3. RESULTS

The results from the December 1995 building characterization survey, the LANL radiological survey, and the LANL beryllium surveys are presented in this section. First the metal contaminants found above the LOC are presented followed by the results of each sampling survey method. Results are discussed in the following terms:

- surface and bulk concentrations of contaminants identified in the building and their location,
- important visual observations noted during the December 1995 survey,
- an evaluation of potential health and safety impacts from the contaminants identified,
- radiological contamination noted during the LANL survey,
- a comparison of the LANL radiological survey with concentrations of uranium and thorium identified during the December 1995 building characterization,
- beryllium contamination noted during the LANL survey and how these results compare to the December 1995 building characterization survey, and
- a summary of the physical hazards noted during the December 1995 building characterization survey.

These results are presented in the same order as Sect. 2. When a contaminant is found at a concentration greater than the LOC, the result is bolded in the tables where the data are presented. When a contaminant is found at gross contamination levels, it is bolded and shaded.

3.1 METALS OF CONCERN

As discussed in the introduction to Sect. 2, three different suites were chosen for metals analysis: standard suite, expanded suite, and full suite. Most of the samples were analyzed for the standard suite (i.e., beryllium, lithium, nickel, thallium, and uranium). However, a few samples were analyzed for the full suite of metals, which includes those available through common ICP analysis. The full suite analysis was performed to determine whether there were any contaminants that were not identified during the historical review of TA-3-141. As a result of this full suite analysis, the following elements were found at concentrations above the LOC:

- arsenic,
- barium,

- beryllium,
- cadmium,
- chromium,
- cobalt,
- copper,
- lead,
- molybdenum,
- nickel,
- thorium,
- uranium,
- vanadium, and
- yttrium.

The elements that were not part of the standard suite that were found above the LOC most often (i.e., in four or more of the full suite analyses) includes copper, lead, thorium, and vanadium. Due to the concerns with the lead standard, it was believed prudent to examine the extent of lead contamination in the standard suite samples. To minimize analytical costs, the lead sample results examined were taken from previous ICP analyses and were, therefore, not validated. Because these results were not validated, they are not included in the tables showing the standard suite analyses in this section. However, based on the successful validation of the other standard suite metals, the lead results may be viewed with confidence. As a result of examining this lead data, concentrations of lead above the LOC were found throughout the building.

Although metals other than those in the standard suite and lead were identified above the LOC, the concentrations of these metals were not evaluated further except for those analyzed as part of a full suite analysis. Further evaluation was not conducted as a cost savings measure and because it would not effect the overall conclusions of this study; however, these additional metals should be monitored during construction activities.

3.2 METAL WIPE SAMPLES

The metal wipe sampling activities conducted during the December 1995 survey provide the most significant information regarding surface contamination in the building. To minimize the number of samples required to adequately characterize the building, surface contamination areas were categorized into five major HAs:

- exhaust ventilation system,
- supply ventilation system,
- walls,
- rotating equipment, and
- miscellaneous horizontal surfaces.

It was also anticipated that contamination associated with these HAs would vary depending on the processes conducted at different locations in the building. Major processes conducted in the building were categorized as beryllium processes, radiological/general laboratory activities, and office activities. Therefore, these HAs are presented separately for each major building process area.

3.2.1 Exhaust Ventilation System

As discussed earlier, there are six exhaust ventilation systems in the building. One of the systems is for servicing the beryllium process area, and the remaining five service the radiological/general laboratory areas. There are no exhaust ventilation systems for the office areas.

Beryllium Process Areas. Six wipe samples were collected from the exhaust ventilation system in the beryllium area (i.e., new FE-1). One sample was taken from the outside of the ductwork, and the other five were from inside of the duct. Sample results are summarized in Table 3.1, and the supporting analytical reports are maintained with the project files.

Concentrations of beryllium above the LOC were detected in five of the six samples. The elevated levels of beryllium are to be expected in this system because it is used to exhaust beryllium dust away from the work areas. Other toxic metals detected in this ductwork include lead, lithium, nickel, and uranium. However, only lead and nickel were found at concentrations above the LOC. Lead was found in five of the six samples, and nickel was found once above the LOC. Beryllium was found above gross contamination levels in two of the samples. Gross contamination levels were not exceeded for any of the others.

Radiological/General Laboratory Areas. Nine wipe samples were collected from three different exhaust ventilation systems used for controlling contamination in the radiological/general laboratory areas (i.e., FE-6, FE-9, and FE-10). No samples were taken from old FE-1 or FE-11. Old FE-1 is used mainly for the area that was outside the scope of the survey conducted by Radian, although old FE-1 does service one small lab hood in Room 130 and has a blanked-off duct that penetrates Room 136, which are within the areas surveyed. Old FE-1 was difficult to access in Rooms 130 and 136, so no internal samples were taken from this system. Old FE-1 is the original exhaust system established for the old part of TA-3-141 that was used for processing uranium in the early days; therefore, uranium contamination may be present. Old FE-1 was determined through visual observation near the exhaust stack to not contain significant quantities of dust. However, some dead areas within the ductwork may have accumulated dust.

FE-11 is used for supplying clean cool air to Room 106 and, therefore, is not truly an exhaust ventilation system. Therefore, it is anticipated that FE-11 would be contaminated with the same metals found on horizontal surface areas in that area of the building. Metal contaminants found on horizontal surfaces over the LOC in this area include beryllium and lead.

Table 3.1. Wipe samples collected from exhaust ventilation system in the beryllium process area (new FE-1)

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Exhaust (Outside)	136A/9 ft/ NE corner	1172Y	**17,200**	34.0	479	8.14	104
Exhaust stack (Inside)	136A/9 ft/near airlock	1174C	**47,900**	393	**5080**	3.74	**44,500**
Exhaust duct (Inside)	141/7 ft /S wall, center	1187Y	**26.5**	3.75	11.9	1.24	20.2
Exhaust duct (Inside)	141/7 ft /S wall, center	1188A (QC)	**15.6**	ND	30.7	ND	<62.8
Exhaust vent (Inside)	141/7 ft /S wall, center	1189C	1.35	ND	12.1	ND	63.5
Exhaust vent (Inside)	141/7 ft /S wall, center	1190F (QC)	**10.7**	ND	16.1	ND	<62.8

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2
Li = 930 ug/ft^2
Ni = 930 ug/ft^2
Tl = 93 ug/ft^2
U = 560 ug/ft^2

Exhaust ventilation wipe samples were analyzed for 45 different elements. From this analysis, 14 elements were found at concentrations greater than the LOC. These contaminants include beryllium (all nine samples), vanadium (one sample), chromium (one samples), cobalt (four samples), nickel (one sample), copper (six samples), arsenic (one sample), yttrium (one sample), molybdenum (one sample), cadmium (one sample), barium (one sample), lead (all nine samples), thorium (six samples), and uranium (eight samples).

Sample results are summarized in Table 3.2, and the supporting analytical reports are included with the project files. Elements most often found above the LOC (i.e., in at least four of the nine samples) include beryllium, cobalt, copper, lead, and uranium. Because of the quantity of dust noted in the exhaust ventilation systems, these areas should be considered grossly contaminated.

3.2.2 Supply Ventilation System

There are six supply ventilation systems in the building. One system is dedicated to the beryllium process area, two systems are dedicated to the office areas (one of these systems also serves Room 126, which is outside the scope of Radian's survey), another system serves radiological/general laboratory areas only, another serves all areas except office areas, and the last provides air for all major building areas. Wipe samples were collected from both the inside and outside surface areas of these systems. Outside surface areas normally sampled were the fins on the vents. The fin area was chosen as a sample point when it was not possible to remove the vent cover without damaging the ductwork. The fins on the ductwork should be indicative of contamination in dust that has settled in the room as well as contamination within the supply ductwork.

Because the source of any detected contamination on the vent fins may come from the process area serviced by the vent, wipe sample results for the supply ventilation systems are presented by building area. However, results are grouped by ventilation system so that contamination associated with a given system may be differentiated.

Beryllium Process Areas. There are two supply ventilation systems that service this area. HVA-3 is dedicated to the beryllium area, and HV-2 services this and other areas. Ten samples were retrieved from HVA-3 (Rooms 139 and 141) and three samples were collected from HV-2 (Room 136A). All the samples taken from HV-2 and HVA-3 were from the fin areas of the vents. However, because of how the vents were situated for HVA-3, the sampled fin areas should be more indicative of internal contamination rather than external. These vents were facing downward, and the portion of the fin sampled was facing upward into the ductwork. On the other hand, samples retrieved from HV-2 are probably more indicative of external contamination and possibly some internal contamination. These vents were faced in a horizontal direction so that dust settling in the area could collect on all surfaces. However, the fin areas facing the most downward direction were sampled in an attempt to approximate internal contamination.

Table 3.2. Wipe samples collected from the exhaust ventilation systems in radiological/process areas

Element	Level	Concentration								
		1043J FE-6 Duct (ug/ft^2)	1044K FE-6 Duct (ug/ft^2)	1050W FE-6 Cabinet (ug/ft^2)	1053A FE-10 Duct (ug/ft^2)	1066X FE-10 Duct (ug/ft^2)	1067Y-QC FE-10 Duct (ug/ft^2)	1069C FE-9 Weld Hood (ug/ft^2)	1070F FE-9 Oven (ug/ft^2)	1071G FE-10 Duct (ug/ft^2)
Antimony	460	3.42	1.98	3.49	5.19	5.71	5.18	5.33	9.56	23.0
Arsenic	190	13.5	16.3	38.3	11.1	15.1	13.7	637	14.4	31.0
Barium	460	89.0	12.0	14.8	53.8	203	159	221	357	**1420**
Beryllium	1.9	**30.6**	**21.7**	**12.8**	**10.8**	**17.7**	**16.8**	**68.9**	**8.94**	**7.79**
Bismuth	9300	6.47	0.344	0.669	14.7	399	273	29.0	6.20	832
Boron	9300	282	15.4	36.8	21.3	72.6	73.1	392	149	42.0
Cadmium	46	3.95	2.09	8.55	6.01	8.82	6.30	**65.8**	11.0	36.0
Cerium	---	1.61	1.32	0.39	4.38	6.17	4.94	1.81	5.83	12.0
Cesium	1900	0.223	0.13	11.4	1.24	2.45	1.55	1.61	0.70	3.73
Chromium	460	29.1	21.7	42.3	19.6	28.3	25.5	**756**	26.0	54.7
Cobalt	19	8.10	0.678	5.56	3.23	**25.3**	**20.5**	**35.6**	5.56	**21.6**
Copper	93	73.4	4.21	**2020**	81.6	**290**	**232**	**42,400**	**218**	**1770**
Drysprosium	---	0.204	0.084	0.084	0.372	0.641	0.353	1.24	0.50	1.70
Erbium	---	0.316	0.111	0.418	3.00	7.98	5.15	0.920	1.59	5.02
Europium	---	0.539	0.056	0.111	0.864	2.12	1.23	0.864	1.09	1.90
Gadolinium	---	3.28	0.158	17.2	4.91	18.4	12.3	6.08	26.6	7.89
Gold	---	2.27	0.316	1.10	2.48	120	78.9	41.2	1.91	2.55
Holmium	---	0.028	0.028	0.019	0.084	0.214	0.167	0.177	0.093	0.167
Lanthanum	---	1.37	0.678	0.910	4.54	9.32	6.87	0.957	68.9	13.7
Lead	46	**182**	**174**	**56.9**	**134**	**784**	**609**	**92.3**	**308**	**540**
Lithium	930	13.4	1.49	2.28	8.21	13.2	11.3	22.3	8.44	48.7
Lutetium	---	0.353	0.028	0.046	7.78	40.7	32.8	0.362	0.297	27.9
Magnesium	9300	155	111	110	206	274	245	582	260	509
Manganese	4600	15.2	7.75	90.0	15.1	19.6	17.4	234	27.0	64.6
Molybdenum	9300	329	2.05	617	71.9	784	549	**27,500**	391	453
Neodymium	---	1.27	0.632	1.11	1.51	2.56	1.94	1.71	2.98	5.15
Nickel	930	143	8.90	234	17.3	119	93.2	**8590**	84.3	325
Praeseodymium	---	0.362	0.139	0.084	0.650	0.975	0.743	0.427	1.59	1.87
Rubidium	---	0.409	0.539	0.409	0.725	0.725	0.622	3.61	1.21	3.12

Table 3.2 (continued)

Element	Level	Concentration								
		1043J FE-6 Duct ug/ft²	1044K FE-6 Duct ug/ft²	1050W FE-6 Cabinet ug/ft²	1053A FE-10 Duct ug/ft²	1066X FE-10 Duct ug/ft²	1067Y-QC FE-10 Duct ug/ft²	1069C FE-9 Weld Hood ug/ft²	1070F FE-9 Oven ug/ft²	1071G FE-10 Duct ug/ft²
Samarium	---	1.27	0.780	4.25	0.864	0.985	0.966	10.4	1.95	1.50
Tellurium	93	3.03	2.59	4.02	3.09	42.8	24.7	67.8	3.23	2.55
Terbium	---	0.037	0.037	0.074	0.966	3.70	2.84	0.362	0.167	1.54
Thallium	93	0.836	0.725	0.214	0.576	4.22	2.83	2.47	1.28	2.21
Thorium (ICP-MS analysis)	46	6.45	0.576	4.21	3.88	9.19	6.87	27.2	9.03	6.35
Thulium	---	3.91	0.019	0.028	0.418	1.66	1.09	0.948	1.48	0.799
Tin	1900	22.3	3.89	62.8	22.4	126	87.0	179	110	84.7
Titanium	9300	1041	7.81	41.5	36.0	100	69.0	935	550	189
Tungsten	4600	2031	15.3	1600	472	2260	1910	2530	2090	2090
Uranium	560	**1880**	2.17	**687**	89.4	**2010**	**2100**	413	468	**691**
Vanadium	46	3.96	2.43	5.26	8.78	11.03	8.69	**2430**	4.26	8.47
Ytterbium	---	0.139	0.121	0.260	0.149	0.307	0.269	1.00	0.307	0.288
Yttrium	930	84.4	0.520	76.0	12.0	28.8	19.5	**1400**	66.7	49.0
Zinc	4600	991	982	116	1207	1368	1270	601	1050	605
Zirconium	---	128	1.31	622	37.4	72.7	79.2	80.3	70.3	42.4

ND = not detected

Sample results are summarized in Table 3.3, and the supporting analytical reports are included in the project files. Concentrations of beryllium well above the LOC were detected in all three samples from the HV-2 system. Concentrations of beryllium above the LOC were also detected in three of the seven samples from the HVA-3 system. In addition, lead was found above the LOC in one of the samples from the HVA-3 system (57 $\mu g/ft^2$). The high beryllium concentrations in Room 136A indicate that the supply ventilation system in this area is grossly contaminated.

Radiological/General Laboratory Areas. Three supply ventilation systems service these areas: HVA-1, HV-2, and HV-3. A total of 7 samples were collected from HVA-1, 12 samples were collected from HV-2, and 17 samples were collected from HV-3 servicing the radiological/general laboratory areas. Sample results are summarized in Table 3.4. Contamination was detected above the LOC for nickel from two of the internal samples taken from HVA-1. In addition, lead was found above the LOC in six samples from HV-3, two samples from HVA-1, and two samples from HV-2. All but two of the samples from HV-3 were taken from inside the ductwork. Therefore, it is safe to assume that the supply ventilation systems serving the laboratory areas contain contamination above the LOC. However, gross contaminant levels were not detected. Lead concentrations ranged from 6.6 to 215 $\mu g/ft^2$.

Office Areas. Three supply ventilation systems service the office areas: HV-1, HVA-1, and HVA-2. No samples were retrieved from HVA-1 within the office areas; however, samples from HVA-1 were retrieved from other areas (see Table 3.4). Two of these samples taken from HVA-1 in nonoffice areas exhibited concentrations of nickel and lead above the LOC. Seven samples were collected from HV-1, and three samples were collected from HVA-2. Sample results are summarized in Table 3.5.

Lead was found at concentrations above the LOC in all three samples collected from HVA-2 and in five of the seven samples collected from HV-1. No other elements were found above the LOC. Therefore, the supply system to the office areas is contaminated with lead. However, gross contamination levels were not detected. Lead concentrations above the LOC ranged from 81.4 to 251 $\mu g/ft^2$.

3.2.3 Walls

Wall areas were categorized separately because it was believed that gross contamination was less likely to accumulate on a vertical surface, and therefore, surface contamination should be less for this HA. Walls were sampled in all three major building areas.

Beryllium Process Areas. Ten wipe samples were collected from the walls located in the beryllium areas. All samples were retrieved at elevations of 3 to 4 ft above floor level. Three of the samples were retrieved from Room 136A, six from Room 141, and one from Room 139. Sample

Table 3.3. Wipe samples collected from the supply ventilation system in beryllium process areas

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Supply vent HV-2 (outside)	136A/18 ft /E side	1175F	**224**	5.78 B	5.56	ND	ND
Supply vent HV-2 (outside)	136A/18 ft /E side	1185W (QC)	**178**	2.89	3.20	ND	ND
Supply vent HV-2 (outside)	136A/18 ft /W side	1176G	**772**	5.78 B	14.7	ND	<62.8
Supply vent HVA-3 (outside)	141/16 ft /E side	1191G	**11.3**	5.05 B	2.94	ND	ND
Supply vent HVA-3 (outside)	141/16 ft /E side	1192H	**2.36**	4.33 B	<1.08	ND	ND
Supply vent HVA-3 (outside)	141/16 ft /Center	1193J	1.11	2.79 B	<1.08	ND	<62.8
Supply vent HVA-3 (outside)	141/16 ft /Center	1194k	1.00	9.38 B	<1.08	ND	<62.8
Supply vent HVA-3 (outside)	141/7 ft /W wall, center	1195L	**2.17**	5.78 B	<1.08	4.41	<62.8
Supply vent HVA-3 (outside)	139/10 ft /S wall, center	1211M	0.585	3.61 B	<1.08	ND	<62.8
Supply vent HVA-3 (outside)	139/10 ft /S wall, center	1212N	**18.7**	11.5	16.6	<3.48	147

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Table 3.4. Summary of wipe samples collected in supply ventilation systems serving rediological/process areas

Item	Room/elevation/ location	Sample no.	Concentration				
			Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Inside fanhouse HV-3	248/3 ft/ Coil area	1045L	ND	6.16	12.3	ND	<62.8
Inside fanhouse HV-3	248/3 ft/Fresh air intake	1046M	<0.139	6.89	12.5	ND	<62.8
Inside fanhouse HV-2	248/4 ft /W wall	1060L	ND	4.71	6.27	ND	<62.8
Inside fanhouse HV-2	248/3 ft /W wall	1061M	ND	3.26	15.7	ND	<62.8
Vent HV-3 (inside)	148/10 ft	1047N	ND	8.34	38.1	ND	<62.8
Vent HV-3 (outside)	144/20 ft	1051X	<0.139	4.71	39.0	ND	ND
Vent HVA-1 (outside)	130/9 ft /SW corner	1054C	ND	6.16	4.78	ND	<62.8
Vent HVA-1 (inside)	130/9 ft /SW corner	1055F	0.204	11.6	27.1	ND	<62.8
Vent HVA-1 (inside)	130/9 ft /SW corner	1056G (QC)	ND	10.5	17.0	ND	<62.8
Vent HVA-1 (outside)	106/9 ft /W wall center	1057H	<0.139	4.71	3.68	ND	<62.8
Vent HVA-1 (outside)	137/7 ft /E wall center	1087H	<0.139	5.43	65.8	ND	<62.8
Vent HVA-1 (inside)	137/7 ft /E wall center	1088J	ND	ND	**1500**	ND	<62.8
Vent HVA-1 (inside)	137/7 ft /E wall center	1089K (QC)	<0.139	ND	**1670**	ND	<62.8
Vent HV-3 (outside)	144/25 ft/ N wall, 4th vent	1091M	ND	ND	10.3	ND	<62.8
Vent HV-3 (outside)	144/25 ft /N wall, 3rd vent	1092N	ND	ND	10.9	ND	<62.8
Vent HV-3 (outside)	148/8 ft /S wall, 2nd vent	1094T	<0.139	10.5	307	ND	300 B
Vent HV-3 (inside)	148/8 ft /S wall, 2nd vent	1095W	ND	<2.76	12.0	ND	ND
Vent HV-3 (inside)	148/8 ft /S wall, 2nd vent	1096X (QC)	ND	<2.76	16.4	ND	ND
Vent HV-3 (outside)	148/8 ft /S wall, 3rd vent	1097Y	ND	7.26	225	ND	204 B
Vent HV-3 (inside)	148/8 ft /S wall, 3rd vent	1098A	ND	5.43	30.7	ND	ND
Vent HV-3 (outside)	144/25 ft /N wall, 3rd vent	1100F	ND	6.16	7.80	ND	<62.8
Vent HV-3 (outside)	150/7 ft /N wall	1103J	ND	5.80	19.4	ND	<62.8
Vent HV-3 (outside)	150/7 ft /S wall	1104K	ND	4.71	17.5	ND	151
Vent HV-3 (outside)	144/25 ft/ N wall, 5th vent	1105L	ND	3.26	5.66	ND	<62.8
Vent HV-3 (outside)	144/25 ft/ N wall, 6th vent	1107N	ND	3.99	12.6	ND	<62.8
Vent HV-3 (outside)	144/25 ft/ N wall, 6th vent	1108R (QC)	ND	3.26	17.5	ND	<62.8
Vent HV-2 (inside)	142/8 ft /S wall, 1st vent	1113A	ND	4.71	3.54	ND	ND
Vent HV-2 (inside)	142/8 ft /S wall,1st vent	1114C	ND	ND	2.81	ND	75.8
Vent HV-2 (outside)	136/25 ft /S wall, 1st vent	1115F	ND	6.16	7.80	ND	<62.8 B

Table 3.4 (continued)

Item	Room/elevation/ location	Sample no.	Concentration Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Vent HV-2 (outside)	136/25 ft /N wall, 3rd vent	1117H	ND	5.80	19.4	ND	<62.8 B
Vent HV-2 (outside)	136/25 ft /N wall, 4th vent	1118J	ND	5.43 B	23.1	ND	ND
Vent HV-2 (outside)	136/25 ft /N wall, 4th vent	1119K	0.223	8.70 B	20.3	ND	86.4
Vent HV-2 (outside)	136/25 ft /S wall, 3rd vent	1129C	<0.139	6.16 B	18.2	ND	ND
Vent HV-2 (outside)	136/25 ft /S wall, 2nd vent	1130F	ND	5.80 B	14.9	ND	<62.8

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Table 3.5. Summary of wipe samples collected in supply ventilation systems serving office areas

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Inside fanhouse HVA-2	248/ SW corner	1058J	ND	14.121	5.230	ND	<62.800
Vent (inside)	146/8 ft /W wall	1059K	0.232	7.255	12.913	ND	98.474
Inside fanhouse HV-1	201/7 ft /W wall	1072H	ND	<2.759	1.403	ND	<62.800
Inside fanhouse HV-1	201/5 ft /W wall	1073J	ND	19.974	2.397	ND	ND
Vent HV-1 (inside)	113/8 ft/ Center	1076M	0.149	6.893	15.050	ND	ND
Vent HV-1 (inside)	113/8 ft/ Center	1077N (QC)	0.242	7.618	29.264	ND	91.042
Vent HV-1 (inside)	100/8 ft/ NE corner	1080W	<0.139	5.797	18.580	ND	<62.800
Vent HV-1 (inside)	116/8 ft E wall, center	1083A	0.279	7.255	20.159	ND	<62.800
Vent HV-1 (inside)	116/8 ft /E wall, center	1084C (QC)	0.622	6.893	17.558	ND	ND
Vent HVA-2 (inside)	138/8 ft /S wall	1090L	<0.139	9.755	11.241	ND	<62.800

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2
Li = 930 ug/ft^2
Ni = 930 ug/ft^2
Tl = 93 ug/ft^2
U = 560 ug/ft^2

results are summarized in Table 3.6. The three samples collected from Room 136A contained levels of beryllium above the LOC. None of the other samples contained contaminants above the LOC. Lead concentrations ranged from < 1 to 22 $\mu g/ft^2$.

The sample results from the wall areas in the beryllium areas are close to what would be expected. In general, wall sample results tend to show less contamination than samples taken from horizontal surfaces. This is because horizontal surfaces are more conducive to dust collection. From examining the data, it would appear that beryllium contamination on the walls in Room 136A is a major concern, but wall contamination in Room 141 is not. The wall samples in Room 136A are high enough to be considered grossly contaminated.

Radiological/General Laboratory Areas. Eight wipe samples were taken from the walls located in the radiological/general laboratory areas. None of the samples indicated contamination above a LOC, except one sample for lead from the mezzanine area (110 $\mu g/ft^2$). A summary of results for these samples is provided in Table 3.7. Lead concentrations outside of the mezzanine area varied from < 1 to 5 $\mu g/ft^2$. Sample results are close to what would be anticipated. In general, wall areas are less conducive to dust accumulation than horizontal surfaces and, therefore, demonstrate less contamination.

Office Areas. Nine wipe samples were taken from the walls located in the office areas. Contamination above the LOC was not detected in any of these samples. A summary of sample results is provided in Table 3.8. Lead concentrations varied from < 1 to 19 $\mu g/ft^2$.

Elevated concentrations of uranium were noted in Rooms 100 and 135. Room 135 is actually a change room, and Room 100 is an entrance way into the main office area.

3.2.4 Rotating Equipment

Rotating equipment was placed in a separate category because it was believed that the type and quantity of contamination that would accumulate on this equipment are different from stationary structures. Examples of rotating equipment includes fans, motors, and pumps. Rotating equipment tends to be closer to the process where various toxic metals were handled, and this equipment often has oil on its surfaces, allowing contaminants to adhere more readily to the equipment. These aspects make contamination more likely. Rotating equipment was sampled in both the beryllium areas and the radiological/general laboratory areas.

Beryllium Process Areas. Six wipe samples were taken from rotating equipment in the beryllium areas, including Rooms 136A and 141. No rotating equipment was noted in Room 139; therefore, no samples were taken from this room. Contamination above the LOC for beryllium was noted for all the samples and one of the samples contained concentrations of lead above the LOC

Table 3.6. Wipe samples collected from walls in beryllium process areas

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Wall	136A/4 ft /N wall	1177H	**21.9**	5.05 B	<1.08	ND	ND
Wall	136A/4 ft /S wall	1178J	**108**	4.33 B	1.27	ND	<62.8
Wall	136A/6 ft /E wall	1179K	**753**	5.05 B	<1.08	ND	98.5
Wall	141/5 ft /W wall by door	1202Y	0.827	4.33 B	ND	<3.48	ND
Wall	141/5 ft /N wall by door	1203A	0.994	5.05 B	1.18	ND	112
Wall	141/5 ft /E wall by door	1204C	0.492	4.33 B	<1.08	<3.48	<62.8
Wall	141/5 ft /S wall, center	1205F	ND	5.05 B	1.19	ND	68.7
Wall	141/5 ft /S wall, center	1206G	<0.139	3.61 B	<1.08	ND	<62.8
Wall	141/5 ft /S wall, center	1207H (QC)	ND	4.33 B	<1.08	ND	<62.8
Wall	139/5 ft /W wall	1208J	0.279	5.05 B	5.07	ND	ND

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Table 3.7. Summary of wipe samples collected from walls in radiological/process areas

Item	Room/elevation/ location	Sample no.	Concentrations				
			Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Wall	126/4 ft /W wall at door	1023A	ND	5.80 B	<1.08	ND	ND
Wall	144/2 ft /NE corner	1027H	ND	4.71 B	1.73	<3.48	89.3
Wall	144/2 ft /NE corner	1028J (QC)	ND	4.71 B	2.64	6.06	<62.8
Wall	148/5 ft /N wall center	1029K	ND	6.16 B	1.48	ND	ND
Wall	248/5 ft /SE corner	1030L	ND	5.43 B	2.08	ND	<62.8
Wall	150/4 ft /NW corner	1169T	ND	5.80 B	5.27	ND	ND
Wall	136/4 ft /N wall center	1170W	ND	5.43 B	1.57	ND	ND

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Table 3.8. Summary of wipe samples collected from walls in office areas

Item	Sample type	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Wall	Wipe	138/4 ft /SE corner	1018R	ND	6.15 B	1.61	ND	<62.8
Wall	Wipe	135/4 ft /S wall center	1019T	ND	4.71 B	<1.08	ND	94.8
Wall	Wipe	117/5 ft /SE corner	1020W	<0.139	4.71 B	3.83	ND	ND
Wall	Wipe	116/5 ft /E wall center	1021X	ND	5.07 B	1.21	ND	<62.8
Wall	Wipe	100/5 ft /SW corner	1022Y	ND	6.16 B	<1.08	ND	88.2
Wall	Wipe	113/5 ft /S wall center	1024C	ND	5.43 B	2.81	ND	<62.8
Wall	Wipe	102/5 ft /NE corner	1025F	ND	5.80 B	4.29	ND	<62.8
Wall	Wipe	133/5 ft / wall center	1026G	ND	5.43 B	1.48	ND	ND
Wall	Wipe	146/3 ft /W wall center	1031M	ND	4.71 B	<1.08	ND	<62.8

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

(Room 136A). A summary of sample results is given in Table 3.9. Lead concentrations varied from 8 to 89 $\mu g/ft^2$.

Concentrations of beryllium above the LOC were anticipated for rotating equipment in these areas. The oil used for rotating equipment provides a convenient place for dust to accumulate. Because the dust associated with this equipment when mixed with oil is less likely to become airborne, these high concentrations are probably not as great a health hazard as they would be for normal dust. However, the concentrations are above gross contamination levels and, therefore, warrant consideration for worker health and safety during reconfiguration activities.

Radiological/General Laboratory Areas. Eighteen wipe samples were collected from rotating equipment in the radiological/general laboratory areas. A summary of these sample results is provided in Table 3.10. Five of these samples were collected from the exhaust system fans on the mezzanine level and the remaining thirteen samples were taken from the first floor. All the samples collected from the mezzanine level contained metal contaminants above the LOC. In addition, one of the samples indicated gross contamination with lead. Contaminants found above the LOC in the mezzanine area include lead (all five samples), beryllium (two samples), nickel (two samples), and uranium (three samples). Lead concentrations in the mezzanine area ranged from 280 to 1350 $\mu g/ft^2$.

Samples taken from the first floor contained less contamination than those from the mezzanine area. Six of the thirteen samples contained lead above the LOC, and one sample contained beryllium above the LOC. Lead found above the LOC on the first floor ranged in concentrations from 83.2 to 300 $\mu g/ft^2$.

Based on these results, rotating equipment in the mezzanine area should be considered grossly contaminated and, therefore, must be handled with care to protect the health and safety of the workers during reconfiguration activities. Rotating equipment on the first floor appears to contain significantly less contamination; however, contamination above the LOC was still noted.

3.2.5 Miscellaneous Horizontal Surfaces

This is the largest category for metal wipe sampling. It was observed during the sampling activity that horizontal surfaces located below 6 ft tended to have less accumulation than higher elevated surfaces. This fact was attributed to the more frequent cleaning conducted for the horizontal surfaces that are readily accessible. Based on this observation, it was assumed that the elevated surfaces were more likely to show historical contamination and lower surfaces were likely to show recent contamination. In addition, surface areas on equipment where powdered metals may be handled were believed to contain additional contamination. Therefore, this category is presented in terms of surface elevation height above 6 ft and below 6 ft and in terms of equipment surfaces.

Table 3.9. Summary of wipe samples collected from rotating equipment in beryllium process areas

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Pump	136A/3 ft/ NW corner	1180L	**1930**	3.61 B	216	ND	68.2
Pump	136A/3 ft/ S end, corner	1181M	**11,400**	12.3 B	71.8	ND	<62.8
Top of equipment	136A/20 ft /N wall, mezz.	1186X	**5930**	1.19	28.0	0.028	2.99
Base of rotating equipment	141/1 ft /S wall, center	1199T	**19.8**	ND	10.2	ND	66.0
Base of rotating equipment	141/1 ft/ S wall, center	1200W (QC)	**23.2**	ND	6.04	ND	<62.8
Pump	141/1 ft/ SE corner	1201X	**31.4**	ND	13.1	ND	<62.8

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Table 3.10. Summary of wipe samples collected from rotating equipment in radiological/process areas

Item	Room/elevation/ location	Sample no.	Concentration Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
FE-9 fan housing	248/3 ft/ backside of fan	1062N	0.530	4.23	976	9.57	**887**
FE-9 fan housing	248/3 ft/ S side of fan	1063R	**2.68**	55.0	**1280**	1.37	**862**
FE-9 fan housing	248/3 ft/ N side of fan	1064T	1.18	5.20	591	3.23	555
FE-10	248/3 ft/ on fan housing	1065W	**2.13**	47.1	89.3	2.79	**1360**
FE-10	248/3 ft /E side of fan	1068A	0.920	4.52	58.1	0.938	280
Lathe	148/5 ft /SW corner	1216X	0.288	9.04	43.5	ND	83.6 B
Lathe	148/5 ft /SW corner, NW end of Lathe	1217Y	ND	4.90	24.2	ND	88.1 B
Lathe	same as 1217Y	1218A (QC)	0.167	5.27	26.3	ND	<62.8
Mixer	148/4 ft /NE corner	1219C	0.409	3.39	24.5	ND	<62.8
Vacuum pump	136/6 ft /NW corner	1220F	1.43	6.40	15.8	ND	<62.8
Vacuum pump	136/4 ft /NE corner	1221G	1.51	3.39	6.01	ND	116 B
Pump	136/1 ft /NE corner	1222H	ND	3.01	1.16	ND	<62.8
Pump	136/1 ft /S side	1223J	<0.139	6.40	21.9	ND	123 B
Next to grinder	142/4 ft /S side	1224K	0.697	15.8	6.43	ND	64.7 B
Melt spinner motor	144/3 ft /S side	1225L	0.344	3.76	41.8	ND	123 B
Melt spinner motor	144/3 ft /S side	1226M (QC)	0.752	<2.76	62.7	ND	<62.8 B
Microwave pump	144/4 ft /NE corner	1227N	<0.139	<2.76	9.22	ND	<62.8 B
Pump	137/4 ft /N center	1228R	5.47	27.9	33.7	ND	<62.8 B

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Beryllium Process Areas. Nine wipe samples were collected from horizontal surfaces in the beryllium area (i.e., Rooms 136A, 139, and 141) at elevations above 6 ft. No samples were gathered at elevations less than 6 ft or for equipment because of the large quantity of historical data available for this type of sample. Historical data for the beryllium are presented in Sect. 3.7. Results for samples collected at elevations above 6 ft are given in Table 3.11.

Concentrations of beryllium above the LOC were detected in all samples collected from this area. In addition, concentrations of lead were found above the LOC in two of the samples. The concentration of beryllium detected in Room 136A was well above gross contamination levels and will, therefore, warrant special consideration for worker health and safety during reconfiguration activities. Lead sample results ranged from 9.5 to 66 $\mu g/ft^2$.

Radiological/General Laboratory Areas. Based on visual observations on accumulated dust, these areas were subdivided into three categories: horizontal surfaces less than 6 ft above the floor, horizontal surfaces greater than 6 ft, and horizontal surfaces on equipment. A total of 48 samples were collected from these three categories and included Rooms 103, 130, 136, 137, 144, 148, and 150. Sample results are summarized in Tables 3.12 through 3.14. Toxic metal concentrations above the LOC were noted within all three categories.

Six samples were collected on horizontal surfaces less than 6 ft above the floor. Toxic metals at concentrations above the LOC were noted in three of these samples. A sample collected from an electrical outlet in Room 106 exceeded the beryllium LOC, and two samples collected from a window sill in Room 148 and from an electrical outlet in Room 150 exceeded the LOC for lead. Lead concentrations varied from 4 to 88 $\mu g/ft^2$.

Twenty-one samples were collected on horizontal surfaces greater than 6 ft above the floor. Toxic metals at concentrations above the LOC were noted for ten of these samples. One of the samples was contaminated with beryllium and lead, and the remaining nine were contaminated with lead. Thorium was also analyzed for sample 1214T with a result of 2.3 $\mu g/ft_2$, which is below the LOC. Lead concentrations varied from 3 to 1122 $\mu g/ft^2$. None of the metals found were above gross contamination levels; however, one of the lead samples was close. (Gross lead contamination is defined as > 1160 $\mu g/ft^2$.)

Twenty-one samples were collected from the horizontal surfaces of equipment. Toxic metals at concentrations above the LOC were noted with 12 samples. One sample contained beryllium contamination above the LOC, and the remaining 11 samples were contaminated with lead. Thorium was also analyzed for sample 1215W (bus bar in Room 136) with a result of 11 $\mu g/ft^2$, which is below the LOC. Lead concentrations varied from 6 to 480 $\mu g/ft^2$ except for one sample containing gross contamination of 2380 $\mu g/ft^2$. Because gross contamination was detected for lead in this area, consideration of the lead standard may be necessary to protect the health and safety of the dismantlement workers.

Table 3.11. Summary of horizontal wipe samples collected in beryllium process areas

Item	Room/elevation/ location	Sample no.	Concentration Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Light fixture	136A/18 ft /N center	1182N	**1580**	22.4 B	40.8	ND	67.2
Lab hood	136A/9 ft /W wall	1183R	**3340**	17.0 B	107	ND	ND
Cabinet	136A/20 ft/ N wall mezz	1184T	**3790**	ND	27.1	ND	<62.8
Light fixture	141/16 ft /N wall center	1196M	**9.85**	7.23 B	3.96	ND	<62.8
Lab hood	141/7 ft /N cntr in hood	1197N	**21.6**	4.33 B	3.19	ND	<62.8
Lab hood	141/7 ft /N cntr in hood	1198R (QC)	**17.2**	<2.76	3.44	ND	ND
Storage cabinet	139/7 ft /S wall center	1209K	**45.2**	6.14 B	4.87	ND	66.5
Storage cabinet	139/7 ft /SW corner	1210L	**78.0**	6.50 B	11.3	<3.48	<62.8

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Table 3.12. Summary of horizontal wipe samples collected in radiological/process areas – <6 ft

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Electrical outlet	106/4 ft /NW corner	1237H	**2.26**	20.0	11.9	<3.48	ND
Electrical outlet	137/5 ft /W wall middle	1230W	1.59	20.0	5.62	ND	ND
Elec. gang outlet	150/5 ft /N wall middle	1167N	ND	3.56	7.84	ND	<62.8
Electrical conduit	137/5 ft /E wall middle	1042H	<0.139	<2.76	3.61	ND	<62.8
Window sill	148A/4 ft /E wall south end	1041G	ND	4.27 B	122	<3.48	125
Control box	150 /S wall	1165L	ND	4.27	10.2	<3.48	245

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Table 3.13. Summary of horizontal wipe samples collected in radiological/process areas -- >6 ft

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Light fixture	148/7 ft /S wall center	1247Y	<0.139	4.99	18.6	<3.48	ND
Light fixture	148/7 ft /NE corner	1246X	0.372	4.14	5.98	ND	86.0 B
Speaker box	130/9 ft /S wall center	1238J	1.01	22.5	3.70	<3.48	<62.8
Light fixture	150/8 ft /SW corner	1168R	ND	7.13	2.75	ND	76.7
Bus bar	136/18 ft /NE corner	1121M	0.223	8.55 B	52.7	ND	ND
Light fixture	136/18 ft /5th from W wall	1120L	0.139	41.7 B	33.4	ND	<62.8
Vent grill (outside)	136/25 ft /1st from W wall	1116G	ND	4.27 B	11.2	<3.48	ND
Light fixture	136/18 ft /2nd from W wall	1112Y	0.195	29.5 B	50.1	<3.48	114
Vent grill (outside)	136/25 ft /1st from W wall	1110W	<0.139	3.92 B	8.95	<3.48	<62.8
Vent grill (outside)	136/25 ft /1st from W wall	1111X (QC)	ND	3.92 B	10.9	5.68	73.1
Duct	144/20 ft /S wall center	1109T	<0.139	5.69 B	25.7	ND	67.9
Vent grill (outside)	144/25 ft /5th from W wall	1106M	ND	3.56 B	7.64	ND	<62.8
Light fixture	144/29 ft /N wall center	1102H	0.910	16.4 B	179	ND	142
Vent grill (outside)	144/25 ft /4th from W wall	1101G	<0.139	3.56 B	6.94	ND	<62.8
Vent grill (outside)	148/8 ft/ 4th from W wall	1099C	ND	3.56 B	94.8	ND	123
Duct	144/20 ft /N side center	1093R	0.260	5.69 B	74.0	ND	175
On the ledge	144/20 ft /N wall center	1052Y	1.11	45.6	137	ND	383
Light fixture	136/18 ft /3rd from W wall	1131G	<0.139	21.0	39.0	<3.48	ND
Light fixture	136/18 ft /3rd from W wall	1132H (QC)	<0.139	21.7	45.7	ND	ND
Beam	144/12 ft /N side center	1214T	**14.8**	<2.76	14.8	14.8	<62.8
Fire hose cage	144/7 ft /N wall center	1033R	**14.8**	14.8	14.8	14.8	14.8

B = method blank qualifier, see Sect. 2.1.

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2

Li = 930 ug/ft^2

Ni = 930 ug/ft^2

Tl = 93 ug/ft^2

U = 560 ug/ft^2

Table 3.14. Summary of horizontal wipe samples in radiological/process areas – equipment

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
Glass book case	144/8 ft /N wall middle	1245W	ND	ND	5.98	ND	95.7 B
Yellow flammable storage cabinet	144/5 ft /N wall middle	1244T	ND	<2.76	1.55	ND	158 B
Lab hood	130/8 ft /E wall	1239K	1.28	7.84	24.3	ND	<62.8
Storage cabinet	106/7 ft /SW corner	1236G	1.24	21.0	16.0	<3.48	<62.8
Storage cabinet	137/7 ft /NW corner	1229T	**4.18**	19.2	30.5	ND	<62.8
Storage cabinet	150/7 ft/ NE corner	1166M	ND	4.99	4.17	4.29	63.2
Storage cabinet	136/6 ft/ SW corner	1128A	0.251	12.1	61.5	ND	167
Storage cabinet	136/7 ft/ SW corner	1126X	0.539	8.91	60.9	ND	<62.8
Storage cabinet	136/7 ft/ SW corner	1127Y (QC)	0.316	9.26	57.4	<3.48	103
Bus bar	136/6 ft/ NW corner	1125W	0.195	7.13	16.4	<3.48	<62.8
Glovebox	136/7 ft/ NW corner	1123R	1.67	7.84	16.3	4.32	109
Glovebox	136/7 ft/ NW corner	1124T (QC)	0.511	10.7	13.8	<3.48	82.0
Lab hood	144/8 ft/ S middle	1215W	ND	15.0	19.5	ND	134 B
Baking furnace	144/8 ft/ S middle wall	1034T	0.715	1.72	348	0.762	4.18
Fluker logging system	144/7 ft/ N middle wall	1035W	ND	5.05 B	3.67	ND	<62.8
Furnace	144/5 ft/S wall middle	1032N	0.427	3.14	136	0.790	16.8
Storage cabinet	144/6 ft /NW corner	1036X	ND	14.5 B	32.6	ND	<62.8
Shaker (exhausted)	148/5 ft /S wall middle	1037Y	ND	279 B	6.45	<3.48	<62.8
Hopper stand	148/7 ft /N wall middle	1038A	ND	7.95 B	9.94	3.49	<62.8
Flammable cabinet	148/5 ft /SE corner	1039C	ND	6.50 B	6.75	ND	<62.8
Powder storage rack	148/4 ft/ NW corner	1040F	ND	8.67 B	15.5	<87.1	<62.8

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2
Li = 930 ug/ft^2
Ni = 930 ug/ft^2
Tl = 93 ug/ft^2
U = 560 ug/ft^2

Office Areas. Based on visual observations of accumulated dust, these areas were subdivided into two categories: horizontal surfaces less than 6 ft and horizontal surfaces greater than 6 ft. A total of 21 samples were collected from these two areas and included Rooms 100, 102, 110, 112, 113, 116, 133, 135, 138, 140, and 146. Sample results are summarized in Tables 3.15 and 3.16. Toxic metal concentrations above the LOC were noted in the areas higher than 6 ft but not in areas less than 6 ft. Contamination above the LOC was noted for 11 of the 18 samples taken from above 6 ft in the office areas; however, gross contamination was not detected with any of the samples. Four of the samples were contaminated with beryllium and lead, one sample was contaminated with beryllium only, and the other samples were contaminated with lead. Lead concentrations varied from 8 to 12 $\mu g/ft^2$ in the areas less than 6 ft and from 12 to 296 $\mu g/ft^2$ in the areas greater than 6 ft. This level of contamination is significant enough that it should be addressed during demolition activities.

3.3 PCB WIPE SAMPLES

Oil stains were observed at seven locations in the building. Wipe samples were obtained from all seven of these areas to determine the presence of PCBs (including QC samples, a total of nine samples were collected). Results from this analysis are shown in Table 3.17. PCBs were not detected in any of the samples. This information, along with the very few number of oil stains noted during the survey, indicate that PCBs should not be a concern for the dismantlement crew during reconfiguration activities.

3.4 BULK DUST SAMPLES

Bulk dust samples were collected from five of the six exhaust ventilation systems in TA-3-141. No dust samples were collected from FE-11 because it was not used for contaminant removal from equipment as were the other exhaust ventilation systems. FE-11 was used for filtering and cooling air for Room 106.

It was noted through visual observations that FE-9 contained the most dust, and therefore, an adequate sample was easy to obtain from this system. Visual observation also noted significant quantities of dust in FE-6 and new FE-1. Very little accumulated dust was noted in the FE-10 ventilation system and old FE-1. Based on visual observation above, FE-6 and FE-1 should be considered grossly contaminated.

A total of five bulk dust samples were collected from these five exhaust ventilation systems, including one from new FE-1, FE-6, and FE-10 and two from FE-9. Old FE-1 was not sampled due to difficulties with accessing the system and inadequate quantities of dust in areas that were accessible. Because these samples should provide a good historical perspective on contaminants,

Table 3.15. Summary of horizontal wipe samples collected in office areas – <6 ft

Item	Room/elevation/ location	Sample no.	Concentrations				
			Be (ug/ft^2)	Li (ug/ft^2)	Ni (ug/ft^2)	Tl (ug/ft^2)	U (ug/ft^2)
File cabinet	138/5 ft /NE corner	1242N	ND	<2.76	4.40	ND	<62.8
File cabinet	138/5 ft /SE corner	1240L	<0.139	3.21	2.43	<3.48	88.7
File cabinet	138/5 ft /SE corner	1241M (QC)	0.372	3.92	2.81	ND	ND

ND = not detected

Level of Concern

Be = 1.9 ug/ft^2
Li = 930 ug/ft^2
Ni = 930 ug/ft^2
Tl = 93 ug/ft^2
U = 560 ug/ft^2

Table 3.16. Summary of horizontal samples collected in office areas – >6 ft

Item	Room/elevation/ location	Sample no.	Concentrations Be (ug/ft²)	Li (ug/ft²)	Ni (ug/ft²)	Tl (ug/ft²)	U (ug/ft²)
Air flow box	133/9 ft /E wall middle	1252H	<0.139	7.22	25.6	<3.48	97.5
Emergency evacuation alarm box	133/8 ft /W wall middle	1251G	<0.139	<2.76	31.4	ND	105
Duct	140/8 ft /NW corner	1250F	0.604	7.84	36.7	ND	ND
Light fixture	146/8 ft /W row N end	1249C	<0.139	ND	44.4	<3.48	<62.8
Glass shelf	146/7 ft /S wall	1248A	0.316	ND	55.6	ND	81.6
Vent grill (outside)	116/8 ft / E wall	1085F	1.37	ND	5.75	7.08	<62.8
Vent grill (outside)	112/8 ft /SE corner	1082Y	ND	ND	1.73	<3.48	<62.8
Vent grill (outside)	100/8 ft /E wall middle	1079T	ND	ND	2.91	<3.48	114
Vent grill (outside)	102/8 ft /N wall middle	1078R	<0.139	3.56	1.53	<3.48	106
Vent grill (outside)	113/8 ft /NE corner	1075L	<0.139	<2.76	2.18	ND	ND
Supply grill vent (outside)	135/7 ft /W wall	1074K	0.223	8.19	19.7	ND	80.7
Book shelf	140/6 ft /S wall	1243R	0.204	<2.76	7.77	ND	<62.8
Duct	112/9 ft /NE corner	1235F	1.26	24.2	67.4	<3.48	<62.8
Fire system piping	110/9 ft /W wall	1234C	**2.47**	24.6	33.9	5.74	<62.8
Light fixture	116/7 ft /S wall middle	1232Y	**12.1**	26.0	46.0	<3.48	69.8
Light fixture	116/7 ft /S wall middle	1233A (QC)	**16.7**	22.9	60.1	<3.48	<62.8
Light fixture	117/8 ft /E side	1231X	**13.4**	31.4	104	ND	<62.8
Fire system piping	116/8 ft /SE corner	1253J	**6.75**	2.84	29.9	<3.48	81.7

ND = not detected

Level of Concern

Be = 1.9 ug/ft²
Li = 930 ug/ft²
Ni = 930 ug/ft²
Tl = 93 ug/ft²
U = 560 ug/ft²

Table 3.17. Results of oil stains for PCBs

HA	Sample	Location	Description	Source	Size	Result	Analysis
P005	1003R	Room 144; N wall, E corner	Stain on metal stand	Pump	< 1 ft^2	< 10 ppm	Immunoassay
P007	1002N	Room 144; center S wall	Stain on floor	Pulverizer	< 1 ft^2	< 10 ppm	Immunoassay
P008	1001M	Room 144; center S wall	Stain on furnace	Furnace	1-3 ft^2	< 10 ppm	Immunoassay
P008	1171X-QC	Room 144; center S wall	Stain on furnace	Furnace	< 5 ft^2	ND	Gas chromatography
P009	1000L	Room 144; center S wall	Stain on floor	Hydraulic press	3-5 ft^2	< 10 ppm	Immunoassay
P012	1004T	Room 201; center W wall	Stain on floor	Yellow compressor	3-5 ft^2	< 10 ppm	Immunoassay
P012	1005W-QC	Room 201; center W wall	Stain on floor	Yellow compressor	3-5 ft^2	< 10 ppm	Immunoassay
P013	1015L	Room 248; N wall, E corner	Stain on equipment	HV-3 fan housing	1-3 ft^2	< 10 ppm	Immunoassay
P014	1016M	Room 148; center N wall	Stain on floor	Unknown	< 1 ft^2	< 10 ppm	Immunoassay

ND = not detected

these samples were analyzed for the full suite of ICP elements. In this manner, any unknown or possibly problematic elements should be detected.

It was anticipated that contamination associated with these different systems would vary according to the processes they served. Both FE-6 and FE-10 serve radiological areas; therefore, higher levels of uranium and thorium were expected in these systems. FE-9 served a number of furnaces, and therefore, higher quantities of accumulated dust were anticipated as well as a large variety of metals. The new FE-1 was expected to have high concentrations of beryllium but not other metals because its primary purpose is servicing the beryllium area.

All metals included in the standard suite except thallium and lithium (i.e., beryllium, nickel, and uranium) were found at concentrations above the LOC. Other metals detected above the LOC include arsenic, barium, cadmium, cobalt, copper, lead, thorium, and vanadium. Therefore, health and safety concerns with these metal dusts should also be considered during reconfiguration activities.

Exhaust systems new FE-1, FE-9, and FE-10 contained contaminants above gross contamination levels. Because of the quantity of dust that may be present in these systems, it is recommended that all exhaust systems be treated as grossly contaminated. A metal that was initially thought to be a concern included thallium. This metal has not been found over the LOC in the bulk dust samples or any other samples collected from the building.

Because of the visual appearance of a graphite-like material in the exhaust ducts, samples were also analyzed for ignitability and total organic carbon to assess whether this material is graphite. Total organic carbon results were greater than 38%, and the ignitability flash point was greater than 140°F. These results provide additional support to classifying this material as graphite contaminated with metals. This conclusion is also supported by historical use of graphite in these systems.

Bulk sample analysis results are shown in Table 3.18. Information gathered while collecting these samples is included in Appendix A.

3.5 ROOF SAMPLES

Roof samples were collected from five different areas that could be impacted by the exhaust ventilation system to determine whether any contaminants within the roofing material exist at concentrations above a LOC. Areas sampled that were thought most likely to be contaminated included locations near three exhaust vents and two locations near roof intake vents. Except for relatively nontoxic metals such as aluminum, calcium, and magnesium, no contaminants were detected above the LOC except thorium and one sample for vanadium. The LOC associated with aluminum, calcium, and magnesium is based on their effects as a nuisance dust. Therefore, if detected below the ACGIH TLV of 10 mg/m^3, there should be no problems with these contaminants.

Table 3.18. Bulk dust sample results

Element	Level of concern	Concentration (μg/g)					
		1213R FE-1 New	1048K FE-6	1141X FE-9 S Duct	1142Y FE-9 N Duct	144C (QC) FE-10	1147H FE-10
Antimony	500	49.7	2.21	6.67	2.03	2.10	14.7
Arsenic	200	199	53.8	**797**	74.1	87.1	74.4
Barium	500	274	93.0	**55,600**	68.2	53.10	**1020**
Beryllium	2	**15,600**	**6.11**	**47.3**	**3.61**	**3.99**	**3.87**
Bismuth	10,000	7.23	2.05	14.9	1.10	1.23	368
Boron	10,000	83.8	142	858	44.0	53.1	59.1
Cadmium	50	**81.3**	5.20	16.7	4.79	6.14	36.9
Cerium	---	45.1	1.02	2.49	2.05	2.03	21.2
Cesium	2000	2.64	2.88	2.28	0.269	0.380	5.58
Chromium	500	257	72.6	**1130**	164	208	128
Cobalt	20	**23.2**	15.9	**95.7**	11.1	13.5	**31.5**
Copper	100	**1000**	**263**	**32,600**	**237**	**402**	**3010**
Drysprosium	---	1.87	0.163	3.42	0.208	0.474	1.78
Erbium	---	4.70	0.171	0.718	0.556	0.604	4.98
Europium	---	3.98	0.191	5.89	0.163	0.272	3.68
Gadolinium	---	5.24	3.17	384	6.28	5.37	31.8
Gold	---	32.0	5.99	20.8	29.7	41.7	161
Holmium	---	0.353	0.028	0.528	0.065	0.061	0.304
Ignitability	NQ	> 140 °F	> 140 °F	> 140 °F		NQ	
Lanthanum	---	22.1	0.721	7.09	5.49	5.88	19.7
Lead	50	**909**	**226**	**139**	**60.2**	**73.8**	**756**
Lithium	1000	24.8	NQ	53.4	NQ	NQ	NQ
Lutetium	---	1.20	0.131	0.498	0.135	0.139	18.1

Table 3.18 (continued)

Element	Level of concern	Concentration (μg/g) 1213R FE-1 New	1048K FE-6	1141X FE-9 S Duct	1142Y FE-9 N Duct	144C (QC) FE-10	1147H FE-10
Magnesium	10,000	2890	63.6	725	126	159	590
Manganese	5000	600	33.5	223	29.5	34.3	110
Molybdenum	10,000	1740	188	4110	1460	1750	813
Neodymium	---	19.9	1.53	2.86	0.991	0.815	7.10
Nickel	1000	317	195	**38,300**	878	1060	634
Praeseodymium	---	4.74	0.311	0.634	11.2	9.86	3.14
Rubidium	---	14.8	0.539	3.85	0.906	0.865	4.02
Samarium	---	6.68	1.15	10.8	1.04	1.22	2.45
Tellurium	100	23.4	8.24	65.2	9.11	8.64	23.0
Terbium	---	0.711	0.057	1.27	0.082	0.099	0.646
Thallium	100	5.64	1.00	2.57	0.403	0.491	3.62
Thorium (ICP-MS analysis)	50	12.0	**82.6**	**90.3**	39.7	44.7	**126**
Thorium (isotopic analysis)	50	**139**	**365**	**95.7**	---	**88.6**	---
Thudium	---	0.215	0.154	0.468	0.140	0.140	2.43
Tin	2000	566	42.0	304	31.7	45.2	159
Titanium	10,000	339	1150	355	179	220	132
TOC[a]	---	43.2%	39.5%	38.4%	---	39.1%	---
Tungsten	5000	555	365	907	407	389	799

Table 3.18 (continued)

Element	Level of concern	Concentration (μg/g)					
		1213R FE-1 New	1048K FE-6	1141X FE-9 S Duct	1142Y FE-9 N Duct	144C (QC) FE-10	1147H FE-10
Uranium	600	98.5	NQ	8870	NQ	NQ	NQ
Vanadium	50	**507**	**94.0**	**355**	**62.7**	73.9	44.2
Ytterbium	---	13.7	0.168	5.16	0.356	0.621	0.745
Yttrium	1000	132	28.1	**9530**	NQ	NQ	NQ
Zinc	5000	356	1960	803	574	521	1800
Zirconium	---	21.2	743	3050	5810	NQ	NQ

NQ = not quantified

*TOC = Total organic carbon used to estimate relative percentage of graphite. Because of high quantity, incomplete combustion was likely during the analytical process; therefore, these measurements are probably low.

In a similar manner, the concentration of vanadium in sample 1139T (near exhaust vent FE-9) was close enough to the LOC that it should not cause any health and safety concerns as long as the ACGIH TLV for nuisance dust is met. A summary of these sample results is given in Table 3.19, except for PCBs. Samples collected for PCB analysis did not contain detectable quantities of PCBs. Based on these few samples, it does appear that the exhaust vents influence contaminant concentrations on the roof but probably not to a great enough extent to impact worker health and safety during roof removal activities. It is recommended that radiological monitoring be performed during construction activities to ensure the thorium DAC is not exceeded.

Because the majority of the contaminants associated with the roofing material are probably bonded within the roof matrix, the possibility of any contaminant becoming airborne at concentrations above any TLV is considered unlikely.

3.6 PAINT SAMPLES

Nine different colors/textures of paint were observed in TA-3-141. Figure 3.1 denotes the locations of the different colors for the major painted areas. All nine of these areas were sampled, and the results are summarized in Table 3.20. In eight paint colors, lead was found above the LOC. Because lead is probably part of the paint formulation, all eight paint colors should be considered contaminated with lead. In addition, four of these eight samples contained gross contamination levels of lead. The one sample that did not contain lead concentrations above the LOC was contaminated with beryllium. Because the beryllium is probably encapsulated and not part of the paint formulation (see QC sample 1008A), this paint color (floor gray) is probably not contaminated in many areas of the building.

Because the majority of the contaminants are bonded with the paint, it is highly unlikely that any of the contaminants found above the LOC will become airborne unless a grinding, abrasive blasting, or similar operation is used to remove the paint. Therefore, the contaminants noted in the paint should not present a health concern if the paint is left in place or removed using a method that minimizes airborne concentrations.

One surprise noted with these samples was the high concentration of uranium detected in one of the samples. This particular sample came from an electrical conduit located near a light switch within a hallway considered part of the office area (i.e., Room 133). It is possible that this uranium was spread to this area through human contact. If this is true, it raises the concern of other areas that may have uranium contamination (which may be painted over) inadvertently spread through human touch, particularly during early operation at the facility.

Table 3.19. Roof bulk sample results

Analyte (mg/kg)	Level of concern	Concentration (μg/g)				
		1139T	1136M	1155W	1158A	1159C
Item Sampled		Asphalt roof	Asphalt roof	Asphalt roof	Asphalt roof	Asphalt roof
Source		FE-9 exhaust vent emissions	FE-10 exhaust vent emissions	FE-9/FE-6 exhaust vent emissions	Supply intake	Supply intake
Location		20 ft E of FE-9	20 ft E of FE-10	15 ft NE of FE-9 (midway between FE-9 and FE-6)	W end of FAR-6	N end of FAR-7
Element						
Aluminum	10,000	7120	188	**11,000**	NA	NA
Antimony	500	<0.385	<0.373	<0.356	NA	NA
Arsenic	200	1.01	0.873	2.03	NA	NA
Barium	500	154	5.9	223	NA	NA
Beryllium	2	0.130	0.0064	0.242	0.398	0.0613
Bismuth	10,000	<0.444	ND	0.740	NA	NA
Boron	10,000	851	6.87	120	NA	NA
Cadmium	50	0.256	0.109	0.959	NA	NA
Calcium	10,000	**24,100**	208	**35,000**	NA	NA
Chromium	500	5.08B	0.401B	8.26B	NA	NA
Cobalt	20	0.940	0.0808	0.189	NA	NA
Copper	100	1.4	1.31	6.42	NA	NA
Gold	---	<1.54B	ND	1.55B	NA	NA
Iron	5000	263	422	319	NA	NA
Lead	50	18.0	3.97	41.4	NA	NA
Lithium	1000	3.02B	0.596B	3.21B	2.71B	1.92B
Magnesium	10,000	7030	65	**10,600**	NA	NA
Manganese	5000	12.0	25.2	18.2	NA	NA
Molybdenum	10,000	1.26	<0.072	0.276	NA	NA
Nickel	1000	23	0.295	1.93	0.508	2.08
PCB	10				NA	NA
Phosphorus	1000	181	14.8	67.9	NA	NA

Table 3.19 (continued)

Analyte (mg/kg)	Level of concern	Concentration (µg/g)				
		1139T	1136M	1155W	1158A	1159C
Potassium	---	3500	44.6	4450	NA	NA
Selenium	200	0.419	ND	0.339	NA	NA
Silicon	10,000	253	99.1	198	NA	NA
Silver	10	0.262	<0.151	0.631	NA	NA
Sodium	---	15,000	48.8	19,500	NA	NA
Strontium	---	70.9	0.998	85.3	NA	NA
Sulfur	---	5280	201	1530	NA	NA
Tellurium	100	1.10B	0.934B	0.745B	NA	NA
Thallium	100	ND	ND	ND	ND	<0.307
Thorium (isotopic analysis)	50	67.2	113	92.5	NA	NA
Tin	200	0.536B	0.274B	0.882	NA	NA
Titanium	10,000	11.1	7.77	10.2	NA	NA
Tungsten	5000	<0.545	<0.527	ND	NA	NA
Uranium	600	ND	ND	ND	ND	<2.08
Vanadium	50	95	1.12	5.35	NA	NA
Zinc	5000	16.6	12.2	69.5	NA	NA

B = method blank qualifier, see Sect. 2.1.
NA = not an analyte for this sample
ND = not detected

Room number	Gray C001	Yellow C002	Pea Green C003	Tan C004	Lime Green C005	White C006	Canary C007	Floor Grey C008	Medium Green C009
100						X			X
102						X			X
106						X			
110						X			X
110 Janitor Closet						X			
112						X			
113						X			X
116						X			X
117						X			
117 Corridor						X			
130						X			
130 Corridor						X		X	X
133					X	X		X	X
135						X			
136					X	X			
136A						X		X	
137					X			X	
138						X			
140					X				
141					X	X		X	
142					X	X		X	
144					X	X		X	
146					X				
148					X	X	X	X	
148A		X			X	X			
139						X			
150					X	X			
201		X							
248	X	X	X	X					

Fig. 3.1. Locations of paint colors by room number.

Table 3.20. Paint sample results

Item	Sample type	Room/ location	Sample no.	Concentration (μg/g)						
				Be	Cr	Pb	Li	Ni	Tl	U
Electrical conduit	Green paint	133/5 ft L corner	1006X	0.055	15.0	87.0	10.6	2.35	1.32	**1900**
Conduit	Lime green paint	148/4 ft N middle	1007Y	ND	354	4420	13.0	60.3	ND	ND
Floor - high traffic	Gray paint	144/0 ft center	1008A	0.0373	2.86	20.4	2.28	20.8	ND	4.06
Electrical conduit	White paint	106/2 ft NE	1010F	0.0124	96.1	691	22.2	2.89	<0.433	ND
Belt housing	Yellow paint	248/5 ft NE leg E - wall	1011G	ND	10.6	78.8	**78.5**	2.64	<0.689	ND
Fan housing	Gray paint	248/5 ft NE leg N - wall	1012H	ND	59.8	2070	**28.2**	95.8	7.47	ND
Compressor	Pea green paint	248/2 ft N leg N - wall	1013J	ND	**1810**	**9570**	18.2	6.49	2.0	ND
Belt guard HV-3	Tan paint	248 N - leg NE	1014K	ND	36.0	**5230**	<0.824	172	2.44	<50.5
Floor - high traffic	Gray paint	144/0 ft center	1017N QC	**0.257**	2.22	26.7	2.04	23.1	ND	6.82

ND = not detected

Level of Concern
Be = 2 μg/g
Li = 1000 μg/g
Ni = 1000 μg/g
Tl = 100 μg/g
U = 600 μg/g
Cr = 500 μg/g
Pb = 50 μg/g

3.7 PERCHLORATE

Personnel currently working in TA-3-141 and retired personnel were interviewed to determine the use of perchloric acid in the building. As a result of these interviews, the perchloric acid questionnaire (i.e., Fig. 2.1). No evidence of perchloric acid use with any of the lab hoods could be established as a result of these interviews. In addition to the interviews, the lab hoods were visually inspected for evidence of perchloric acid use. No evidence supporting perchloric acid use was noted. Later when samples were retrieved from the ductwork, no evidence of perchlorate crystals could be found. Based on the interviews and observations, it was concluded that there is no perchlorate risk associated with the lab hoods or exhaust ductwork.

3.8 PHYSICAL HAZARDS ASSESSMENT

A number of potential physical hazards were noted during the survey of TA-3-141. This survey was conducted by room number rather than major building area due to the wide variation of materials/equipment maintained in the rooms. As a result, 26 different rooms were surveyed. The detailed results of this survey are included in Appendix B. This appendix may also be used as a detailed list of physical hazards that should be considered when working in each room.

Six classes of physical hazards were identified: confined spaces, electrical hazards, fall hazards, heat stress concerns, elevated work areas, and other physical hazards within each room. The number and type of physical hazards noted for each class within each room are provided in Table 3.21.

Confined spaces were observed both inside the building and areas adjacent to the building. The location and a description of these confined spaces is provided in Table 3.22. The major electrical hazard identified was ensuring that the appropriate lockout/tagout procedures were followed when removing energized equipment. Because this is a concern in all areas of the building and should be a standard construction practice, it was not included in the table. Other electrical hazards identified included unidentified circuits in control boxes and exposed bus bars and conduits.

The observed fall hazards were associated with unlevel floors, missing guardrails/handrails, deficient ladders, poor lighting, and other room-specific observations. Heat stress concerns were usually associated with working near steam lines and the building roof during the summer months. The major concern with elevated work included elevated systems/equipment that will probably be removed during the reconfiguration. The removal of this equipment will require scaffolding and/or ladders. Other typical hazards identified included the presence of pressurized systems, major lockout/tagout concerns, defective building components, congestion, unguarded rotating/moving equipment, and other room-specific hazards.

Table 3.21. LANL TA-3-141 physical hazards

Room umber	Function	Hazard during renovation	Confined space	Confined space present	Electrical hazards	Open/damaged conduit	Open/damaged bus bar	Other deficiencies	Fall hazards	Unlevel floors	Unacceptable guardrail/handrail	Deficient ladder	Poor lighting	Other deficiencies	Hazard during renovation	Heat stress	Hot work area/poor ventilation	Other deficiencies	Hazard during renovation	Elevated work areas	Elevated objects for removal	Hazard during renovation	Other physical hazards	Pressurized systems	Lockout/tagout	Other hazards present	Hazard during renovation
)2	Office	X																			X	X		X	X	X	X
)6	Laboratory	X																			X	X		X	X		X
10/100	Corridor/Close	X															X		X		X	X		X	X		X
13/112	Womans Change Room	X															X		X		X	X		X			X
16	Mens Change Room	X															X		X		X	X		X	X		X
17	Bathroom/Showers	X															X		X		X	X		X	X		X
26	Corridor/Process	X								X		X	X	X	X		X		X		X	X		X	X	X	X
30	Laboratory	X																			X	X		X	X		X
33	Corridor	X																			X	X		X	X		X
35	Office	X																			X	X		X	X		X
36	Laboratory/Process	X		X											X						X	X		X	X		X
36A	Be Processing	X				X									X						X	X		X	X		X
37	Laboratory	X																			X	X		X	X		X
39	Be Buffer Area	X																			X	X			X		X
38	Office																				X	X		X	X	X	X

Table 3.21. LANL TA-3-141 physical hazards (continued)

Room number	Function	Hazard during renovation	Confined space	Confined space present	Electrical hazards	Open/damaged conduit	Open/damaged bus bar	Other deficiencies	Fall hazards	Unlevel floors	Unacceptable guardrail/handrail	Deficient ladder	Poor lighting	Other deficiencies	Hazard during renovation	Heat stress	Hot work area/poor ventilation	Other deficiencies	Hazard during renovation	Elevated work areas	Elevated objects for removal	Hazard during renovation	Other physical hazards	Pressurized systems	Lockout/tagout	Other hazards present	Hazard during renovation
0	Office																				X	X		X	X	X	X
1	Be Processing	X									X	X	X		X				X		X	X		X	X		X
2	Laboratory	X						X													X	X		X	X		X
4	Laboratory	X		X																							
6	Office	X																									
8	Process	X						X																			
0	Process	X																									
1	Mechanical	X						X																			
8	Mechanical	X						X																			
8	Steam Pit	X		X																							
8	FE-1 New Filter House	X		X																							
8	Roof	X		X																							
8	FE-6 Baghouse	X		X																							
8	FE-1 Old	X		X																							

Table 3.22. Confined spaces for TA-3-141 and surrounding locations

Location	Description	Comments
141-126	Blue vessel	6 × 2 ft diameter
141-144	Baking furnace	opening ~18 in. diameter, vessel to be discarded
141-136A	Plasma spray chamber	
141-208	Supply system, labeled HV-1	
141-248	Supply system, labeled HV-2	Smaller doors are cofnined spaced, two larger doors not considered confined spaces
141-248	Supply system, labeled HV-3	Smaller doors are cofnined spaced, two larger doors not considered confined spaces
141-248	NW corner of room, exhaust system, FE-9	
141-248	South end of building along east wall, exhaust system, FE-10	
141-Mezzanine	New FE-1 HEPA filter system	
141-Roof	Supply system	Two systems with openings
Outside, SE corner of 141	Exhaust system, FE-1 and FAR-1	
Outside, E side of 141	Hatch to electrical system	
Outside, W side of 141	SM-74, pit	Radioactive liquid waste line
Outside, W side of 141	Pit for cooling water	
Outside, W side of 141	Manhole	80 ft W of building
Outside, N side of 141	Bag filter, SG-1	Access by ladder
Outside, N side of 141	Exhaust ventillation fan housing, FE-6	

3.9 HISTORICAL DATA

Past surveys have been conducted in TA-3-141 to determine contamination levels for beryllium, lead, and ionizing radiation. Swipe samples and air samples for beryllium analysis were collected between July 19 and October 30, 1995, from the beryllium areas (swipe samples collected on October 30, 1995, were also analyzed for lead content). In addition, radiological surveys using smear samples were conducted on August 19, September 2, and October 14, 1995. Swipe samples indicated the consistent presence of beryllium contamination in the beryllium areas, and the radiological surveys indicated consistent contamination in Rooms 136 and 150. More detail on the results for the beryllium surveys is provided in Sect. 3.7.1, and the radiological survey results are given in Sect. 3.7.2.

3.9.1 Historical Beryllium Surveys

Six surveys for the presence of beryllium were conducted between July 19 and October 30, 1995. Two of the surveys were for determining air concentrations of beryllium, and the remainder were for estimating beryllium and lead surface contamination in the beryllium areas.

Air Surveys. A total of 24 air samples were taken, including 22 personal and 2 area samples from the beryllium processing areas. The 22 personal air samples were taken from six operators performing various activities in Rooms 136A and 141 through two separate studies. Without respiratory protection, three of the six operators would have exceeded the allowed time-weighted average (TWA) limit for an 8-hour work day (two operators during the first study and one during the second). The TWA (0.09 $\mu g/m^3$) for the operator who restricted work to Room 141 did not exceed the limit. Results for the two area air samples that were taken in Room 136A were below the TLV (0.1 and 0.13 $\mu g/m^3$). A summary of the air survey results is provided in Table 3.23.

Table 3.23. Summary of beryllium air concentrations in beryllium process areas

Collection date	Room number	Number of samples	Concentration ($\mu g/m^3$)		
			Range	Median	Average
July 19, 1995	136A	6	1.76 - 58.2	16.4	6
July 19, 1995	141	2	0.09 - 0.35	0.22	0.22
August 14-17, 1995	136A	15	0.1 - 59	2.33	13.57

Note: TWA must be <2.0 $\mu g/m^3$ for an 8-hour work day.

Surface Contamination Surveys. Most of the historical swipe samples taken were from miscellaneous horizontal surfaces at elevations under 6 ft and on equipment. Between August 16 and October 30, 1995, 87 beryllium swipe samples were collected from Rooms 136A, 139, and 141 in the beryllium areas. A summary of the results from these surveys is contained in Table 3.24. As indicated in the table, surface contamination with beryllium is often above the limit of concern. Therefore, it must be assumed that these areas are contaminated with beryllium when conducting reconfiguration activities.

Table 3.24. Summary of beryllium surface concentrations in beryllium process areas

Collection date	Room number	Number of samples	Concentration ($\mu g/ft^2$)		
			Range	Median	Average
August 16, 1995	136A	15	31 - 24,000	500	2500
August 16, 1995	139	3	1.8 - 9.3	7.5	6.3
August 16, 1995	141	5	13 - 290	92	140
August 18, 1995	141	25	0.14 - 100	7.0	1.4
September 1 and 5, 1995	136A	14	1.2 - 530	2.6	86
September 1 and 5, 1995	139	3	0.13 - 0.72	0.54	0.46
September 1 and 5, 1995	141	5	1.1 - 2.9	15	1.4
October 30, 1995	136A	12	1.6 - 300	32	73
October 30, 1995	139	3	0.11 - 0.61	0.35	0.36
October 30, 1995	141	4	0.71 - 8.7	1.2	3.0

Note: LOC for beryllium is 1.9 $\mu g/ft^2$.

From examining this table, it is noted that concentrations of beryllium were found above the LOC (i.e., 1.9 $\mu g/ft^2$) in all rooms associated with the beryllium area. Concentrations in Room 136A were found to be consistently above the LOC; however, beryllium concentrations in the other rooms were often below the LOC, and most of the samples in the transition room (i.e., 139) were below the LOC.

These findings are consistent with those measured during the December 1995 survey in Rooms 136A and 141. In Room 139 the beryllium concentrations found during the December 1995 survey were significantly higher. It is believed this is because the December 1995 samples were gathered from higher areas that are not cleaned as frequently as lower surfaces. During the December 1995 survey, the average beryllium concentrations were 2900 $\mu g/ft^2$ in Room 136A (as compared to 966 $\mu g/ft^2$ for the LANL survey), 16 $\mu g/ft^2$ in Room 141 (as compared to 29 $\mu g/ft^2$ for the LANL survey), and 41 $\mu g/ft^2$ in Room 139 (as compared to 2.4 $\mu g/ft^2$ for the LANL survey).

In addition to the beryllium survey, 17 swipes collected on October 30, 1995, were also analyzed for lead. The results for these analyses are summarized in Table 3.25. As can be seen, the surface concentration for lead is consistently below the LOC.

Table 3.25. Summary of lead surface concentrations in beryllium process areas

Collection date	Room number	Number of samples	Concentration ($\mu g/ft^2$)		
			Range	Median	Average
October 30, 1995	136A	12	<0.5 - 4.3	0.70	1.2
October 30, 1995	139	3	<0.5 - 1.9	1.9	1.4
October 30, 1995	141	4	<0.5 - 0.70	<0.5	0.36

Note: When calculating averages, less than values were assumed to be equal to one-half their value.

As can be seen from examining the table, all lead concentrations were found to be much less than the LOC for lead (i.e., 46 $\mu g/ft^2$).

3.9.2 Historical Radiological Surveys

The most recent radiological survey for TA-3-141 was conducted on three days: August 19, September 2, and October 14, 1995. The initial survey conducted on August 19, 1995, examined the floor of the entire building and the walls in some of the office areas located at the south end of the building. The survey conducted on September 2, 1995, examined the remainder of the walls that were not surveyed on August 19, 1995. The last survey conducted on October 14, 1995, examined miscellaneous surface areas within the controlled areas (i.e., Rooms 136 and 150) and miscellaneous surface areas on the mezzanine (i.e., Room 248). Low-level contamination was noted in the controlled areas, especially Rooms 136 and 150, and a few areas with detectable contamination levels were noted elsewhere; however, no contamination was detected in most rooms of the building.

The radiological survey was not conducted for the same HAs that were characterized during the survey performed by Radian. The HAs examined during the radiological survey included floors, walls, and miscellaneous surfaces. The results from this survey are summarized in Table 3.26. The information provided in this table is presented by building area for comparison purposes with the survey conducted by Radian.

In order to compare radiological survey results with results from the toxic metals survey, it is necessary to convert disintegrations per minute (dpm)/100 cm^2 into $\mu g/100\ cm^2$. If it is assumed that all the activity is in the form of depleted uranium (i.e., ^{238}U), then 1 μg of uranium is equivalent to 0.74 dpm α and 1.48 dpm β. On the other hand, if the activity is due totally to highly enriched uranium (i.e., ^{235}U), then 1 μg of uranium is equivalent to 4.8 dpm α or β. In either case, if only

Table 3.26. Radiological survey summary

Building area	HA	Number of samples	Number of samples (> detection limit)	Concentration (dpm/100 cm²)	
				Range	Median[a]
Beryllium areas (room 139 only)	Floor	4	0	NDA	NDA
Beryllium areas	Wall	0	-	-	-
Misc. lab areas	Floor	182	1 - α, 1 - β 1 - α or β	NDA - 9 α NDA - 20 β	9 α 20 β
Misc. lab areas	Wall	175	5 - α, 5 - β 9 - α or β	NDA - 23 α NDA - 78 β	14 α 49 β
Misc. lab areas (room 248 only)	Misc. surface	125	12 - α, 14 - β 16 - α or β	NDA - 84 α NDA - 96 β	24 α 64 β
Radiological areas	FE-9 exhaust ventilation	5	5 - α or β	44.4 - 378.5 α 100.7 - 2080.5 β	70.2 α 152.2 β
Radiological areas	FE-10 exhaust ventilation	4	4 - α or β	30.8 - 398.8 α 57.4 - 1117.8 β	
Radiological areas	Floor	40	29 - α, 35 - β 35 - α or β	NDA - 59 α NDA - 326 β	20 α 64 β
Radiological areas	Wall	84	0	NDA	NDA
Radiological areas	Misc. surface	350	147 - α, 187 - β 203 - α or β	NDA - 2,552 α NDA - 13,124 β	105 α 311 β
Office areas	Floor	39	0	NDA	NDA
Office areas	Wall	105	0	NDA	NDA

NDA = non-detectable activity
[a]Median value for samples > NDA only.

a relative comparison is desired (i.e., within an order of magnitude), then dpm may be compared almost directly with μg in the case of uranium.

Detectable uranium concentrations in the metal wipe samples collected by Radian ranged from 38 to 383 $\mu g/ft^2$ (4.1 to 41.2 $\mu g/100\ cm^2$). These values are approximately within the same range as those determined in the radiological survey, except for radiological smears taken from miscellaneous surfaces in the controlled areas. These smears showed significantly higher contamination than samples gathered during the survey conducted by Radian. The primary reason for this is probably the types of surfaces sampled. Surfaces sampled in the controlled areas during the Radian survey were more often from building structures such as the tops of lights, vents, and shelves where dust tends to accumulate. During the radiological survey conducted by LANL, most of the surfaces sampled in the controlled areas were associated with equipment where uranium had been handled.

Another difference noted when comparing the two surveys is that uranium was detected more often in the general laboratory areas through the survey conducted by Radian than through the LANL radiological survey. During the LANL radiological survey, only 26 out of 482 samples indicated detectable levels of radioactivity in the nonradiological general laboratory areas. However, during the survey conducted by Radian, uranium was detected above the LOC for 23 out of 48 samples. The reason for this discrepancy is probably because of the two different sampling approaches used by Radian and LANL. During Radian's survey, the focus was on sampling areas most likely to be contaminated. This included many locations higher than 6 ft from the floor because these areas are probably cleaned less often. On the other hand, LANL's survey focused on sampling areas near work areas where personnel are most likely to be exposed. Nearly all of these areas surveyed by LANL were located less than 6 ft from the floor.