuge basin/ lid surfaces which are part of the fume hood.
  - *Fume hood FHE 45 interior surfaces were not IH Metals surveyed due to high radioactive contamination levels.

Conclusion

ES&H has supported the minor demolition of cabinetry and casework inside building 151 rooms 1318, 1322, and 1326. During the demolition and removal of items from these labs, detailed sampling and monitoring for contaminants was performed in order to develop a characterization report. To date, cabinetry and casework contamination has been primarily lead with some isolated spots of radioactive contamination and beryllium. The maximum level of lead was 5.6 ug/ cm^2.

Fume hoods and associated duct work were also sampled. The maximum contamination for radioactive materials was found to be approximately 13,500 dpm/100cm^2 alpha, 7,390 dpm/100cm^2 beta, and 2,900 dpm/100 cm^2 tritium in hood FHE-45 in room 1326. The identified isotopes were americium-241, plutonium-239, plutonium-240, and uranium-235. The majority of radioactive contamination levels were found to be in room 1318 hood FHE-25 and room 1326 hood FHE-45. The maximum levels of contamination for IH characterization were 1.9 ug/ cm^2 of lead inside fume hood trough surfaces, possible above Beryllium Release Criteria levels on fume hood trough surfaces in FHE-26 in room 1318, and 5.2 ug/ cm^2 of cadmium on the fume hood centrifuge basin/ lid surface.

Detailed surveys of results are available upon request.

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