RPT-107

SITE LEGACY BERYLLIUM CONTAMINATION SURVEY RESULTS

IDAHO NATIONAL LABORATORY

Revision 2, November 2010

Prepared by:

Troy Bodily, CIH
Jack Novak, CIH, PE

TABLE of CONTENTS

INTRODUCTION

This report presents the results and conclusions of a survey for beryllium (Be) contamination at INEEL locations known to have formerly used, stored or processed beryllium or its compounds. The survey was made between August and October of 2004 in accordance with the *Idaho National Engineering and Environmental Laboratory Site Beryllium Contamination Sampling and Analysis Plan* (PLN-1747).

The sampling plan details the background, objectives, scope and general methods for the survey. In summary, the plan:

1. Describes the impetus and background for the survey arising from the August 2003 *Final Report of the Investigation of Beryllium Exposure Cases Discovered at the North Las Vegas Facility.*

2. Defines the scope of the survey to be wipe sampling to evaluate spreadable surface contamination at former beryllium locations and mitigation of any areas found above the criterion level.

3. Adopts the 10 CFR 850 criterion level of "...0.2 μg /100 cm^2 or the concentration level of beryllium in the soil at the point of release, whichever is greater" used by DOE for a "beryllium-free" release of possibly contaminated equipment to the general public.

4. Specifies the wipe sampling and analysis methods based upon OSHA Analytical Method ID-125G and NIOSH Method 7300. The media chosen for all wipe samples in the survey was the Smear Tab (SKC Cat. No. 225-24). Data Chem, Inc. of Salt Lake City, UT was contracted to perform all sample analyses using their ICP instruments.

5. Provides a statistically based strategy for obtaining a non-random, biased set of samples. The strategy is biased in favor of locations and surfaces within the locations most likely to be contaminated.

6. Suggests a guideline for deciding whether a sample that exceeds 0.2 μg/100 cm^2 represents beryllium contamination from INEEL processes or background from naturally occurring soils.

SURVEY METHODS

Appendix A to the sampling plan, PLN-1747, lists the locations of concern developed through document research and anecdotal evidence from interviews with employees and former employees. The sampling locations are stated as either a building or specific rooms or other areas within a building. The number of locations identified in Appendix A was nineteen. This survey did not include active beryllium handling and use locations that are being managed in accordance with beryllium program requirements established in MCP-50 *Chronic Beryllium Disease Prevention.*

Table 1 of this document identifies the nineteen locations and associated processes that were surveyed. The alphabetic code in the left-hand column was used for tracking samples.

Based on statistical confidence level considerations, the number of samples per location was specified at twenty-two plus two sample blanks. Five "Homogeneous Sampling Areas" (HSA)--Floors, Process equipment, Storage, building Infrastructure, and Miscellaneous--each describing a type of surface, are defined in the plan for consistent distribution of samples in a location. Based on observations during the course of the survey, we added a sixth (Walls). Figure 1 provides photographic examples of the six HSAs.

Table 2 gives the number of initial phase samples obtained per HSA per sample location. This number depended on the conditions in each location. For example, because we were surveying processes no longer in operation, many locations contained few, if any, "Process" surfaces. However, building "Infrastructure" surfaces were almost always available that were unlikely to have been cleaned or refurbished in several years. Each location/area was walked just prior to sampling to determine the best available HSA surfaces.

EXECUTIVE SUMMARY

This report provides the results of sampling activities conducted in accordance with document PLN-1747 *Idaho National Engineering and Environmental Laboratory Site Beryllium Contamination Sampling and Analysis Plan.* Completion of a site legacy beryllium contamination survey was prompted by the recent experience of chronic beryllium disease and beryllium sensitization at the North Las Vegas facility as reported in the *Investigation of Beryllium Exposure Cases Discovered at the North Las Vegas Facility of the National Nuclear Security Administration, August 2003.* Sampling activities conducted in accordance with PLN-1747 used surface wipe sampling to determine the extent of removable contamination still in place at INEEL site locations where beryllium operations formerly occurred.

The adopted criterion level for beryllium surface contamination was the 10 CFR 850 "release criteria" established for equipment or other items released to the general public. As stated in 10 CFR 850 this release criteria is "...0.2 µg /100 cm^2 or the concentration level of beryllium in the soil at the point of release, whichever is greater". The sensitivity of the analytical technique allowed beryllium detection at least twenty times below the criterion level (0.01 to 0.003µg /100 cm^2). In addition to beryllium, a guideline was devised to use copper and barium in the sample results as "markers" to determine whether the source of any beryllium detected was native soil or INEEL industrial activity. Twenty-two samples (plus two blanks) were obtained at each of nineteen selected building locations. The sampling strategy was intentionally biased in favor of locations and surfaces thought most likely to be contaminated; however, very little was found. On more than half the samples, no beryllium was detected. The average value was less than 10% of the criterion level (0.017 µg /100 cm^2). Only three of the 418 initial samples exceeded the criterion level. These three samples and subsequent follow-up samples identified contamination levels exceeding the release criteria to be present within CFA 689, Room 128.

Report Update: On February 2005 the Idaho National Laboratory, managed by Battelle Energy Alliance, was consolidated to include the Argonne National Laboratory-West contract. The facility complex was subsequently renamed the Materials and Fuels Complex (MFC). As a result of this contract consolidation the beryllium characterization reports for MFC facilities were collected and added to this INL characterization report as Appendix A.

TABLE 1 - WIPE SAMPLE LOCATIONS

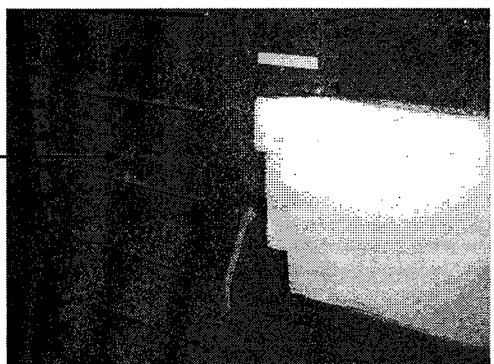
	Building	Room / Area	Process / Be source[1]	Process equipment notes
A	CFA 621	All	Instrument tech work or machining	Equipment removed.
B	CFA 623	GRITB & Room100	Abrasive blasting room	Equipment still present.
C	CFA 625	150, 170	Prep Be analytical standards	Be standards removed.
D	CFA 633	134-136, 132, 106, 113, 124A, 126A, 125	Prep Be analytical standards	Some lab equipment still present. Building abandoned.
E	CFA 686	High Bay	Instrument tech work or machining	Equipment removed.
F	CFA 689	128	R&D, lab hoods cleaned & Make Be alloy TCs	Lab hoods removed. Space converted to Wind Tunnel operations & Offices.
G	CFA 688	132, 116, 112, 120	Make Be alloy TCs (132) & Machining	Lab benches still present (132).
J	CPP 627	Shift Lab – 2nd floor	Lab chemical analysis	Some equipment remains. Lab abandoned.
K	CPP 630	Old High Bay	Machine small Be parts	Equipment removed. Renovated as two floors of office space.
L	IF 603	B 16	Handle thermocouples w/ BeO insulators	Equipment removed.
N	PBF 609	B:101,102,105- 107, 109 & A: 108, 101	Ash handling	Equipment removed.
P	PBF reactor	All	Cable assembly w / BeO insulators	Some equipment remains in Control Rooms.
R	TAN 607	(High Bay) 149	Machine Be parts for mag particle test & custodial	Equipment removed.
S	TAN reactor (LOFT)	Rooms 123, 124, 123A	Cable assembly w / BeO insulators	Some equipment remains in Control Rooms. Building abandoned.
T	TRA 635	101	Cleaning Be bars, Be machining?	Equipment removed.
U	TRA 642	ETR reactor bldg	ETR Be reflector change outs	Equipment still present: 766 kg shielding; 81 kg reflector.
W	TRA 654	ETRC reactor bldg	Be components used in reactor	Equipment removed.
X	TRA 660	ARMF reactor bldg	Be components used in reactor	Equipment removed.
Z	TRA 603	MTR reactor bldg	Be components used in reactor	Equipment still present: 2608 kg shielding (main floor); 1134 kg & 2 reflector block spares ATR (basement)

Note 1: Historical information. None of these processes currently operate.

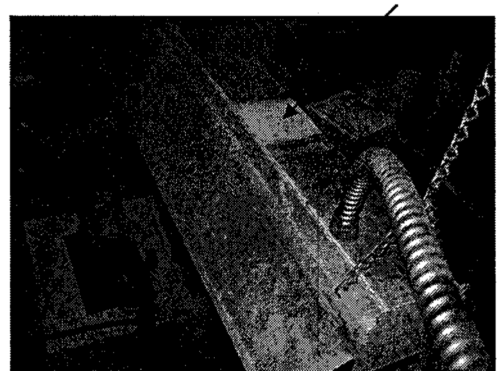
FIGURE 1 - Homogeneous Sampling Area Examples

FLOOR

PROCESS – Catch Tank

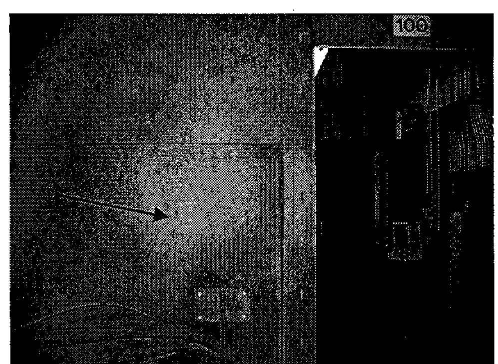


STORAGE - Shelving



INFRASTRUCTURE
Light Fixture

MISCELLANEOUS
Top of Door



WALL

TABLE 2 - NUMBER of WIPE SAMPLES PER HSA and LOCATION

	Sample Location																				
HSA	A	B	C	D	E	F	G	J	K	L	N	P	R	S	T	U	W	X	Z	Total	
Floor	7	2	1	3	6	4	1	4	0	4	5	7	3	10	6	4	6	4	4	81	19%
Process	0	2	0	6	1	0	0	5	0	2	1	6	0	4	0	2	0	0	3	33	8%
Storage	4	1	1	9	2	4	8	1	0	2	5	4	2	2	6	4	6	0	3	64	15%
Infrastructure	7	7	10	3	8	7	9	12	18	8	9	4	13	5	5	10	6	17	5	162	39%
Miscellaneous	4	3	9	1	3	7	4	0	4	5	2	1	4	1	5	2	4	0	7	66	16%
Wall	0	7	1	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	12	3%
Total	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	418	

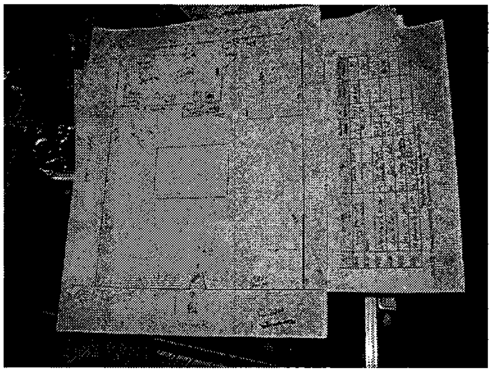
Table 2 enumerates only the initial phase of sampling. Follow up wipe and air samples were also obtained to guide mitigation in one location, CFA 689.

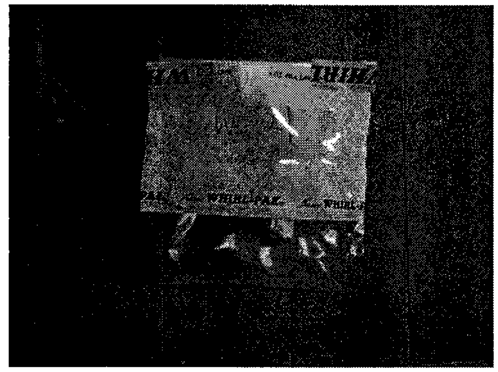
We obtained each sample as follows.

Prepare to sample: measure and mark sample surface if 100 cm^2 template could not be used; denote sample number on sample bag (Nasco "Whirl-Pak"); denote sample number on field log sketch or plan view map of the area; don pair of gloves (Kimberly-Clark, Safeskin, purple nitrile); moisten smear tab with deionized water.

Obtain sample: manually wipe area as clean as possible transferring as much material as possible to the smear tab; use additional smear tab(s) up to four total if necessary; place smear tab(s) in sample bag; wipe off template if used; remove gloves.
Analyze sample: list sample on field log describing

specific location, HSA, square area wiped, number of smear tabs used and date / time of sample. The samples were batched in sets of two or three by location for shipment to the lab where they were analyzed for beryllium, copper and barium content.





The area templates used to obtain many of the samples were wiped and submitted as samples twice—once before any other samples were taken and once at the conclusion of our initial round of 418 samples. No beryllium was detected on the templates. No copper or barium was detected on the pre-sample templates. However, small amounts of copper (0.24 µg max.) and barium (0.14 µg max.) were on the post-sample templates. We did not consider this to be a factor affecting our results.

GENERAL RESULTS and CONCLUSIONS

In all of the following data tables, a listed result of zero means that the analytical laboratory did not find the element at or above its limit of detection (LOD). For beryllium, the LOD (in units of µg/100 cm^2) ranged between 0.01 and 0.003. Therefore, a listed result of zero for beryllium assures the sample was below the criterion level by a factor of at least twenty.

The LOD for copper and barium was 0.06 µg ±0.01 µg.

Our specific results and conclusions are presented in sections by location. The sections are arranged in descending order by total amount of beryllium found in the location. Each section contains three forms of tabulation for the data.

1. Summary Table: lists the beryllium results in µg/100 cm^2 and the general area where the sample was obtained within the location.

2. Full Results Table: lists the µg per sample results for all three elements (Be, Cu and Ba) and the associated ratios.

3. Sample Detail Table: lists the circumstances under which the sample was obtained.

The following comments are based on our review of all the above-mentioned results in the aggregate.

Sample Blanks:

No beryllium or barium was detected on any of the sample blanks. However, copper was detected on 37% of the blanks (14 of 38). The range of copper hits was 0.06 to 1.40 µg. The average hit for the fourteen positive blanks was 0.5 µg, approximately 10 times the LOD for copper. Determining the possible cause for copper on the blanks was beyond the scope of this survey. No adjustment was made to the data to account for copper on the blanks.

Beryllium Source Guideline:

The "Full Results Tables" may be used to apply the guideline referred to in INTRODUCTION item 6. This guideline compares beryllium, barium and copper in the sample to the concentration ratios for these elements determined in the prior soils study *Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclides Concentrations for the Idaho National Engineering Laboratory* (Rood et. al., 1996).

Using this soils study, INEEL Geosciences Research in their report of 29 July 2004, *Estimates of Metal/Beryllium Mass Concentration Ratios for Use in Determining Beryllium Source Terms in Old INEEL-Site Buildings,* established concentration ratio threshold values of 3.8 for Ba/Be and 1.8 for Cu/Be.

Their suggested guideline is that if a sample exceeds these threshold ratios, then the source of the beryllium is likely soil. If a threshold is not exceeded, then the beryllium source is likely from INEEL activities. Inspection of the tables shows that in every instance of a beryllium result above the LOD, the thresholds were exceeded. Thus, beryllium could have been regarded as from soil source for all samples. However, as discussed later in this report, we obtained beryllium results at a CFA 689 location that we considered were from INEEL activities based upon process knowledge and distribution patterns where the criterion level was exceeded.

The suggested ratios of 3.8 and 1.8 were established by comparing the overall maximum soils beryllium value (4.9 mg/kg) to the overall minimums for barium (19 mg/kg) and copper (9 mg/kg).

As a second point of comparison, the values for the overall mean concentration of beryllium, barium, and copper can be used to establish threshold ratios. Using the overall mean concentration, a rough estimate of reliability can be made. These ratios are 231 for Ba/Be and 23 for Cu/Be.

Table 3, below, lists all beryllium sample results that were above 50% of the criterion level (i.e., above 0.1 μg/100 cm^2) and their associated ratios.

TABLE 3

Sample No.	Be μg / 100 cm^2	Ba / Be	Cu / Be
Z-19	0.170	588	482
Z-21	0.190	4526	4158
F-05	0.951	9	41
F-07	0.775	14	125
F-08	0.504	7	46
F-29	1.003	12	78
F-30	1.647	39	59
F-31	1.550	16	63
F-32	3.000	11	100
F-33	0.950	7	60
F-34	0.359	16	165
F-72	0.530	38	81
F-73	0.120	64	125
Z-82	0.174	378	1000

Using the adjusted threshold ratios above, the beryllium in the "Z" samples can be stated as occurring from soil and the "F" samples from INEEL activities. Significantly, the series of "F" samples represents the interior contaminated return air leg located in CFA 689. While a comparison to this adjusted ratio provides limited statistical reliability it does supports the intuitively correct conclusions for contamination sources when evaluating Ba/Be ratios.

Statistical Summary:

Table 4, below, is a statistical summary of the 418 initial phase sample results.

TABLE 4

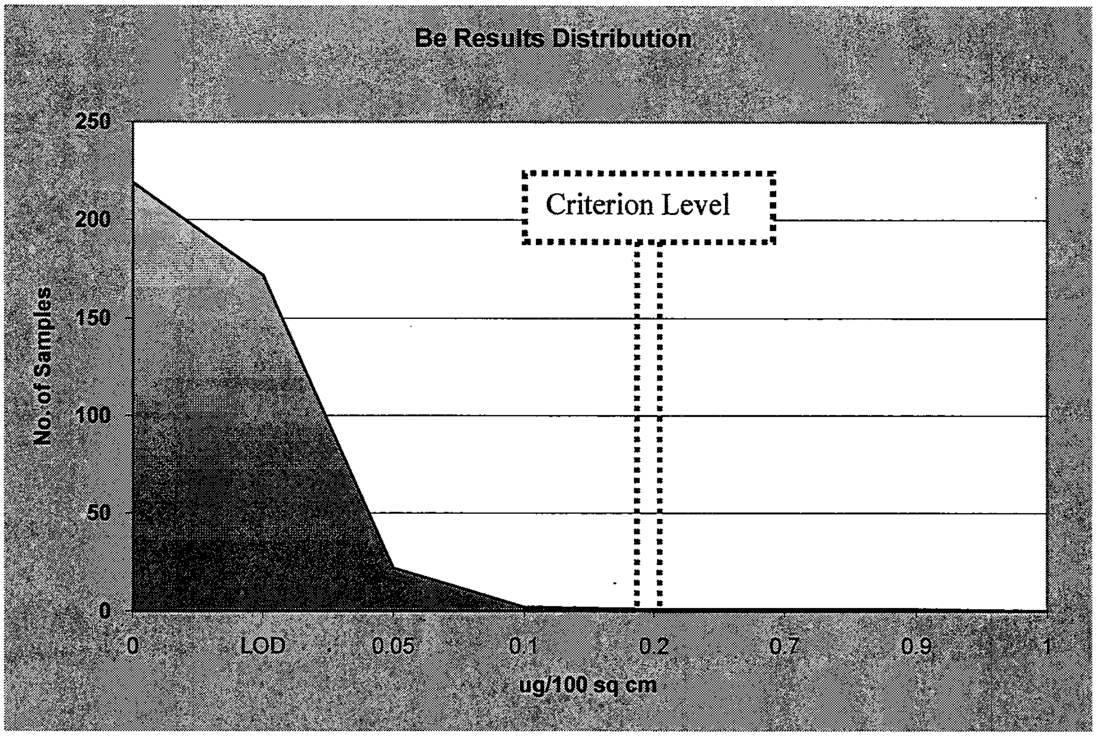
	Be µg	Be µg / 100cm²	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
MAX	0.920	0.951	2500.0	860.0	240000	21765	121.7
MIN	0.000	0.000	0.1	0.0			0.0
MEDIAN	0.000	0.000	9.8	5.8	1267	793	0.6
# >LOD	199 (47.6%)		418 (100%)	416 (99.5%)			
MEAN	0.017	0.017	47.4	16.1	5536	1220	1.7
STD DEV	0.070	0.067	163.2	50.3	20917	1946	6.6

The beryllium distribution curve (Table 5) is extremely "positive" skewed (no result could be less than zero). The median of all samples was below the LOD even though the sampling strategy was biased in favor of finding the locations most likely to be contaminated.

Beryllium Criterion Level:

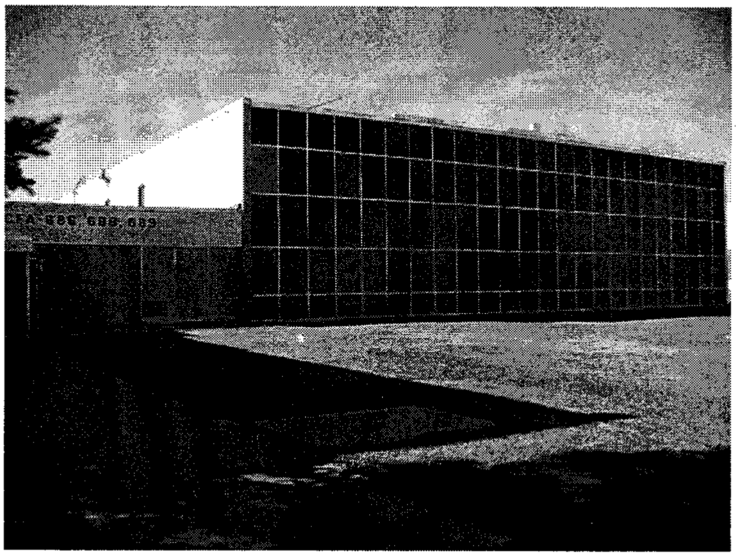
All of the wipe sample Be results for the initial survey phase were below 0.2 µg/100 cm^2 except for three samples in one location—CFA 689, Room 128.

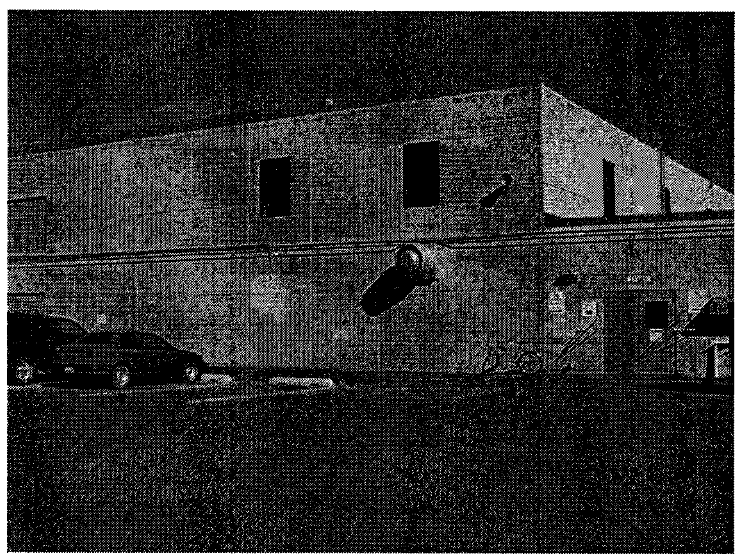
TABLE 5



Be µg/100 cm²	No. of Samples
<LOD	219
LOD to 0.05	172
0.05 to 0.10	22
0.10 to 0.20	2
0.2 to 0.7	1
0.7 to 0.9	1
0.9 to 1.0	1

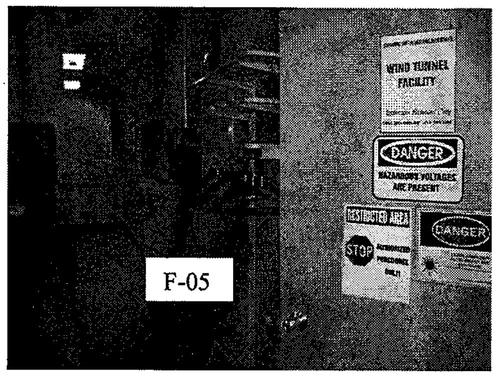
SURVEY RESULTS and CONCLUSIONS
for
CFA 689, Room 128

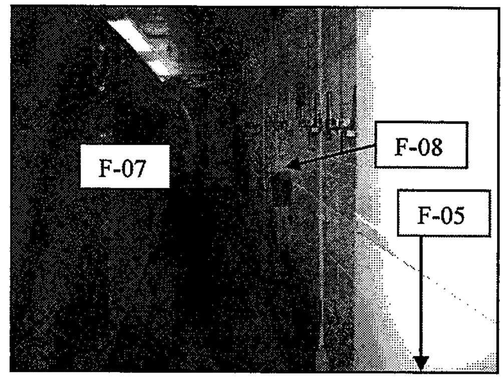




CFA 689, Room 128: Initial Phase

At this location, thermocouples were assembled using beryllium oxide insulators. It has been converted to house the wind tunnel used by the Calibration Lab plus office space and miscellaneous labs. A low partition separates the wind tunnel from the other spaces.





Three samples—F-05, F-07 and F-08--exceeded the criterion level. Sample F-05 was of particular interest because it was taken on the louver of an HVAC return air duct. All three were close together along the South wall of the room. It was along this same wall that employees who worked on the thermocouples said their workbench had been positioned. The work included sandblasting end sections of the beryllium oxide insulation inside a sandblasting enclosure which exhausted air back into to the general work area through a non-descript filter system.

These three sample locations correlated closely with the former work area. Additionally, the sampled surfaces looked as if they had been there continuously since the time of the reported beryllium work. There was no indication that these surfaces had been cleaned any time recently. Therefore, we considered these samples to represent contamination from INEEL activities even though the copper and barium marker results met the original sampling plan guideline to classify the beryllium as naturally occurring soil contamination.

Consequently, we obtained six area air samples and fifty additional wipe samples to characterize the possible extent of contamination and to guide mitigation clean up efforts. Our review of the HVAC system and associated drawings showed that the contaminated system serviced only the first floor of CFA 689.

CFA 689, Room 128: Initial Phase

SUMMARY TABLE

No.	General Area	Be µg / 100 cm²
F01	W wall, outside wind tunnel partition	0.097
F02	W wall, inside wind tunnel partition	0.000
F03	Outside & adjacent N wind tunnel partition	0.000
F04	W wall, inside wind tunnel partition	0.000
F05	S wall, inside wind tunnel partition	**0.951**
F06	Blank	NA
F07	S wall, inside wind tunnel partition	**0.775**
F08	S wall, inside wind tunnel partition	**0.504**
F09	SE corner, inside wind tunnel partition	0.000
F10	E wall, inside wind tunnel partition	0.000
F11	S wall, inside wind tunnel partition	0.000
F12	E end, inside wind tunnel partition	0.040
F13	E wall, inside wind tunnel partition	0.022
F14	E wall, inside wind tunnel partition	0.000
F15	N wall, inside wind tunnel partition	0.000
F16	N wall, inside wind tunnel partition	0.000
F17	W end, inside wind tunnel partition	0.000
F18	W end, inside wind tunnel partition	0.079
F19	Blank	NA
F20	Middle, inside wind tunnel partition	0.076
F21	N wall, inside wind tunnel partition	0.000
F22	N wall, inside wind tunnel partition	0.000
F23	E wall, inside wind tunnel partition	0.025
F24	Middle, inside wind tunnel partition	0.000

CFA 689, Room 128: Initial Phase

FULL RESULTS TABLE

Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
F01	0.110	200.00	18.00	1818	164	0.09
F02	0.000	2.20	0.98			0.45
F03	0.000	3.10	0.50			0.16
F04	0.000	33.00	9.90			0.30
F05	0.920	38.00	8.40	41	9	0.22
Blank	0.000	0.00	0.00			
F07	0.800	100.00	11.00	125	14	0.11
F08	0.520	24.00	3.60	46	7	0.15
F09	0.000	24.00	1.50			0.06
F10	0.000	36.00	7.90			0.22
F11	0.000	16.00	4.60			0.29
F12	0.040	53.00	9.60	1325	240	0.18
F13	0.022	13.00	6.10	591	277	0.47
F14	0.000	4.50	2.60			0.58
F15	0.000	3.20	1.50			0.47
F16	0.000	1.40	0.96			0.69
F17	0.000	5.20	0.65			0.13
F18	0.076	13.00	23.00	171	303	1.77
Blank	0.000	0.00	0.00			
F20	0.076	18.00	21.00	237	276	1.17
F21	0.000	3.60	15.00			4.17
F22	0.000	1.90	1.00			0.53
F23	0.026	170.00	10.00	6538	385	0.06
F24	0.000	3.70	1.20			0.32
LOQ	0.020	0.200	0.060			
LOD	0.005	0.060	0.020			

CFA 689, Room 128: Initial Phase

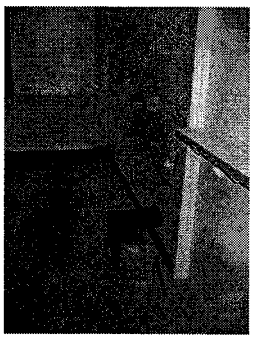
SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
F01	W wall, outside wind tunnel partition	Miscellaneous	top of hall way door	1-3/4" x 10"	1
F02	W wall, inside wind tunnel partition	Miscellaneous	ledge of Dutch door	100 sq cm	1
F03	Outside & adjacent N partition	Floor	within outline of former partition	100 sq cm	1
F04	W wall, inside partition	Infrastructure	wall bracket for mounting electrical panels	1-3/4" x 10"	1
F05	S wall, inside partition	Infrastructure	HVAC, return, grille fixed louver, exterior	3/4" x 20"	2
F06	Blank	NA	N/A	N/A	1
F07	S wall, inside partition	Infrastructure	electrical outlet conduit run, 6" AFL	1" x 16"	1
F08	S wall, inside partition	Storage	"stub box" on wall	4" x 4"	1
F09	SE corner, inside partition	Floor		100 sq cm	1
F10	E wall, inside partition	Miscellaneous	wall bracket for mounting wind tunnel	1-3/4" x 10"	1
F11	S wall, inside partition	Miscellaneous	on wind tunnel	4" x 4"	1
F12	E end, inside partition	Infrastructure	top side of drop ceiling panel	100 sq cm	2
F13	E wall, inside partition	Storage	small, low work surface w/stone top	100 sq cm	1
F14	E wall, inside partition	Storage	storage rack	100 sq cm	1
F15	N wall, inside partition	Storage	shelf above work bench	100 sq cm	1
F16	N wall, inside partition	Miscellaneous	top of file cabinet	100 sq cm	1
F17	W end, inside partition	Miscellaneous	bottom ledge of work bench	100 sq cm	1
F18	W end, inside partition	Infrastructure	in-floor electrical outlet box	2-1/2" x 6"	1
F19	Blank	NA	N/A	N/A	1
F20	Middle, inside partition	Infrastructure	top side of drop ceiling panel	100 sq cm	2
F21	N wall, inside partition	Floor		100 sq cm	1
F22	N wall, inside partition	Miscellaneous	ballistic flow calibrator	100 sq cm	1
F23	E wall, inside partition	Infrastructure	electrical outlet conduit run, 6" AFL	1" x 16"	1
F24	Middle, inside partition	Floor	under wind tunnel	100 sq cm	1

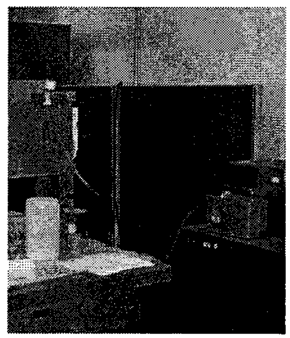
CFA 689: Mitigation and Clearance

Immediately following our decision that the surface contamination criterion level was exceeded, we obtained three area air samples under normal conditions in Room 128. This was done to confirm our observation that the surface contamination could not easily become airborne. Subsequently, three additional samples were obtained with the wind tunnel operating to rule out the possibility that its operation might disturb the surface contamination.

The samples were obtained using high volume air pumps and generally in accordance with NIOSH Method 7300. Sample analysis was by Data Chem Labs, Inc. on their ICP instruments.



F-26, 76 Location



F-27, 77 Location

F-28, 78 Location

Our criterion level for the air samples was 0.2 μg/m^3, which is the action level established by 10 CFR 850. Area air samples below the criteria level would confirm the absence of conditions requiring controls such as regulated areas, periodic monitoring, and exposure reduction plans. The permissible exposure limit for beryllium is 2 μg/m^3 as established by 10 CFR 850 and the Occupational Safety and Health Administration (OSHA). The permissible exposure limit is the value at which an employer must assure that no worker is exposed to airborne concentrations above, as measured in the breathing zone.

No detectable beryllium was found on the area air samples either with or without the wind tunnel in operation. The LOD was less than the criterion level by a factor of approximately 100.

CFA 689: Follow Up Area Air Samples

Sample #	Date	Time start	Time end	Rate LPM	Location	Be $\mu g / m^3$	LOD $\mu g / m^3$
F-25	21 Sep			Blank		ND	0.004 µg
F-26	21 Sep	0819	1057	10	W wall Room 128, by Dutch door	ND	0.0025
F-27	21 Sep	0820	1058	10	E wall Room 128, by sink	ND	0.0025
F-28	21 Sep	0821	1102	10	N of the wind tunnel low partition	ND	0.0025

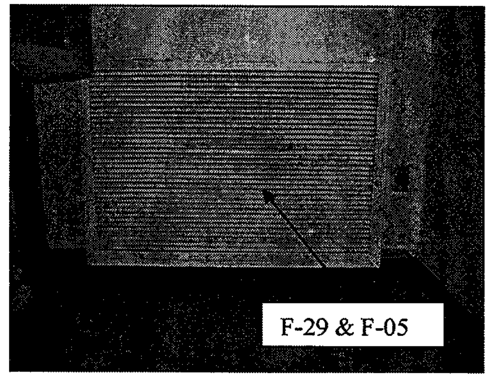
Wind tunnel not in operation

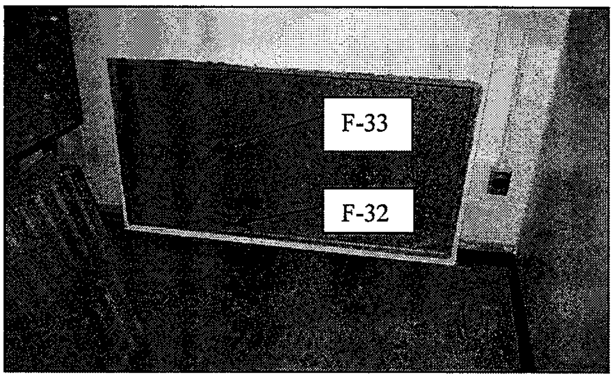
Sample #	Date	Time start	Time end	Rate LPM	Location	Be $\mu g / m^3$	LOD $\mu g / m^3$
F-75	5 Oct			Blank		ND	0.004 µg
F-76	5 Oct	0941	1206	10	W wall Room 128, by Dutch door	ND	0.0028
F-77	5 Oct	0939	1204	10	E wall Room 128, by sink	ND	0.0028
F-78	5 Oct	0942	1210	10	N of the wind tunnel low partition	ND	0.0028

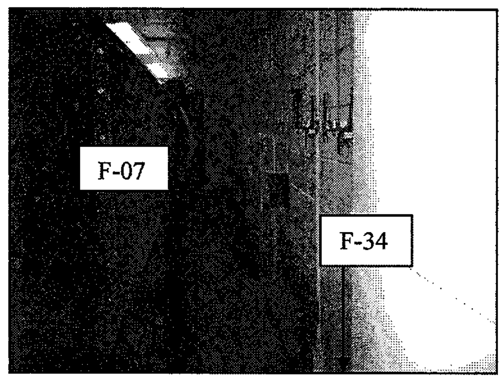
Wind tunnel operating at its mid-range (60 mph)

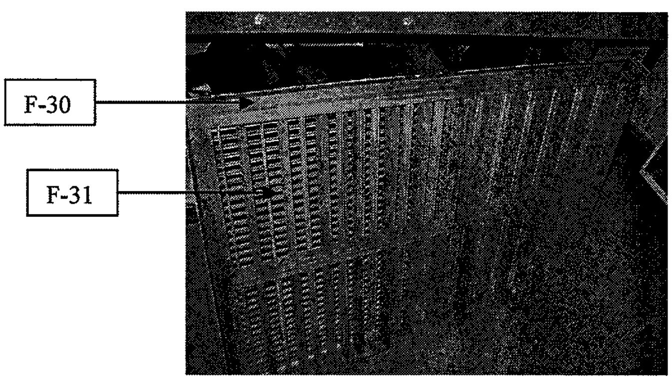
CFA 689: Follow up wipe samples

Seven of the fifty follow up wipe samples (14%) exceeded the criterion level: F-29 through 34 and F-72. Of these seven, six were related to the same HVAC return air leg upon which sample F-05 was found. The seventh (F-34) was along the South wall near samples F-07, 08 and on the same electric outlet conduit as F-07.



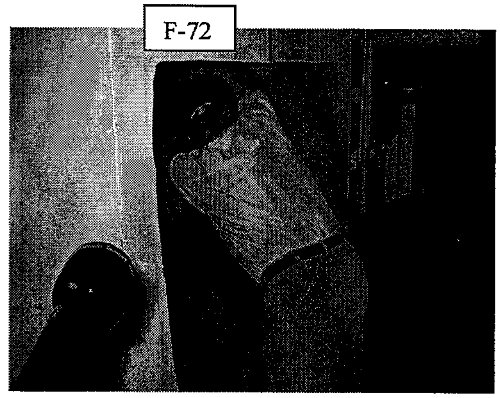


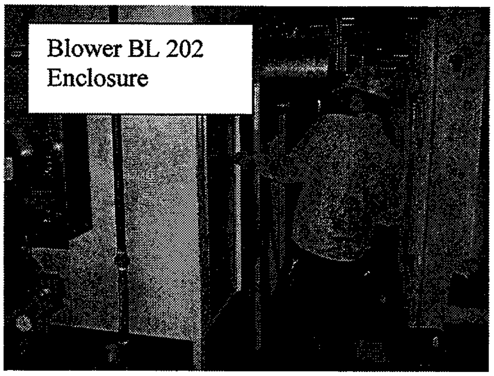




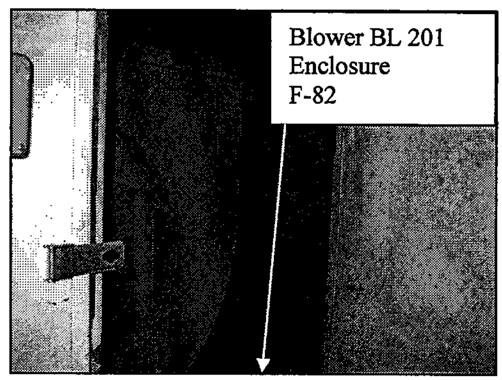
CFA 689: Follow up wipe samples

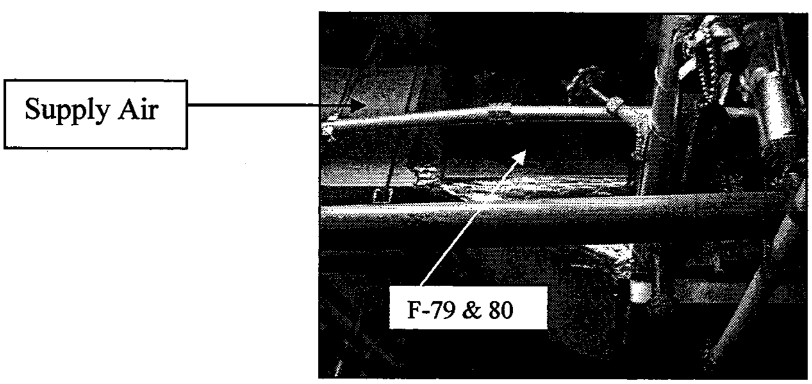
Sample F-72 was one of three obtained inside the enclosure on the negative pressure side of the return air blower (BL-202). This location represented the other end of this leg of the return air ducting. Since it also exceeded the criterion level, we concluded this entire leg was contaminated. The return air portion of the system has two other legs inside Room 128 but none of our five samples in these legs were over the criterion level.





None of the twenty-one samples we obtained on the positive pressure side of BL-202 exceeded the criterion level. This included fifteen samples on supply air ceiling diffusers throughout the first floor. It also included two samples in the main supply air duct on the positive side of supply air blower BL-201 plus four samples in the blower and associated filter bank enclosure on the negative side of BL-201.





CFA 689: Follow up wipe samples

SUMMARY TABLE (1 of 3)

No.	General Area	Be µg / 100 cm^2
F-29	S wall, same as F5 location	**1.003**
F-30	S wall, same as F5 location	**1.647**
F-31	S wall, same as F5 location	**1.550**
F-32	S wall, same as F5 location	**3.000**
F-33	S wall, same as F5 location	**0.950**
F-34	S wall next to cold air return	**0.359**
F-35	SE corner	0.042
F-36	S wall	0.060
F-37	Middle of wind tunnel room	0.000
F-38	W wall, outside wind tunnel partition	0.060
F-39	Stoller Room 124-123	0.000
F-40	Stoller Room 124-123	0.019
F-41	Blank	0.000
F-42	S wall Room 128	0.000
F-43	S wall Room 128	0.000
F-44	SW corner Room 128	0.033
F-45	W wall Room 128	0.021
F-46	S wall Room 128	0.081
F-47	E wall Room 128	0.000
F-48	S wall Room 128	0.004
F-49	S end Room 128	0.005
F-50	S wall Room 128	0.050
F-51	Room 128	0.016
F-52	Room 128	0.020

CFA 689: Follow up wipe samples

SUMMARY TABLE (2 of 3)

No.	General Area	Be µg / 100 cm^2
F-53	Room 128	0.025
F-54	Room 108	0.021
F-55	Room 120	0.007
F-56	Blank	0.000
F-57	Room 129	0.033
F-58	Room 129	0.000
F-59	Room 125	0.023
F-60	Room 127	0.044
F-61	Security vault anteroom	0.017
F-62	Stoller "cage"	0.010
F-63	Room 121	0.028
F-64	Room 121	0.028
F-65	Room 118	0.007
F-66	Room 101	0.017
F-67	Men's room	0.008
F-68	S wall, same as F5 location	0.004
F-69	Room 128, above drop ceiling	0.016
F-70	Room 128, above drop ceiling	0.046
F-71	Room 128, above drop ceiling	0.044
F-72	Mech Room, 1st floor, blower BL-202	**0.530**
F-73	Mech Room, 1st floor, blower BL-202	0.120
F-74	Mech Room, 1st floor, blower BL-202	0.024

CFA 689: Follow up wipe samples

SUMMARY TABLE (3 of 3)

No.	General Area	Be $\mu g / 100\ cm^2$
F-79	Mech Room, 1st floor, blower BL-201	0.000
F-80	Mech Room, 1st floor, blower BL-201	0.051
F-81	Mech Room, 1st floor, blower BL-201	0.019
F-82	Mech Room, 1st floor, blower BL-201	0.174
F-83	Mech Room, 1st floor, blower BL-201	0.018
F-84	Mech Room, 1st floor, blower BL-201	0.005
F-85	Blank	0.000

CFA 689: Follow up wipe samples

FULL RESULTS TABLE (1 of 3)

Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
F-29	0.970	76.00	12.00	78	12	0.16
F-30	1.700	100.00	67.00	59	39	0.67
F-31	1.600	100.00	26.00	63	16	0.26
F-32	3.000	300.00	32.00	100	11	0.11
F-33	0.950	57.00	6.50	60	7	0.11
F-34	0.370	61.00	5.80	165	16	0.10
F-35	0.043	59.00	4.00	1372	93	0.07
F-36	0.062	250.00	9.90	4032	160	0.04
F-37	0.000	15.00	1.20			0.08
F-38	0.068	900.00	19.00	13235	279	0.02
F-39	0.000	1.30	1.30			1.00
F-40	0.014	2.60	4.30	186	307	1.65
F-41	0.000	0.00	0.00			
F-42	0.000	9.10	0.27			0.03
F-43	0.000	1.70	0.49			0.29
F-44	0.033	16.00	3.00	485	91	0.19
F-45	0.022	4.80	0.89	218	40	0.19
F-46	0.084	3.20	0.37	38	4	0.12
F-47	0.000	4.30	0.39			0.09
F-48	0.004	1.60	0.37	400	93	0.23
F-49	0.005	17.00	2.80	3400	560	0.16
F-50	0.024	16.00	2.00	667	83	0.13
F-51	0.016	3.90	6.10	244	381	1.56
F-52	0.020	4.50	6.90	225	345	1.53
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

CFA 689: Follow up wipe samples

FULL RESULTS TABLE (2 of 3)

Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
F-53	0.018	3.80	6.30	211	350	1.66
F-54	0.015	3.20	5.00	213	333	1.56
F-55	0.005	2.70	2.80	540	560	1.04
F-56	0.000	0.20	0.00			0.00
F-57	0.024	5.20	8.30	217	346	1.60
F-58	0.000	0.40	49.00			122.50
F-59	0.017	3.40	6.00	200	353	1.76
F-60	0.032	6.30	11.00	197	344	1.75
F-61	0.012	2.30	3.80	192	317	1.65
F-62	0.010	7.10	5.80	710	580	0.82
F-63	0.020	4.60	6.70	230	335	1.46
F-64	0.020	4.20	6.80	210	340	1.62
F-65	0.005	2.10	2.40	420	480	1.14
F-66	0.012	2.80	4.30	233	358	1.54
F-67	0.006	5.30	2.60	883	433	0.49
F-68	0.004	0.41	0.22	103	55	0.54
F-69	0.016	7.30	7.10	456	444	0.97
F-70	0.046	11.00	11.00	239	239	1.00
F-71	0.044	8.50	4.30	193	98	0.51
F-72	0.530	43.00	20.00	81	38	0.47
F-73	0.120	15.00	7.70	125	64	0.51
F-74	0.024	3.10	1.90	129	79	0.61
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

CFA 689: Follow up wipe samples

FULL RESULTS TABLE (3 of 3)

Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
F-79	0.000	1.2	1.4			1.17
F-80	0.051	19	21	373	412	1.11
F-81	0.019	21	12	1105	632	0.57
F-82	0.180	180	68	1000	378	0.38
F-83	0.018	18	5.1	1000	283	0.28
F-84	0.005	4.2	1.7	840	340	0.40
F-85	0.000	**0.51**	0			0.00
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

CFA 689: Follow up wipe samples

SAMPLE DETAIL TABLE (1 of 3)

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
F-29	S wall, same as F5 location	Infrastructure	HVAC, return, grille fixed louver, exterior	3/4" x 20"	2
F-30	S wall, same as F5 location	Infrastructure	HVAC, return, grille interior top edge	2" x 8"	2
F-31	S wall, same as F5 location	Infrastructure	HVAC, return, grille interior, adjustable louver	2" x 8"	2
F-32	S wall, same as F5 location	Infrastructure	HVAC, return, duct interior, bottom	100 sq cm	2
F-33	S wall, same as F5 location	Infrastructure	HVAC, return, duct interior, side	100 sq cm	1
F-34	S wall by F5 location	Infrastructure	electrical conduit 6" AFL	1" x 16"	1
F-35	SE corner	Infrastructure	electrical conduit 6" AFL	1" x 16"	1
F-36	S wall	Infrastructure	electrical conduit 6" AFL	1" x 16"	2
F-37	Wind tunnel room	Floor	Middle	100 sq cm	1
F-38	W wall Same as F01	Miscellaneous	top of hall way door	1-3/4" x 10"	1
F-39	Stoller Room 124-123	Infrastructure	horizontal fire riser above drop ceiling	3" x 5-1/2"	1
F-40	Stoller Room 124-123	Infrastructure	HVAC, supply, ceiling diffuser CD 308B	5" x 2-1/4"	1
F-41	Blank	NA	NA	NA	1
F-42	S wall Room 128	Floor		100 sq cm	1
F-43	S wall Room 128	Floor		100 sq cm	1
F-44	SW corner Rm 128	Floor		100 sq cm	1
F-45	W wall Room 128	Wall	baseboard	4" x 4"	1
F-46	S wall Room 128	Wall	baseboard	4" x 4"	1
F-47	E wall Room 128	Wall	baseboard	4" x 4"	1
F-48	S wall Room 128	Wall	5 ft AFL	100 sq cm	1
F-49	S end Room 128	Floor	under wind tunnel	100 sq cm	1
F-50	S wall Room 128	Infrastructure	240V outlet box	2-1/2" x 3"	1
F-51	Room 128	Infrastructure	HVAC, supply, ceiling diffuser CD 309	1-3/4" x 9"	1
F-52	Room 128	Infrastructure	HVAC, supply, ceiling diffuser CD 306	1-3/4" x 9"	1

CFA 689: Follow up wipe samples

SAMPLE DETAIL TABLE (2 of 3)

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
F-53	Room 128	Infrastructure	HVAC, supply, ceiling diffuser CD 304	5" x 2-1/4"	1
F-54	Room 108	Infrastructure	HVAC, supply, ceiling diffuser CD 110	5" x 2-1/4"	1
F-55	Room 120	Infrastructure	HVAC, supply, ceiling diffuser CD 203	5" x 2-1/4"	1
F-56	Blank	NA	NA	NA	1
F-57	Room 129	Infrastructure	HVAC, supply, ceiling diffuser CD 404	5" x 2-1/4"	1
F-58	Room 129	Infrastructure	HVAC, return, grille fixed louver, exterior	1" x 16"	1
F-59	Room 125	Infrastructure	HVAC, supply, ceiling diffuser CD 321	5" x 2-1/4"	1
F-60	Room 127	Infrastructure	HVAC, supply, ceiling diffuser CD 301	5" x 2-1/4"	1
F-61	Security vault anteroom	Infrastructure	HVAC, supply, ceiling diffuser CD 305	5" x 2-1/4"	1
F-62	Stoller "cage"	Infrastructure	HVAC, return, grille fixed louver, exterior	1" x 16"	1
F-63	Room 121	Infrastructure	HVAC, supply, ceiling diffuser CD 106	5" x 2-1/4"	1
F-64	Room 121	Infrastructure	HVAC, supply, ceiling diffuser CD 107	5" x 2-1/4"	1
F-65	Room 118	Infrastructure	HVAC, supply, ceiling diffuser CD 207A	5" x 2-1/4"	1
F-66	Room 101	Infrastructure	HVAC, supply, ceiling diffuser CD 115	5" x 2-1/4"	1
F-67	Men's room	Infrastructure	HVAC, supply, ceiling diffuser CD 112	5" x 2-1/4"	1
F-68	S wall, same as F5 location	Infrastructure	HVAC, return, duct exterior, 7 ft AFL	100 sq cm	1
F-69	Room 128, above drop ceiling	Infrastructure	HVAC, return, duct interior, bottom	100 sq cm	1
F-70	Room 128, above drop ceiling	Infrastructure	HVAC, return, duct interior, side	100 sq cm	1
F-71	Room 128, above drop ceiling	Infrastructure	HVAC, return, duct interior, bottom	100 sq cm	1
F-72	Mechanical Room, 1st floor, blower BL-202	Infrastructure	HVAC, return, blower duct interior, R side	100 sq cm	2
F-73	Mechanical Room, 1st floor, blower BL-202	Infrastructure	HVAC, return, blower duct interior, L side	100 sq cm	1
F-74	Mechanical Room, 1st floor, blower BL-202	Infrastructure	HVAC, return, blower duct interior, bottom	100 sq cm	1

CFA 689: Follow up wipe samples

SAMPLE DETAIL TABLE (3 of 3)

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
F-79	Mechanical Room, 1st floor, blower BL-201	Infrastructure	HVAC, supply, duct interior, access door	100 sq cm	1
F-80	Mechanical Room, 1st floor, blower BL-201	Infrastructure	HVAC, supply, duct interior	100 sq cm	1
F-81	Mechanical Room, 1st floor, blower BL-201	Infrastructure	HVAC, return after filters, in blower plenum	100 sq cm	2
F-82	Mechanical Room, 1st floor, blower BL-201	Infrastructure	HVAC, return after filters, ledge of blower support	4" x 4"	3
F-83	Mechanical Room, 1st floor, blower BL-201	Infrastructure	HVAC, return before filters, plenum wall	100 sq cm	1
F-84	Mechanical Room, 1st floor, blower BL-201	Infrastructure	HVAC, return before filters, return air duct end	100 sq cm	1
F-85	Blank	NA	NA	NA	1

CFA 689: Mitigation & Clearance

Table 6, below, lists the specific locations of all pre-clearance wipe samples at or above the criterion level (i.e., 0.2 μg/100 cm^2) in descending order of beryllium found.

TABLE 6

No.	General Area	Specific Surface	Be μg / 100 cm^2
F-32	S wall, same as F5 location	HVAC, return, duct interior, bottom	3.000
F-30	S wall, same as F5 location	HVAC, return, grille interior top edge	1.647
F-31	S wall, same as F5 location	HVAC, return, grille interior, adjustable louver	1.550
F-29	S wall, same as F5 location	HVAC, return, grille fixed louver, exterior	1.003
F-05	S wall, inside wind tunnel partition	HVAC, return, grille fixed louver, exterior	0.951
F-33	S wall, same as F5 location	HVAC, return, duct interior, side	0.950
F-07	S wall, inside wind tunnel partition	electrical outlet conduit run, 6" AFL	0.775
F-72	Mechanical Room, 1st floor, blower BL-202	HVAC, return, blower duct interior, R side	0.530
F-08	S wall, inside wind tunnel partition	"stub box" on wall	0.504
F-34	S wall next to cold air return	electrical outlet conduit run, 6" AFL	0.359

Table 6 plus the area air samples and specific wipe sampling locations below the criterion level indicate that the contamination has not spread beyond the:

1. Interior and exterior of the grille of the return air duct at Sample F-05.
2. Interior of the return air ductwork leg from the grille, above, to the BL-202 enclosure.
3. Attachments on the South wall next to the wind tunnel to include the "stub box", electrical outlet conduit run, and HVAC return air louver.

Figure 2 is a sketch indicating the locations of all initial and follow up wipe samples in the vicinity of the wind tunnel.

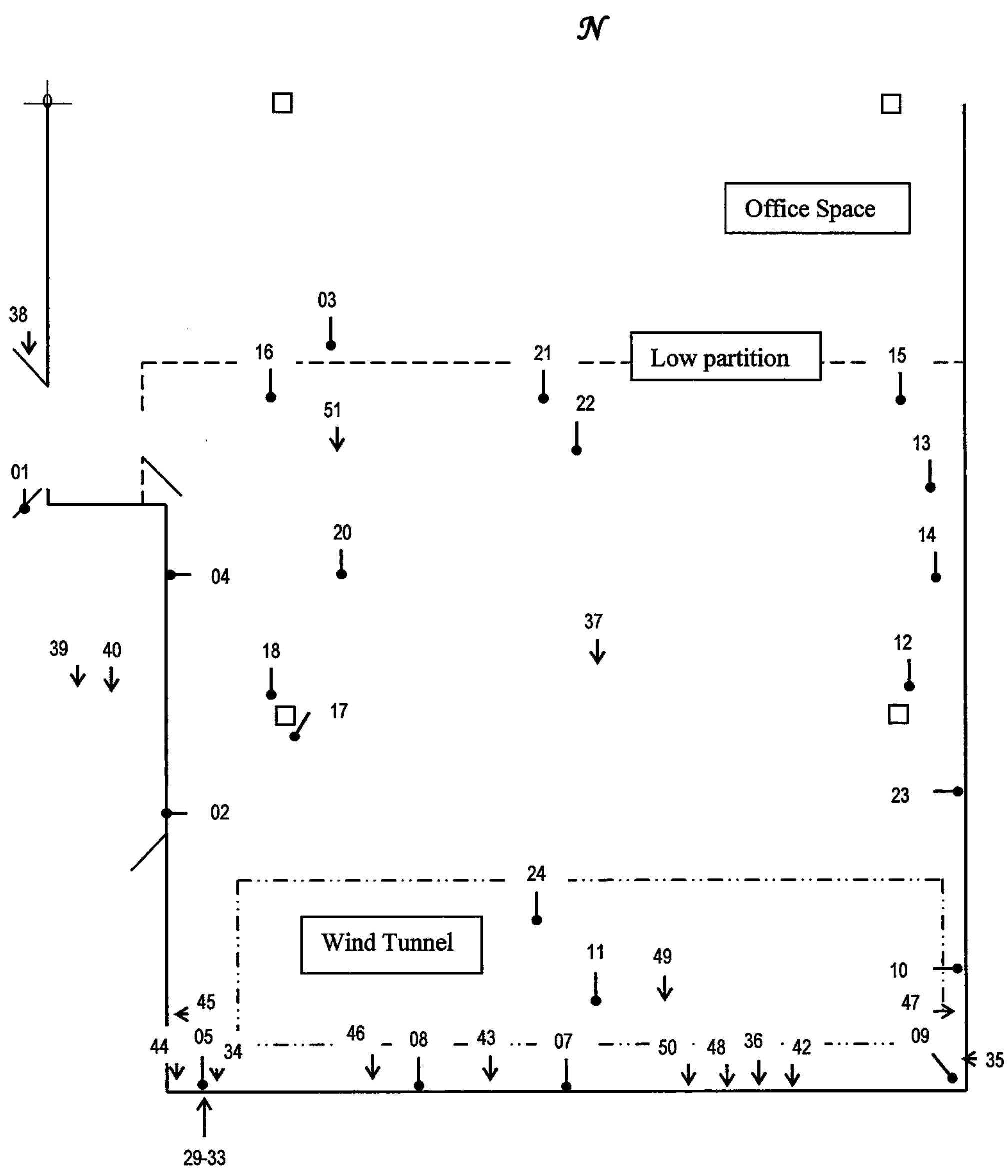
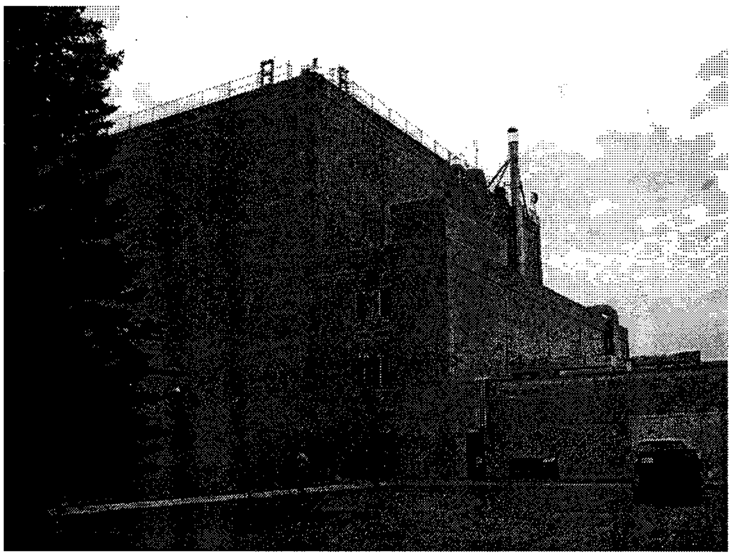


FIGURE 2

CFA 689, Room 128, Wind Tunnel Vicinity: Wipe Sample Locations

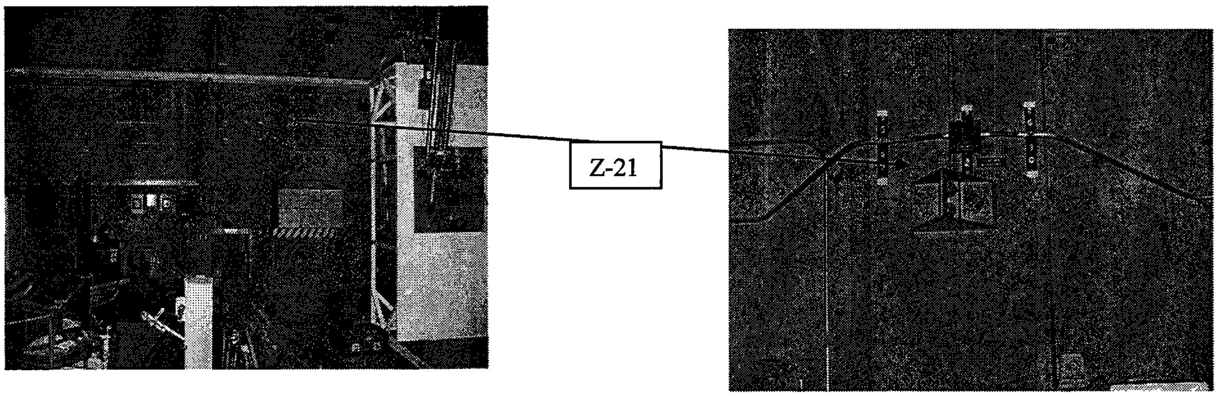
Initial Phase	—•
Follow Up	→

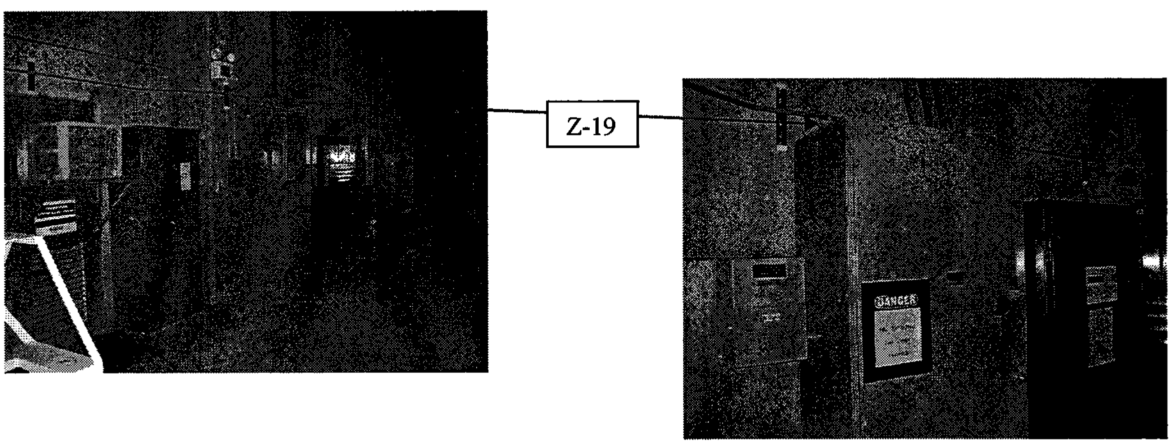
SURVEY RESULTS and CONCLUSIONS for TRA 603, MTR



TRA 603, MTR

No results exceeded the criterion level. The highest two results were 95% and 85% of the criterion (Z-21 and Z-19, respectively). They were obtained at opposite ends of the Main Floor in locations unrelated to any known past beryllium activities. We consider the beryllium on these samples to be from naturally occurring soil.





TRA 603, MTR

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
Z01	Penthouse	0.000
Z02	Penthouse	0.037
Z03	Penthouse	0.000
Z04	Penthouse	0.020
Z05	Basement, NE end	0.000
Z06	Basement, SE "machine shop"	0.000
Z07	Basement, SE "machine shop"	0.000
Z08	Basement, SE "machine shop"	0.053
Z09	Basement, SW end	0.000
Z10	Blank	NA
Z11	Main floor, NW end	0.000
Z12	Main floor, S wall	0.000
Z13	Main floor, S wall	0.024
Z14	2nd floor	0.024
Z15	Main floor, top reactor	0.000
Z16	Main floor, top reactor	0.020
Z17	Main floor, top reactor	0.033
Z18	Main floor, top calciner	0.064
Z19	Main floor, S wall	0.170
Z20	Main floor, W wall	0.065
Z21	Main floor, N wall	0.190
Z22	Blank	NA
Z23	Main floor, E wall	0.023
Z24	Main floor, NE corner	0.037

TRA 603, MTR

FULL RESULTS TABLE

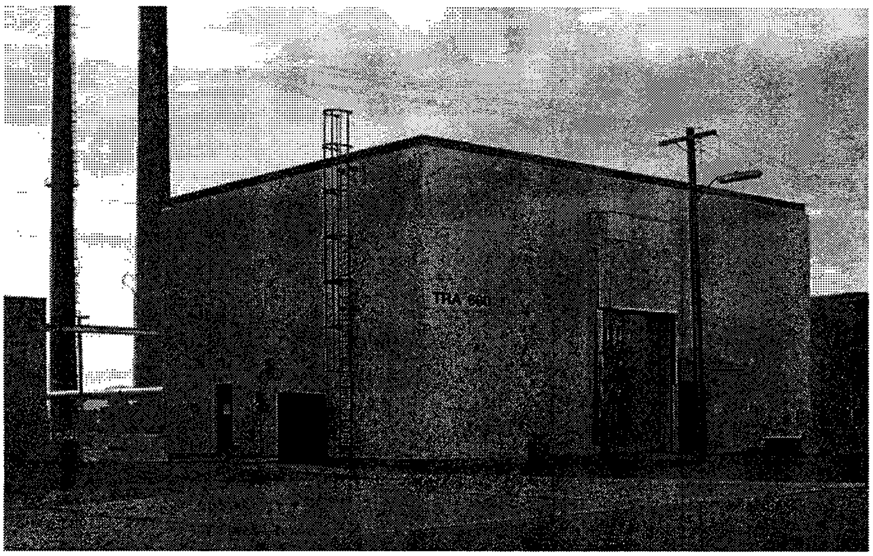
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
Z01	0.000	1.40	11.00			7.86
Z02	0.037	29.00	26.00	784	703	0.90
Z03	0.000	3.80	7.40			1.95
Z04	0.019	9.90	9.20	521	484	0.93
Z05	0.000	0.85	0.36			0.42
Z06	0.000	5.10	4.80			0.94
Z07	0.000	1.10	2.20			2.00
Z08	0.053	12.00	22.00	226	415	1.83
Z09	0.000	5.20	5.90			1.13
Blank	0.000	0.00	0.00			
Z11	0.000	11.00	6.70			0.61
Z12	0.000	4.50	1.90			0.42
Z13	0.027	14.00	16.00	519	593	1.14
Z14	0.024	12.00	14.00	500	583	1.17
Z15	0.000	18.00	10.00			0.56
Z16	0.020	23.00	18.00	1150	900	0.78
Z17	0.034	96.00	28.00	2824	824	0.29
Z18	0.064	86.00	56.00	1344	875	0.65
Z19	0.170	82.00	100.00	482	588	1.22
Z20	0.067	86.00	47.00	1284	701	0.55
Z21	0.190	790.00	860.00	4158	4526	1.09
Blank	0.000	**0.54**	0.00			0.00
Z23	0.023	50.00	21.00	2174	913	0.42
Z24	0.037	48.00	52.00	1297	1405	1.08
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

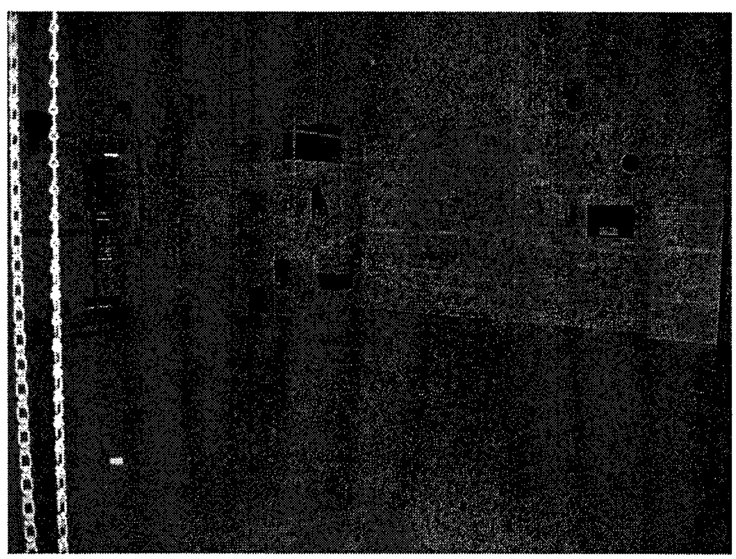
TRA 603, MTR

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
Z01	Penthouse	Miscellaneous	top of door to roof	1-3/4" x 10"	1
Z02	Penthouse	Infrastructure	concrete structure adjacent to floor	100 sq cm	1
Z03	Penthouse	Floor	W wall	100 sq cm	1
Z04	Penthouse	Miscellaneous	stair tread support rail	1-1/2" x 10"	1
Z05	Basement, NE end	Storage	work bench, near glove box	100 sq cm	1
Z06	Basement, SE "machine shop"	Storage	inside gray cabinet, SE corner	100 sq cm	1
Z07	Basement, SE "machine shop"	Floor	NE corner	100 sq cm	1
Z08	Basement, SE "machine shop"	Infrastructure	power panel M, N wall	100 sq cm	2
Z09	Basement, SW end	Miscellaneous	freight elevator, dog on door	3" x 7"	1
Z10	Blank	NA	N/A	NA	1
Z11	Main floor, NW end	Floor	inside personnel elevator	100 sq cm	1
Z12	Main floor, S wall	Storage	inside gray cabinet next to Chopper Lab door	100 sq cm	1
Z13	Main floor, S wall	Miscellaneous	through-door exhaust louver, Chopper Lab	1-3/4" x 10"	1
Z14	2nd floor	Miscellaneous	top of concrete railing support	100 sq cm	1
Z15	Main floor, top reactor	Process	deck, SW corner	100 sq cm	1
Z16	Main floor, top reactor	Process	Transome idler roll equpt	100 sq cm	1
Z17	Main floor, top reactor	Process	Welding control box, NW corner	4" x 4"	2
Z18	Main floor, top calciner	Miscellaneous	HEPA filter box, NW corner	100 sq cm	1
Z19	Main floor, S wall	Infrastructure	power supply cabinet MA603-P-2	100 sq cm	2
Z20	Main floor, W wall	Infrastructure	light fixture	4" x 4"	2
Z21	Main floor, N wall	Infrastructure	alarm light fixture	100 sq cm	2
Z22	Blank	NA	N/A	NA	1
Z23	Main floor, E wall	Miscellaneous	top wooden storage cabinet	100 sq cm	1
Z24	Main floor, NE corner	Floor	mezzanine, NW corner	100 sq cm	2

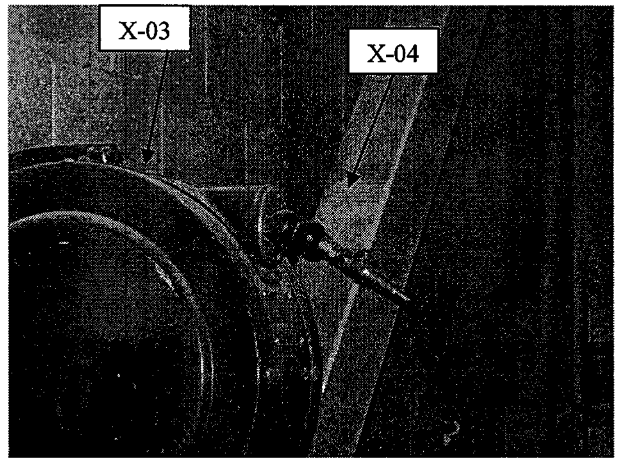
SURVEY RESULTS and CONCLUSIONS for TRA 660, ARMF

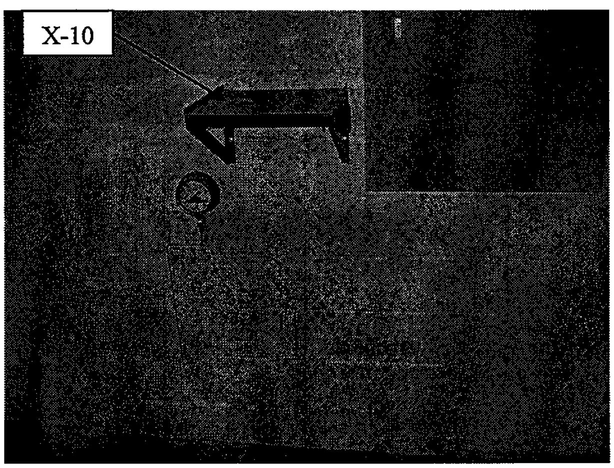




TRA 660, ARMF

All process equipment was completely removed from this location and decontamination has been extensive. The floors have been repainted and coated; the walls have all been repainted. The two samples with the highest values at this location were approximately 30% and 25% of the criterion level (X-03 and X-10, respectively). We consider the beryllium on these samples to be from naturally occurring soil.





TRA 660, ARMF

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
X01	N wall	0.023
X02	N wall	0.036
X03	W wall	0.060
X04	W wall	0.029
X05	Inside rest room	0.007
X06	Inside rest room	0.010
X07	NW corner	0.000
X08	SE corner	0.000
X09	Blank	NA
X10	S wall	0.052
X11	S wall	0.000
X12	W wall	0.024
X13	W wall	0.046
X14	E wall	0.030
X15	S wall	0.007
X16	W wall	0.032
X17	S wall	0.043
X18	W wall	0.031
X19	E wall	0.007
X20	Deck above rest room	0.012
X21	Blank	NA
X22	N end	0.040
X23	E wall	0.048
X24	SE corner	0.000

TRA 660, ARMF

FULL RESULTS TABLE

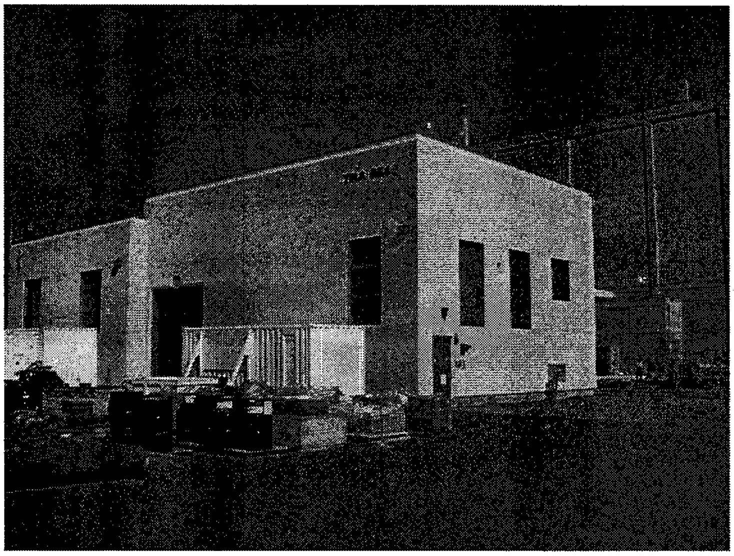
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
X01	0.021	11.00	21.00	524	1000	1.91
X02	0.037	6.90	14.00	186	378	2.03
X03	0.058	15.00	24.00	259	414	1.60
X04	0.029	13.00	15.00	448	517	1.15
X05	0.007	7.80	20.00	1114	2857	2.56
X06	0.011	7.90	6.90	718	627	0.87
X07	0.000	0.85	1.20			1.41
X08	0.000	0.74	6.10			8.24
Blank	0.000	0.00	0.00			
X10	0.052	24.00	69.00	462	1327	2.88
X11	0.000	2.30	3.70			1.61
X12	0.024	5.00	10.00	208	417	2.00
X13	0.046	53.00	21.00	1152	457	0.40
X14	0.031	110.00	28.00	3548	903	0.25
X15	0.007	2.70	4.40	386	629	1.63
X16	0.032	37.00	21.00	1156	656	0.57
X17	0.044	11.00	23.00	250	523	2.09
X18	0.032	6.60	15.00	206	469	2.27
X19	0.007	3.80	4.80	543	686	1.26
X20	0.012	5.60	14.00	467	1167	2.50
Blank	0.000	**0.24**	0.00			0.00
X22	0.041	36.00	84.00	878	2049	2.33
X23	0.050	5.90	44.00	118	880	7.46
X24	0.000	5.50	2.60			0.47
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

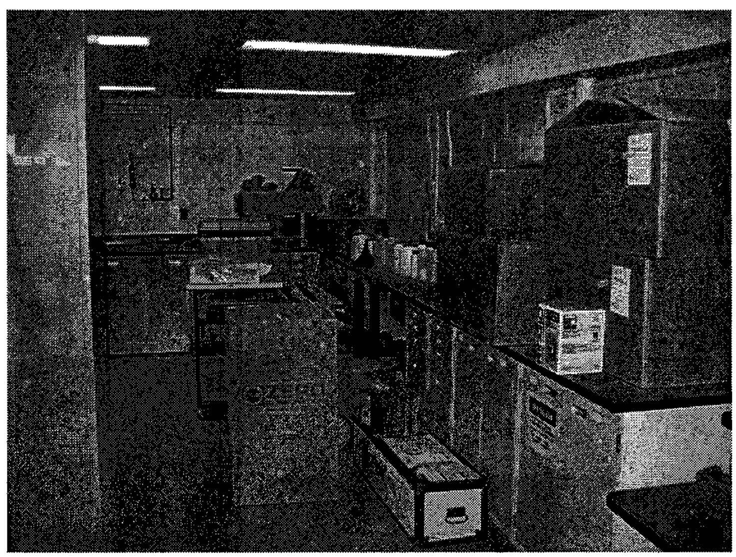
TRA 660, ARMF

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
X01	N wall	Infrastructure	blue circuit breaker panel	2" x 7"	2
X02	N wall	Infrastructure	conduit run	2" x 8"	2
X03	W wall	Infrastructure	hose reel case	5" x 3"	2
X04	W wall	Infrastructure	crane support beam	100 sq cm	2
X05	Inside rest room	Infrastructure	green light fixture	4" x 4"	2
X06	Inside rest room	Wall	top of partition	3" x 5-1/2"	1
X07	NW corner	Floor	corner	100 sq cm	1
X08	SE corner	Floor	corner	100 sq cm	1
X09	Blank	NA	N/A	N/A	1
X10	S wall	Infrastructure	wall mounted equipment support bracket	100 sq cm	2
X11	S wall	Floor	steel diamond plate	100 sq cm	1
X12	W wall	Infrastructure	control panel "PB 3"	100 sq cm	2
X13	W wall	Infrastructure	panel "660-DP-1"	100 sq cm	2
X14	E wall	Infrastructure	inside ADT box, under 1977 calendar page	4" x 4"	2
X15	S wall	Infrastructure	wall mounted gage	2" x 8"	1
X16	W wall	Infrastructure	transformer "T-3"	100 sq cm	2
X17	S wall	Infrastructure	alarm horn	4" x 4"	1
X18	W wall	Infrastructure	alarm horn	4" x 4"	1
X19	E wall	Infrastructure	alarm horn	4" x 4"	1
X20	Deck above rest room	Floor	concrete edge	4" x 4"	1
X21	Blank	NA	N/A	N/A	1
X22	N end	Infrastructure	light fixture near ceiling	4" x 4"	2
X23	E wall	Infrastructure	HVAC, return, grille fixed louver, exterior	4" x 4"	2
X24	SE corner	Infrastructure	heater fan blade	3-1/2" x 4-1/2"	1

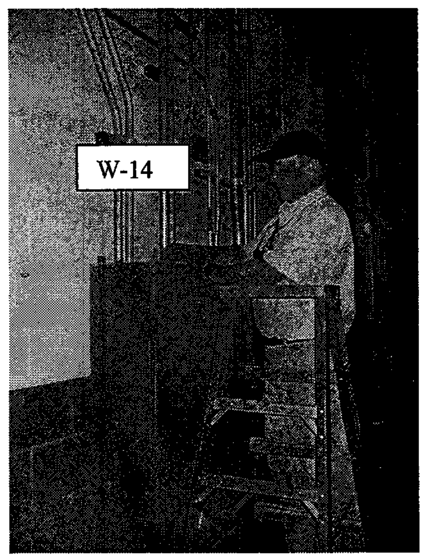
SURVEY RESULTS and CONCLUSIONS
for
TRA 654, ETRC reactor





TRA 654, ETRC reactor

The two samples with the highest values at this location were approximately 50% and 35% of the criterion level (W-13 and W-14, respectively). We consider the beryllium on these samples to be from naturally occurring soil.



TRA 654, ETRC reactor

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
W01	Main floor area	0.000
W02	Main floor area	0.018
W03	Main floor area	0.023
W04	Main floor, Lab 102	0.000
W05	Mezzanine	0.000
W06	Mezzanine	0.014
W07	NE Lab wall	0.000
W08	Blank	NA
W09	near Lab 102 door	0.000
W10	NE Lab wall	0.000
W11	Lab 102	0.000
W12	Lab 102	0.000
W13	Main area adjacent Lab 102 NE wall	0.097
W14	Main area SW wall	0.072
W15	In Lab 102, SW wall	0.000
W16	Mezzanine	0.054
W17	NW wall, Main area	0.044
W18	NW wall, Main area	0.063
W19	Main area adjacent Lab 102 SW wall	0.000
W20	Blank	NA
W21	Staircase to mezzanine	0.026
W22	Door to Lab 102	0.015
W23	Door from 635	0.000
W24	At entrance to Lab 102	0.013

TRA 654, ETRC reactor

FULL RESULTS TABLE

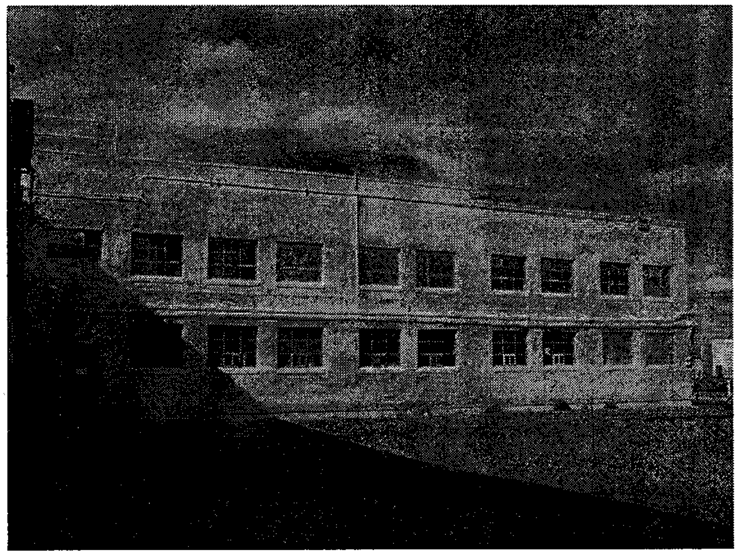
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
W01	0.000	1.10	1.40			1.27
W02	0.018	1.60	4.50	89	250	2.81
W03	0.023	11.00	8.70	478	378	0.79
W04	0.000	3.10	1.60			0.52
W05	0.000	1.70	2.70			1.59
W06	0.014	8.80	7.00	629	500	0.80
W07	0.000	5.60	2.50			0.45
Blank	0.000	0.00	0.00			
W09	0.000	0.30	0.41			1.37
W10	0.000	2.00	1.70			0.85
W11	0.000	0.64	1.00			1.56
W12	0.000	1.20	1.30			1.08
W13	0.110	47.00	47.00	427	427	1.00
W14	0.072	7.50	21.00	104	292	2.80
W15	0.000	0.33	0.40			1.21
W16	0.056	24.00	27.00	429	482	1.13
W17	0.044	9.80	37.00	223	841	3.78
W18	0.063	31.00	23.00	492	365	0.74
W19	0.000	0.38	0.52			1.37
Blank	0.000	0.00	0.00			
W21	0.029	6.80	7.40	234	255	1.09
W22	0.015	2.50	6.10	167	407	2.44
W23	0.000	5.30	6.40			1.21
W24	0.013	2.40	3.80	185	292	1.58
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

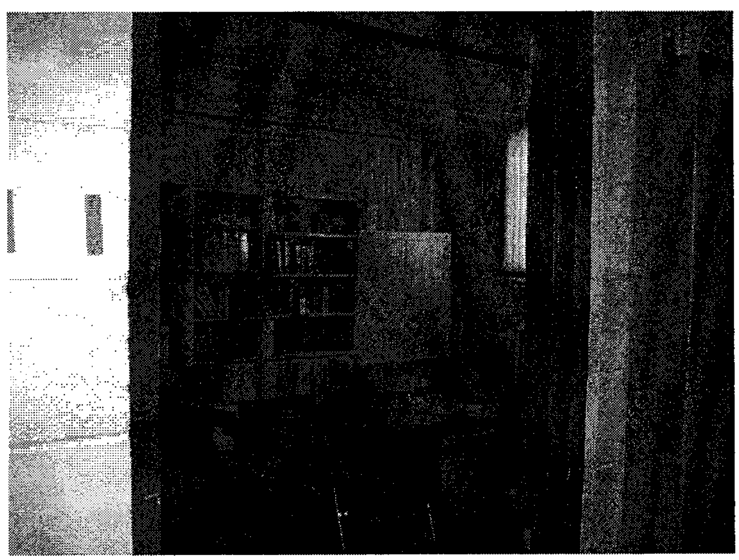
TRA 654, ETRC reactor

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
W01	Main floor area	Floor	just inside SW entrance	100 sq cm	1
W02	Main floor area	Floor	SE corner roll up door	100 sq cm	1
W03	Main floor area	Floor	under steps to mezzanine	100 sq cm	1
W04	Main floor, Lab 102	Floor	in front of sink	100 sq cm	1
W05	Mezzanine	Floor	SE wall near steps	100 sq cm	1
W06	Mezzanine	Floor	NE wall between E most windows	100 sq cm	1
W07	NE Lab wall	Storage	Green cabinet interior shelf	100 sq cm	1
W08	Blank	NA	N/A	N/A	1
W09	near Lab 102 door	Storage	Gray cabinet interior shelf	100 sq cm	1
W10	NE Lab wall	Storage	Cabinet E of green cabinet interior bottom shelf	100 sq cm	1
W11	Lab 102	Storage	Cabinet w/ "Cd" sign interior shelf	100 sq cm	1
W12	Lab 102	Storage	Cabinet next to Flammables cabinet interior shelf	4" x 4"	1
W13	Main area adjacent Lab 102 NE wall	Infrastructure	light fixture	3.5" x 5"	2
W14	Main area SW wall	Infrastructure	electrical panel "P136"	100 sq cm	2
W15	In Lab 102, SW wall	Infrastructure	HVAC, return, grille fixed louver, exterior	3/4" x 24"	1
W16	Mezzanine	Infrastructure	light fixture next to fixed ladder	4" x 4"	2
W17	NW wall, Main area	Infrastructure	switch box feed panel	100 sq cm	1
W18	NW wall, Main area	Infrastructure	motor connect box	100 sq cm	2
W19	Main area adjacent Lab 102 SW wall	Storage	bench top	100 sq cm	1
W20	Blank	NA	N/A	N/A	1
W21	Staircase to mezzanine	Miscellaneous	top of stair tread support beam	2.5" x 7"	1
W22	Door to Lab 102	Miscellaneous	top of door	2" x 8"	1
W23	Door from 635	Miscellaneous	top of door casing on 635 side	1/2" x 36"	1
W24	At entrance to Lab 102	Miscellaneous	top of blue cabinet	100 sq cm	1

SURVEY RESULTS and CONCLUSIONS
for
CPP 630, Old machine shop

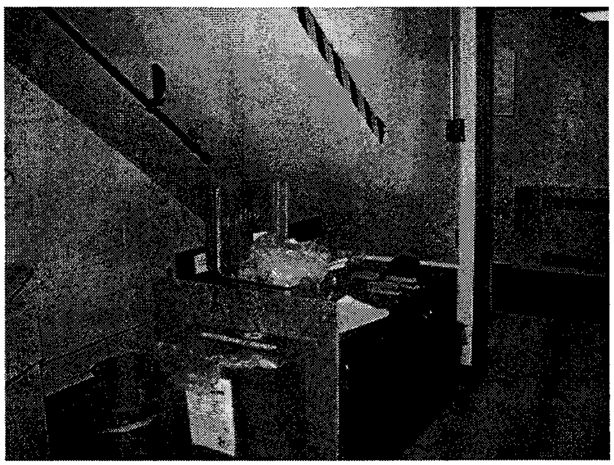




CPP 630, Old machine shop

The old machine shop high bay space has been converted to two floors of offices.

The two samples with the highest values at this location were approximately 50% and 35% of the criterion level (K-22 and K-04, respectively). These two samples were obtained at diagonally opposite ends of the building space. We consider the beryllium on these samples to be from naturally occurring soil.



CPP 630, Old machine shop

SUMMARY TABLE

No.	General Area	Be $\mu g / 100\ cm^2$
K01	Room 129	0.028
K02	Room 129	0.034
K03	Room 129	0.021
K04	Room 128	0.072
K05	Room 124	0.007
K06	SE hallway, 1st floor	0.010
K07	SE hallway, 2nd floor	0.021
K08	Room 121A	0.000
K09	NW hallway, 1st floor	0.000
K10	Blank	0.000
K11	NW hallway, 2nd floor	0.000
K12	Room 113	0.010
K13	Room 226	0.000
K14	SW hallway, 1st floor	0.006
K15	SW end, 1st floor	0.018
K16	Blank	0.000
K17	W hallway, 1st floor	0.010
K18	W hallway, 1st floor	0.010
K19	SE hallway, 2nd floor	0.020
K20	Room 110	0.018
K21	SW hallway, 2nd floor	0.032
K22	SW corner, 1st floor	0.093
K23	Room 108	0.000
K24	Room 137	0.000

CPP 630, Old machine shop

FULL RESULTS TABLE

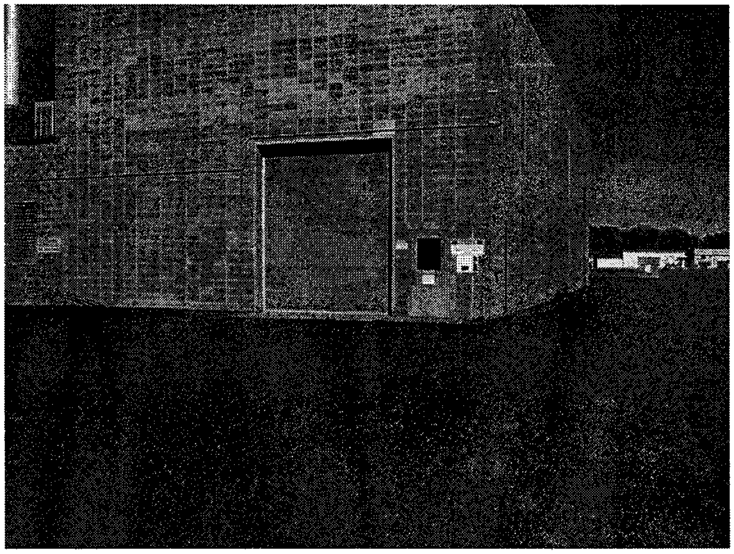
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
K01	0.027	34.00	3.70	1259	137	0.11
K02	0.035	49.00	19.00	1400	543	0.39
K03	0.020	17.00	5.80	850	290	0.34
K04	0.070	40.00	15.00	571	214	0.38
K05	0.007	37.00	8.50	5286	1214	0.23
K06	0.010	15.00	5.30	1500	530	0.35
K07	0.020	20.00	8.70	1000	435	0.44
K08	0.000	1.70	0.83			0.49
K09	0.000	3.20	1.50			0.47
Blank	0.000	0.00	0.00			
K11	0.000	7.40	2.40			0.32
K12	0.010	25.00	7.20	2500	720	0.29
K13	0.000	1.60	1.20			0.75
K14	0.006	2.20	1.80	367	300	0.82
K15	0.020	19.00	10.00	950	500	0.53
Blank	0.000	0.00	0.00			
K17	0.010	36.00	6.50	3600	650	0.18
K18	0.010	28.00	5.50	2800	550	0.20
K19	0.020	29.00	8.00	1450	400	0.28
K20	0.020	30.00	9.00	1500	450	0.30
K21	0.032	26.00	19.00	813	594	0.73
K22	0.063	25.00	130.00	397	2063	5.20
K23	0.000	7.40	5.60			0.76
K24	0.000	5.80	2.30			0.40
LOQ	0.020	0.200	0.060			
LOD	0.005	0.060	0.020			

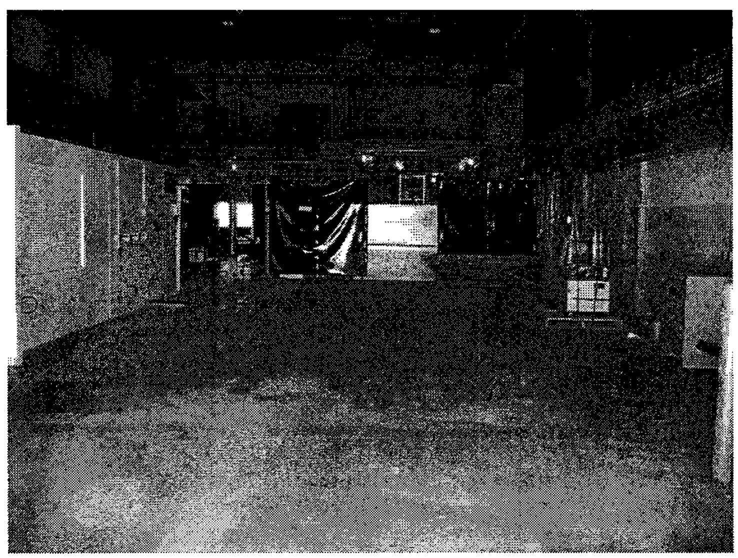
CPP 630, Old machine shop

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
K01	Room 129	Infrastructure	electric outlet conduit run	1-1/2" x 10"	1
K02	Room 129	Infrastructure	HVAC, supply, ceiling diffuser	4" x 4"	1
K03	Room 129	Infrastructure	drain pipe fitting	1" x 15"	1
K04	Room 128	Infrastructure	emergency light	5" x 3"	2
K05	Room 124	Infrastructure	ceiling truss above drop ceiling	1-1/2" x 10"	1
K06	SE hallway, 1st floor	Infrastructure	fire riser horizontal run	4" x 4"	1
K07	SE hallway, 2nd floor	Infrastructure	fire riser support bracket	2-1/2" x 6"	1
K08	Room 121A	Infrastructure	transformer	100 sq cm	1
K09	NW hallway, 1st floor	Infrastructure	transformer	100 sq cm	1
K10	Blank	NA	N/A	N/A	1
K11	NW hallway, 2nd floor	Infrastructure	floor level next to stairway	100 sq cm	1
K12	Room 113	Infrastructure	telephone cabinet	100 sq cm	2
K13	Room 226	Infrastructure	HVAC, supply, ceiling diffuser	100 sq cm	2
K14	SW hallway, 1st floor	Miscellaneous	top side of drop ceiling panel	100 sq cm	2
K15	SW end, 1st floor	Miscellaneous	top of door	1-3/4" x 10"	1
K16	Blank	NA	N/A	N/A	1
K17	W hallway, 1st floor	Miscellaneous	Fire department connection box	5" x 3"	2
K18	W hallway, 1st floor	Infrastructure	yellow alarm horn	4" x 4"	1
K19	SE hallway, 2nd floor	Infrastructure	transformer	100 sq cm	2
K20	Room 110	Infrastructure	fire riser horizontal run	3-1/2" x 5"	2
K21	SW hallway, 2nd floor	Infrastructure	top of ventilation duct by Room 209	100 sq cm	2
K22	SW corner, 1st floor	Infrastructure	wall bracket	1-3/4" x 6"	2
K23	Room 108	Miscellaneous	top of door	1-3/4" x 10"	1
K24	Room 137	Infrastructure	HVAC, supply, ceiling diffuser	6" x 2"	2

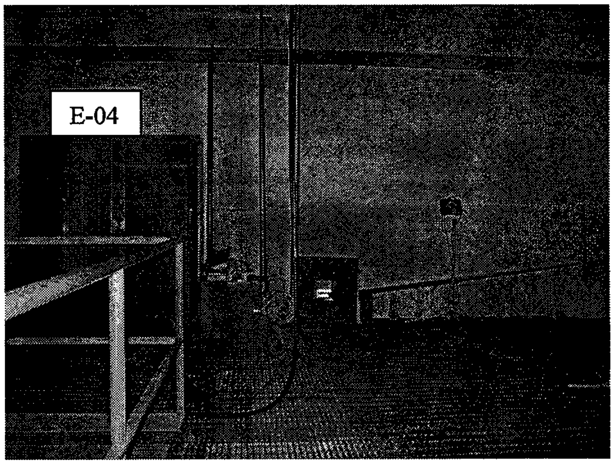
SURVEY RESULTS and CONCLUSIONS
for
CFA 686 (High Bay)





CFA 686 (High Bay)

No sample at this location exceeded 30% of the criterion level. The beryllium machining equipment has been removed and the space converted largely to storage.



CFA 686 (High Bay)

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
E01	Mezzanine, E wall	0.005
E02	Mezzanine, S wall	0.000
E03	Mezzanine, S wall	0.028
E04	Mezzanine, E wall	0.035
E05	Blank	NA
E06	Mezzanine, N wall	0.021
E07	Mezzanine, E wall	0.022
E08	Main floor, S wall	0.008
E09	Main floor, N wall	0.014
E10	Main floor, W wall	0.021
E11	Main floor, E end	0.024
E12	Main floor, S wall	0.006
E13	Main floor, S wall	0.019
E14	Main floor, W end	0.000
E15	Main floor, S wall	0.008
E16	Main floor, S wall	0.005
E17	Main floor, N wall	0.020
E18	Main floor, E end	0.018
E19	Main floor, middle	0.016
E20	Blank	NA
E21	Main floor, W end	0.019
E22	Main floor, W end	0.057
E23	Main floor, SW corner	0.006
E24	Main floor, NE corner	0.025

CFA 686 (High Bay)

FULL RESULTS TABLE

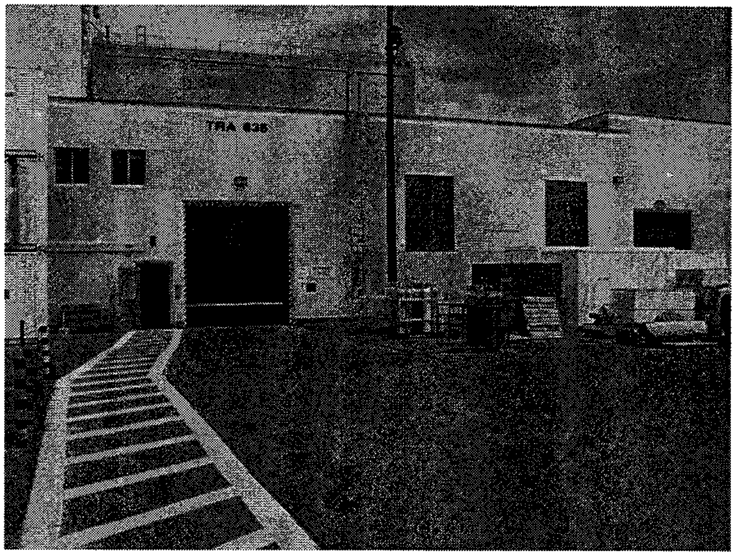
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
E01	0.005	17.00	9.80	3400	1960	0.58
E02	0.000	5.60	2.90			0.52
E03	0.028	100.00	25.00	3571	893	0.25
E04	0.035	130.00	43.00	3714	1229	0.33
Blank	0.000	**0.83**	0.00			0.00
E06	0.021	180.00	31.00	8571	1476	0.17
E07	0.022	930.00	29.00	42273	1318	0.03
E08	0.008	11.00	5.80	1375	725	0.53
E09	0.014	28.00	9.20	2000	657	0.33
E10	0.021	9.40	10.00	448	476	1.06
E11	0.024	39.00	25.00	1625	1042	0.64
E12	0.006	17.00	5.30	2833	883	0.31
E13	0.017	180.00	370.00	10588	21765	2.06
E14	0.000	0.90	20.00			22.22
E15	0.008	12.00	5.20	1500	650	0.43
E16	0.005	22.00	4.20	4400	840	0.19
E17	0.020	72.00	22.00	3600	1100	0.31
E18	0.020	41.00	15.00	2050	750	0.37
E19	0.016	68.00	19.00	4250	1188	0.28
Blank	0.000	**0.47**	0.00			0.00
E21	0.019	130.00	26.00	6842	1368	0.20
E22	0.057	310.00	52.00	5439	912	0.17
E23	0.006	16.00	4.90	2667	817	0.31
E24	0.031	140.00	40.00	4516	1290	0.29
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

CFA 686 (High Bay)

SAMPLE DETAIL TABLE

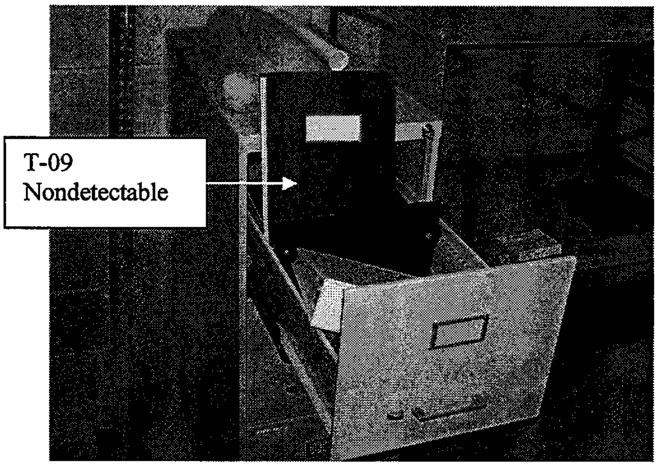
No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
E01	Mezzanine, E wall	Storage	shelf in S cabinet	100 sq cm	1
E02	Mezzanine, S wall	Storage	shelf in cabinet "outgoing"	100 sq cm	1
E03	Mezzanine, S wall	Miscellaneous	top of storage cabinet "incoming"	100 sq cm	2
E04	Mezzanine, E wall	Miscellaneous	top of N cabinet	100 sq cm	2
E05	Blank	NA	N/A	N/A	1
E06	Mezzanine, N wall	Infrastructure	electrical panel "AB"	100 sq cm	2
E07	Mezzanine, E wall	Process	tank PAED-59-M-7	100 sq cm	2
E08	Main floor, S wall	Floor	by main column	100 sq cm	1
E09	Main floor, N wall	Floor	by main column	100 sq cm	1
E10	Main floor, W wall	Floor	W side of roll up door	100 sq cm	1
E11	Main floor, E end	Floor	mezzanine support post base	3-1/2" x 4-1/2"	2
E12	Main floor, S wall	Floor	by electrical panel PL 2,4,6	100 sq cm	1
E13	Main floor, S wall	Infrastructure	electrical panel PL 1,3,5	3-1/2" x 4"	3
E14	Main floor, W end	Miscellaneous	on locker # 11 "Stringham"	100 sq cm	1
E15	Main floor, S wall	Floor	steel plate by transformer 83966	100 sq cm	1
E16	Main floor, S wall	Infrastructure	Transformer T-1	100 sq cm	1
E17	Main floor, N wall	Infrastructure	top of steam pipe	100 sq cm	1
E18	Main floor, E end	Infrastructure	stair tread support rail	2-1/2" x 7"	1
E19	Main floor, middle	Wall	top of partition wall	3-1/2" x 4-1/2"	2
E20	Blank	NA	N/A	N/A	1
E21	Main floor, W end	Wall	top of partition wall	3-1/2" x 4-1/2"	1
E22	Main floor, W end	Infrastructure	electrical panel "MDP"	100 sq cm	3
E23	Main floor, SW corner	Infrastructure	fire system riser	4" x 4"	1
E24	Main floor, NE corner	Infrastructure	light fixture	3-1/2" x 5-1/2"	2

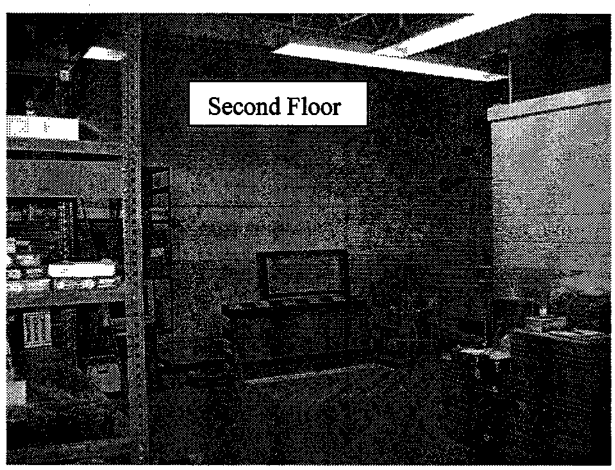
SURVEY RESULTS and CONCLUSIONS
for
TRA 635, Room 101



TRA 635, Room 101

The two samples with the highest values at this location were approximately 35% and 25% of the criterion level (T-22 and T-21, respectively). We consider the beryllium on these samples to be from naturally occurring soil.





TRA 635, Room 101

SUMMARY TABLE

No.	General Area	Be μg / 100 cm^2
T01	1st Floor, N end	0.000
T02	1st Floor, W wall	0.000
T03	1st Floor, E wall	0.000
T04	1st Floor, S wall	0.000
T05	2nd Floor, E side	0.000
T06	Blank	NA
T07	2nd Floor, N side	0.025
T08	1st Floor, E side	0.018
T09	2nd Floor, E wall	0.000
T10	2nd Floor, W wall	0.000
T11	2nd Floor, S wall	0.000
T12	1st Floor, E wall	0.017
T13	1st Floor NW end	0.024
T14	1st Floor, SW end	0.000
T15	1st Floor, SW end	0.025
T16	1st Floor, E wall	0.020
T17	Blank	NA
T18	2nd Floor, NW side	0.013
T19	2nd Floor, S side	0.000
T20	2nd Floor, NE side	0.041
T21	2nd Floor, area formerly walled	0.050
T22	2nd Floor, N side	0.071
T23	2nd Floor, NE end	0.044
T24	1st Floor, SE	0.000

TRA 635, Room 101

FULL RESULTS TABLE

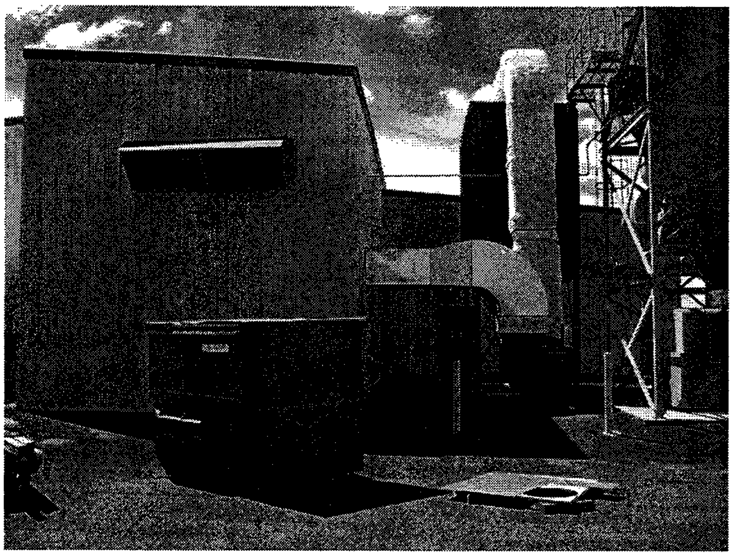
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
T01	0.000	4.40	3.10			0.70
T02	0.000	2.20	23.00			10.45
T03	0.000	0.93	2.40			2.58
T04	0.000	7.90	5.20			0.66
T05	0.000	6.00	4.20			0.70
Blank	0.000	0.00	0.00			
T07	0.025	6.50	11.00	260	440	1.69
T08	0.018	9.10	10.00	506	556	1.10
T09	0.000	0.40	0.97			2.43
T10	0.000	0.85	1.30			1.53
T11	0.000	0.32	0.48			1.50
T12	0.018	7.20	10.00	400	556	1.39
T13	0.024	13.00	14.00	542	583	1.08
T14	0.000	6.90	4.50			0.65
T15	0.025	8.60	11.00	344	440	1.28
T16	0.020	10.00	11.00	500	550	1.10
Blank	0.000	0.00	0.00			
T18	0.013	7.50	4.40	577	338	0.59
T19	0.000	2.30	45.00			19.57
T20	0.042	4.30	15.00	102	357	3.49
T21	0.052	24.00	20.00	462	385	0.83
T22	0.080	21.00	12.00	263	150	0.57
T23	0.045	4.00	3.70	89	82	0.93
T24	0.000	0.22	0.65			2.95
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

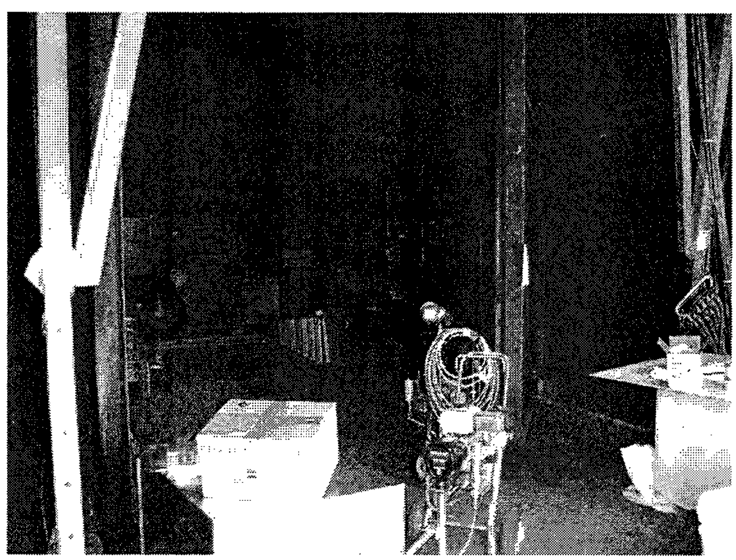
TRA 635, Room 101

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
T01	1st Floor, N end	Floor	by Lab 101 door	100 sq cm	1
T02	1st Floor, W wall	Floor	near double roller doors	100 sq cm	1
T03	1st Floor, E wall	Floor	near door to outside	100 sq cm	1
T04	1st Floor, S wall	Floor	near water heater	100 sq cm	1
T05	2nd Floor, E side	Floor	inside area where walls are now gone	100 sq cm	1
T06	Blank	NA	N/A	N/A	1
T07	2nd Floor, N side	Floor	inside small room w/block walls	100 sq cm	1
T08	1st Floor, E side	Storage	storage box, "Pb"	100 sq cm	1
T09	2nd Floor, E wall	Storage	work book cover inside filing cabinet	100 sq cm	1
T10	2nd Floor, W wall	Storage	storage rack, bottom shelf	100 sq cm	1
T11	2nd Floor, S wall	Storage	storage rack, shelf 3	100 sq cm	1
T12	1st Floor, E wall	Storage	storage rack	3" x 5.5"	1
T13	1st Floor NW end	Infrastructure	top of electrical panel H-635	100 sq cm	2
T14	1st Floor, SW end	Infrastructure	fire alarm box 38	100 sq cm	1
T15	1st Floor, SW end	Miscellaneous	top of film storage safe	100 sq cm	1
T16	1st Floor, E wall	Miscellaneous	S-most service counter	100 sq cm	1
T17	Blank	NA	N/A	N/A	1
T18	2nd Floor, NW side	Miscellaneous	stationary edge of crane pass door in floor	1" x 16"	1
T19	2nd Floor, S side	Miscellaneous	top of entrance door	1-3/4" x 10"	1
T20	2nd Floor, NE side	Infrastructure	electrical panel I-4	4" x 4"	2
T21	2nd Floor, area formerly walled	Infrastructure	light fixture	4" x 4"	1
T22	2nd Floor, N side	Miscellaneous	top of door to walled room	1-3/4" x 10"	1
T23	2nd Floor, NE end	Infrastructure	light fixture	4" x 4"	1
T24	1st Floor, SE	Storage	storage cabinet #2 near X-ray room	100 sq cm	1

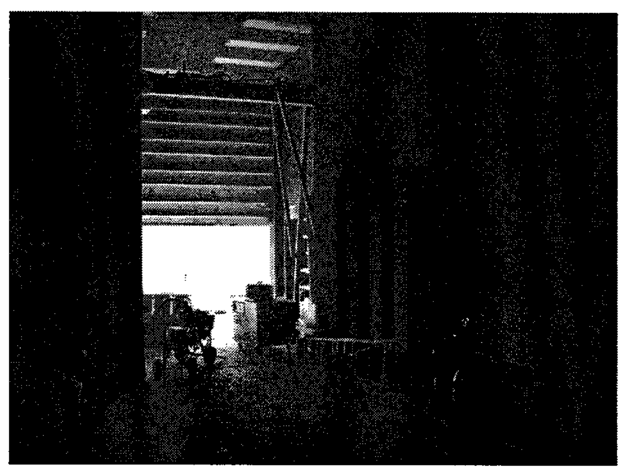
SURVEY RESULTS and CONCLUSIONS
for
CFA 623, GRITB





CFA 623, GRITB

The room and equipment is designed for abrasive grit blasting and can accommodate large parts. However, parts containing beryllium or its alloys are no longer processed here. The highest sample result at this location was 43% of the criterion level (B-13) and occurred on the exterior side of a blast room wall.



CFA 623, GRITB

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
B01	Blast room, interior, N wall	0.000
B02	Blank	NA
B03	Blast room, interior	0.019
B04	Blast room, interior, W wall	0.000
B05	Blast room, interior, S wall	0.000
B06	Blast room, interior, blast door	0.000
B07	Blast room, interior, S wall	0.000
B08	Ante room, interior, S wall	0.000
B09	Ante room, interior, N side	0.020
B10	Ante room, interior, S wall	0.008
B11	Ante room, interior, N wall	0.000
B12	Ante room, interior, N wall	0.015
B13	Ante room, exterior, S wall	0.086
B14	Ante room, exterior, N wall	0.025
B15	Blast room, exterior, S wall	0.037
B16	Blast room, exterior, W wall	0.014
B17	Blast room, exterior, N wall	0.012
B18	Room 100	0.000
B19	Room 100, S wall	0.018
B20	Room 100	0.017
B21	Room 100, N wall	0.004
B22	Room 100, W wall	0.000
B23	Room 100, E wall	0.033
B24	Blank	NA

CFA 623, GRITB

FULL RESULTS TABLE

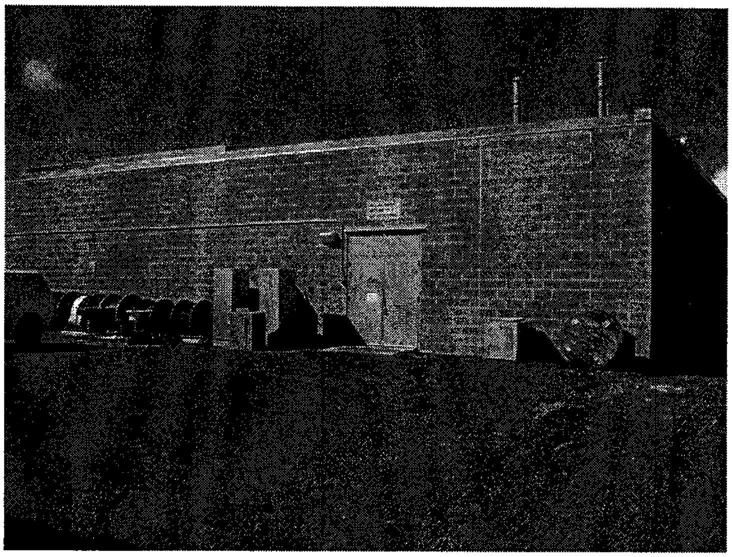
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
B01	0.000	1.70	7.40			4.35
Blank	0.000	0.00	0.00			
B03	0.019	18.00	150.00	947	7895	8.33
B04	0.000	1.00	2.80			2.80
B05	0.000	1.60	6.30			3.94
B06	0.000	0.96	3.50			3.65
B07	0.000	9.00	21.00			2.33
B08	0.000	45.00	240.00			5.33
B09	0.023	15.00	65.00	652	2826	4.33
B10	0.009	12.00	51.00	1333	5667	4.25
B11	0.000	1.30	8.30			6.38
B12	0.015	19.00	57.00	1267	3800	3.00
B13	0.097	210.00	160.00	2165	1649	0.76
B14	0.028	53.00	59.00	1893	2107	1.11
B15	0.038	35.00	74.00	921	1947	2.11
B16	0.014	24.00	36.00	1714	2571	1.50
B17	0.012	33.00	25.00	2750	2083	0.76
B18	0.000	3.90	6.10			1.56
B19	0.019	28.00	68.00	1474	3579	2.43
B20	0.016	62.00	64.00	3875	4000	1.03
B21	0.004	16.00	39.00	4000	9750	2.44
B22	0.000	45.00	17.00			0.38
B23	0.038	87.00	82.00	2289	2158	0.94
Blank	0.000	0.00	0.00			
LOQ	0.010	0.200	0.200			
LOD	0.004	0.070	0.050			

CFA 623, GRITB

SAMPLE DETAIL TABLE

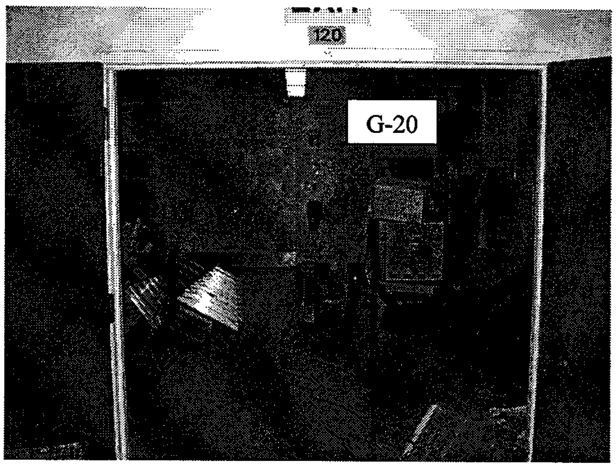
No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
B01	Blast room, int., N wall	Wall	adjacent to Room 100 door, 5' AFL	100 sq cm	1
B02	Blank	NA	N/A	N/A	1
B03	Blast room, int.	Process	glove box	100 sq cm	2
B04	Blast room, int., W wall	Wall	near bughouse intake, 9' AFL	100 sq cm	1
B05	Blast room, int., S wall	Wall	6' AFL	100 sq cm	1
B06	Blast room, int., blast door	Wall	N blast door, 1' AFL	100 sq cm	1
B07	Blast room, int., S wall	Floor	hoist guide rail	1" x 16"	1
B08	Ante room, int., S wall	Process	hoist base	2" x 8"	1
B09	Ante room, int., N side	Miscellaneous	N blast door, bottom ledge	5" x 3-1/2"	2
B10	Ante room, int., S wall	Miscellaneous	bottom strip of man door	1-1/2" x 11"	1
B11	Ante room, int., N wall	Wall	5' AFL	100 sq cm	1
B12	Ante room, int., N wall	Infrastructure	1-1/4" air line, top half	2"x 8"	1
B13	Ante room, ext., S wall	Infrastructure	horizontal ledge 6' AFL	2-1/2" x 7"	3
B14	Ante room, ext., N wall	Infrastructure	horizontal ledge 6' AFL	2-1/2" x 7"	2
B15	Blast room, ext., S wall	Infrastructure	paint room light box	4" x 4"	2
B16	Blast room, ext., W wall	Floor	mid wall	100 sq cm	1
B17	Blast room, ext., N wall	Wall	vapor barrier of external wall, 5' AFL	100 sq cm	1
B18	Room 100	Storage	shelf inside storage cabinet	100 sq cm	1
B19	Room 100, S wall	Miscellaneous	top of man door	1-1/2" x 11"	1
B20	Room 100	Infrastructure	Low V control box	5" x 3"	2
B21	Room 100, N wall	Wall	vapor barrier of external wall, 6' AFL	100 sq cm	1
B22	Room 100, W wall	Infrastructure	AC vertical surface	100 sq cm	1
B23	Room 100, E wall	Infrastructure	electrical panel LP1	3" x 6"	2
B24	Blank	NA	N/A	N/A	1

SURVEY RESULTS and CONCLUSIONS
for
CFA 688; Rooms 132, 116, 112, 120



CFA 688; Rooms 132, 116, 112, 120

Previously used as a machine shop, the location is now used largely for storage or is otherwise unoccupied. The two samples with the highest values at this location were approximately 40% and 30% of the criterion level (G-12 and G-20, respectively). We consider the beryllium on these samples to be from naturally occurring soil.



CFA 688; Rooms 132, 116, 112, 120

SUMMARY TABLE

No.	General Area	Be $\mu g / 100\ cm^2$
G01	Room 112, N wall	0.004
G02	Room 112, N wall	0.000
G03	Room 132, NW corner	0.000
G04	Room 132, W wall	0.000
G05	Room 132, W wall	0.000
G06	Room 132, S wall	0.000
G07	Blank	NA
G08	Room 116, E wall	0.009
G09	Room 116, E wall	0.000
G10	Room 120, N wall	0.000
G11	Room 120, W wall	0.000
G12	Room 120, S wall	0.082
G13	Room 120, SE corner	0.000
G14	Room 112, S wall	0.000
G15	Room 116, E wall	0.020
G16	Room 112, N wall	0.006
G17	Room 116, W wall	0.030
G18	Blank	NA
G19	Room 120, E wall	0.000
G20	Room 120, NW corner	0.056
G21	Room 120, W wall	0.017
G22	Room 120, E wall	0.000
G23	Room 116, E wall	0.000
G24	Room 112, NW corner	0.000

CFA 688; Rooms 132, 116, 112, 120

FULL RESULTS TABLE

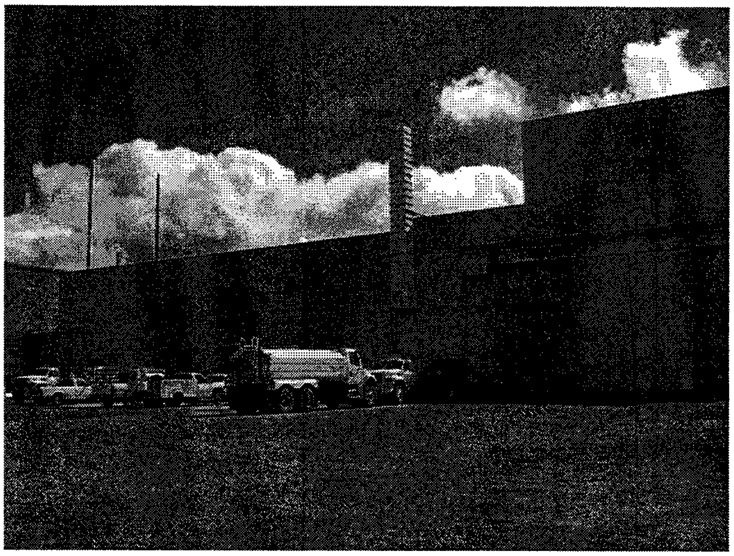
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
G01	0.005	49.00	5.60	9800	1120	0.11
G02	0.000	430.00	1.40			0.00
G03	0.000	1.50	0.36			0.24
G04	0.000	0.20	0.20			1.00
G05	0.000	9.00	1.40			0.16
G06	0.000	0.84	1.20			1.43
Blank	0.000	**1.40**	0.00			0.00
G08	0.008	80.00	10.00	10000	1250	0.13
G09	0.000	23.00	0.90			0.04
G10	0.000	29.00	6.90			0.24
G11	0.000	11.00	6.10			0.55
G12	0.087	500.00	69.00	5747	793	0.14
G13	0.000	2.00	1.50			0.75
G14	0.000	2.90	1.60			0.55
G15	0.020	12.00	13.00	600	650	1.08
G16	0.006	63.00	10.00	10500	1667	0.16
G17	0.031	330.00	20.00	10645	645	0.06
Blank	0.000	**0.92**	0.00			0.00
G19	0.000	8.50	2.90			0.34
G20	0.056	330.00	110.00	5893	1964	0.33
G21	0.018	85.00	32.00	4722	1778	0.38
G22	0.000	180.00	12.00			0.07
G23	0.000	33.00	0.57			0.02
G24	0.000	7.10	3.70			0.52
LOQ	0.010	0.200	0.200			
LOD	0.004	0.070	0.050			

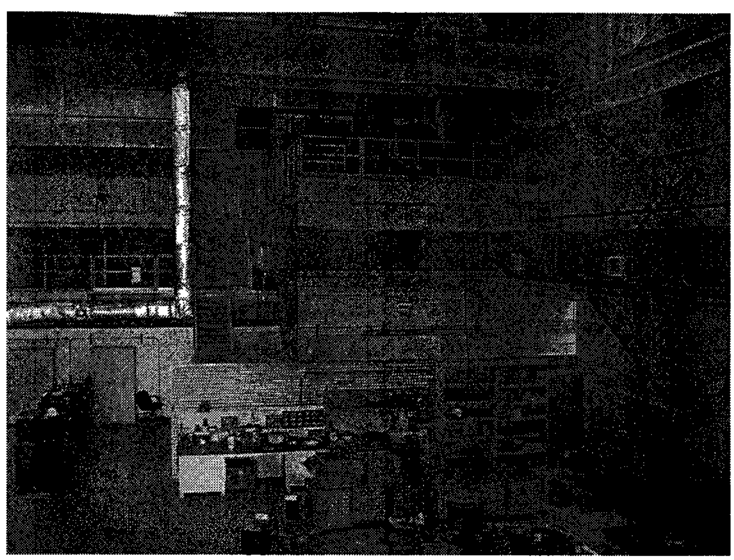
CFA 688; Rooms 132, 116, 112, 120

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
G01	Room 112, N wall	Infrastructure	electrical panel R-3	3" x 6"	2
G02	Room 112, N wall	Storage	shelf, green wooden cabinets	100 sq cm	1
G03	Room 132, NW corner	Storage	shelf, gray cabinet	100 sq cm	1
G04	Room 132, W wall	Storage	lab bench top counter	100 sq cm	1
G05	Room 132, W wall	Storage	lab bench 2nd counter	100 sq cm	1
G06	Room 132, S wall	Miscellaneous	top of gray storage cabinet	100 sq cm	1
G07	Blank	NA	N/A	N/A	1
G08	Room 116, E wall	Infrastructure	drain pipe fitting	3/4" x 18"	2
G09	Room 116, E wall	Floor	unpainted patch	100 sq cm	1
G10	Room 120, N wall	Storage	inside face shield storage box	100 sq cm	2
G11	Room 120, W wall	Storage	work bench 2nd counter	100 sq cm	1
G12	Room 120, S wall	Infrastructure	electrical outlet conduit run	1-1/2" x 11"	3
G13	Room 120, SE corner	Miscellaneous	top of "Plan Hold" cabinet	100 sq cm	1
G14	Room 112, S wall	Miscellaneous	top of door	1-3/4" x 10"	1
G15	Room 116, E wall	Infrastructure	top of transformer box	100 sq cm	1
G16	Room 112, N wall	Infrastructure	ledge 6" AFL	1" x 16"	2
G17	Room 116, W wall	Infrastructure	panel R-3	4" x 4"	2
G18	Blank	NA	N/A	N/A	1
G19	Room 120, E wall	Storage	work bench storage ledge	100 sq cm	1
G20	Room 120, NW corner	Infrastructure	ADT panel	100 sq cm	3
G21	Room 120, W wall	Infrastructure	conduit run above door, 120 side	1" x 16"	3
G22	Room 120, E wall	Miscellaneous	top of door	1-3/4" x 10"	1
G23	Room 116, E wall	Infrastructure	panel H-1	8" x 2"	1
G24	Room 112, NW corner	Storage	shelf of wooden storage cabinet	100 sq cm	1

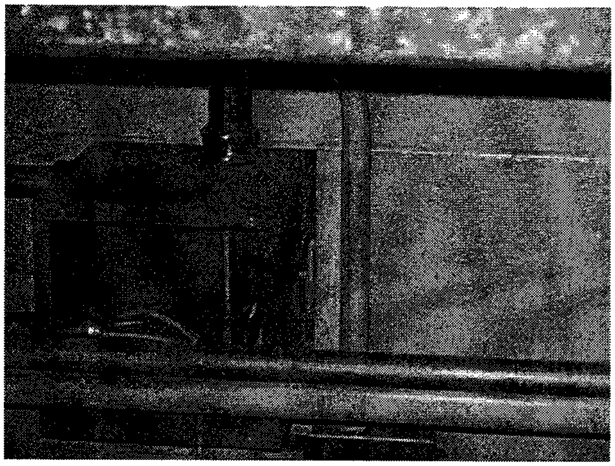
SURVEY RESULTS and CONCLUSIONS
for
TAN 607, Room 149 (High Bay)

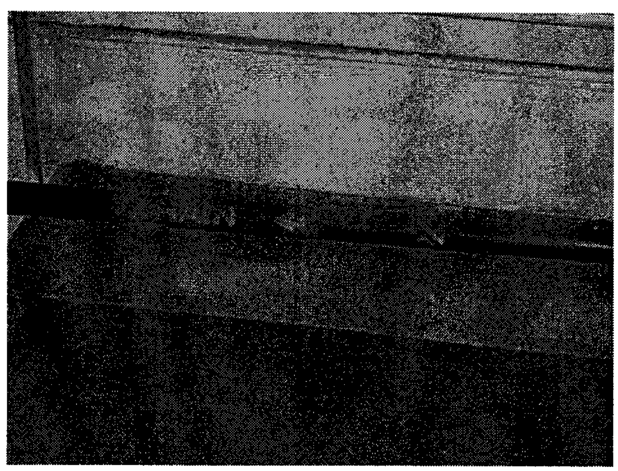




TAN 607, Room 149 (High Bay)

The highest result at this location was only approximately 20% of the criterion level and all others were negligible.





TAN 607, Room 149 (High Bay)

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
R01	E wall, low Mezzanine	0.000
R02	E wall, low Mezzanine	0.014
R03	E wall, low Mezzanine	0.016
R04	Blank	NA
R05	N wall, low Mezzanine	0.005
R06	N wall, low Mezzanine	0.008
R07	N wall, low Mezzanine	0.015
R08	N wall	0.024
R09	W end	0.000
R10	W end	0.012
R11	S wall	0.013
R12	N wall	0.005
R13	E end	0.013
R14	149B	0.010
R15	149B	0.000
R16	Blank	NA
R17	W wall	0.011
R18	S wall	0.010
R19	149B mezzanine	0.000
R20	N wall	0.043
R21	S wall	0.000
R22	E end	0.004
R23	E end	0.007
R24	W wall	0.000

TAN 607, Room 149 (High Bay)

FULL RESULTS TABLE

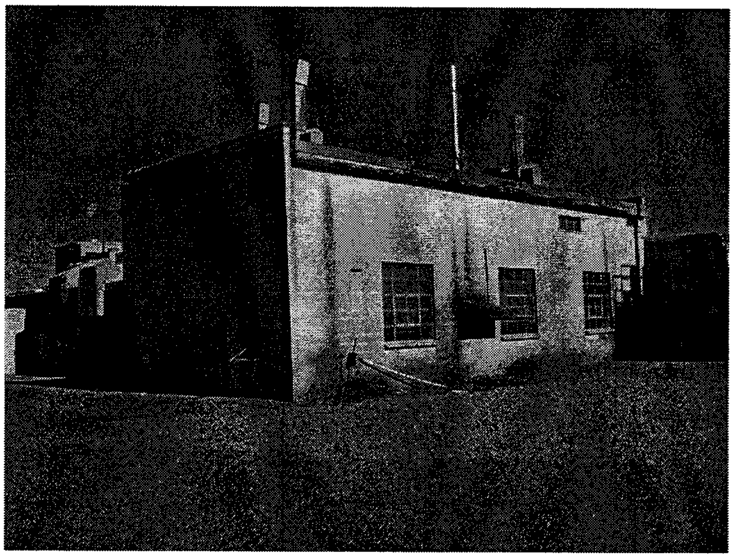
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
R01	0.000	1.10	0.77			0.70
R02	0.014	34.00	14.00	2429	1000	0.41
R03	0.016	41.00	14.00	2563	875	0.34
Blank	0.000	0.06	0.00			0.00
R05	0.005	12.00	12.00	2400	2400	1.00
R06	0.008	75.00	17.00	9375	2125	0.23
R07	0.016	89.00	21.00	5563	1313	0.24
R08	0.024	180.00	35.00	7500	1458	0.19
R09	0.000	10.00	3.70			0.37
R10	0.012	26.00	12.00	2167	1000	0.46
R11	0.013	69.00	17.00	5308	1308	0.25
R12	0.005	40.00	7.20	8000	1440	0.18
R13	0.013	16.00	8.00	1231	615	0.50
R14	0.010	14.00	7.50	1400	750	0.54
R15	0.000	16.00	4.30			0.27
Blank	0.000	0.00	0.00			
R17	0.011	10.00	6.60	909	600	0.66
R18	0.019	110.00	32.00	5789	1684	0.29
R19	0.000	2.30	1.40			0.61
R20	0.011	210.00	39.00	19091	3545	0.19
R21	0.000	2.20	1.20			0.55
R22	0.004	410.00	38.00	102500	9500	0.09
R23	0.008	31.00	6.60	3875	825	0.21
R24	0.000	560.00	5.40			0.01
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

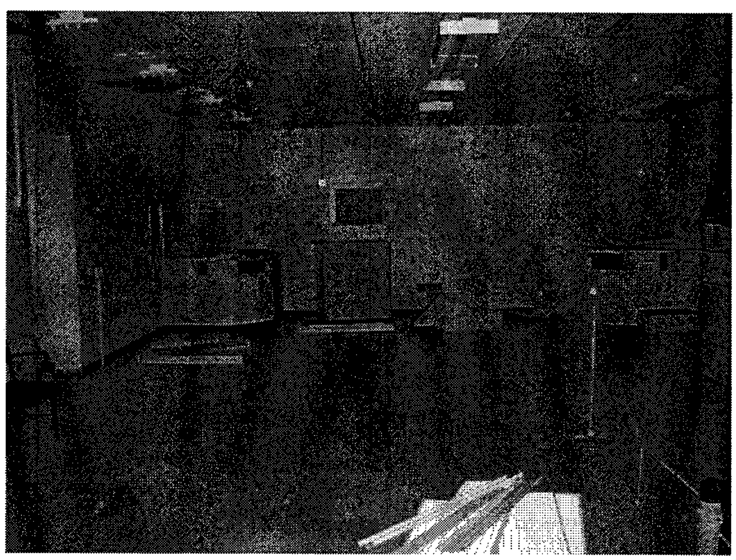
TAN 607, Room 149 (High Bay)

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
R01	E wall, low Mezzanine	Floor	under HVAC duct	100 sq cm	1
R02	E wall, low Mezzanine	Infrastructure	HVAC duct, exterior	100 sq cm	2
R03	E wall, low Mezzanine	Infrastructure	electrical box under HVAC duct	100 sq cm	2
R04	Blank	NA	N/A	N/A	1
R05	N wall, low Mezzanine	Floor	under HVAC duct	100 sq cm	1
R06	N wall, low Mezzanine	Infrastructure	HVAC, supply, ceiling diffuser	1-1/2" x 11"	4
R07	N wall, low Mezzanine	Infrastructure	drain pipe	3" x 5-1/2"	2
R08	N wall	Miscellaneous	top of "Heavy Item" storage locker	100 sq cm	3
R09	W end	Miscellaneous	top of upper Dutch door	1-3/4" x 10"	1
R10	W end	Infrastructure	light fixture	4" x 4"	2
R11	S wall	Infrastructure	crane rail "X" brace	3-3/4" x 4"	3
R12	N wall	Infrastructure	fire hose bracket inside storage box	4" x 4"	1
R13	E end	Miscellaneous	top ledge of gray work bench	100 sq cm	2
R14	149B	Infrastructure	light fixture	4" x 4"	1
R15	149B	Infrastructure	fire protection riser	2" x 8"	1
R16	Blank	NA	N/A	N/A	1
R17	W wall	Infrastructure	conduit stand-off	1-3/4" x 9"	1
R18	S wall	Infrastructure	conduit under HVAC duct	2-1/2" x 12"	2
R19	149B mezzanine	Storage	shelf of storage rack	100 sq cm	1
R20	N wall	Infrastructure	power panel "PA"	2" x 2"	2
R21	S wall	Floor	near low wall	100 sq cm	1
R22	E end	Infrastructure	alarm horn	3-1/2" x 5"	3
R23	E end	Miscellaneous	top of door	1-3/4" x 10"	1
R24	W wall	Storage	inside spare sprinkler box	3" x 5-1/2"	1

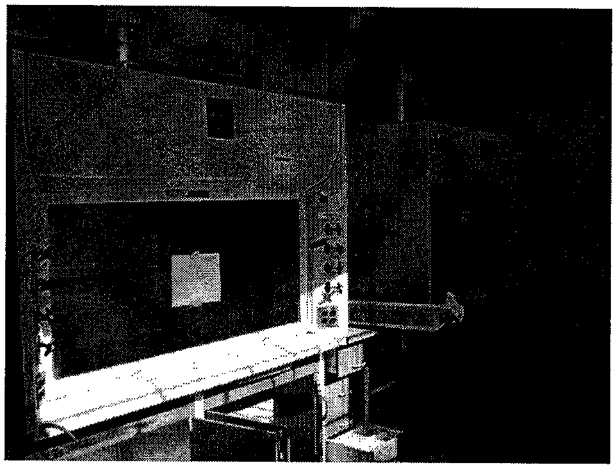
SURVEY RESULTS and CONCLUSIONS
for
CFA 633

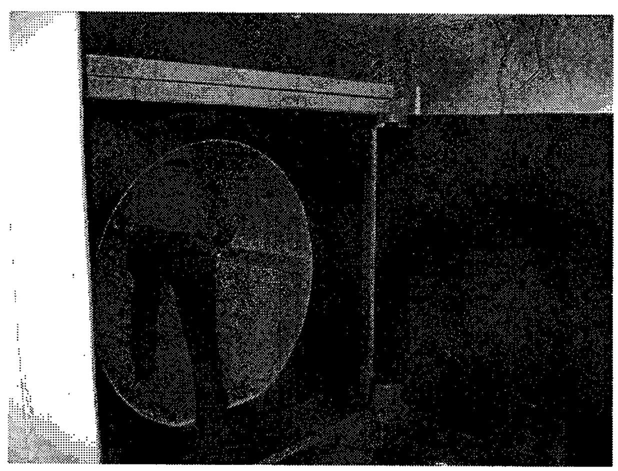




CFA 633, Rooms 132-136, 106, 113, 124A, 126A, 125

The building is now totally abandoned. The highest result at this location was only approximately 30% of the criterion level and all others were negligible.





CFA 633, Rooms 132-136, 106, 113, 124A, 126A, 125

SUMMARY TABLE

No.	General Area	Be $\mu g / 100\ cm^2$
D01	Room 135, N wall	0.008
D02	Room 135, W wall	0.006
D03	Room 135, W wall	0.010
D04	Blank	NA
D05	Room 135, E wall, N end	0.010
D06	Room 135, S wall	0.015
D07	Room 135, E wall	0.008
D08	Room 135, W wall	0.008
D09	Room 135, W wall	0.065
D10	Room 135, W wall	0.000
D11	Room 135, E wall, S end	0.005
D12	Room 136, W wall	0.011
D13	Room 132, N wall	0.004
D14	Room 132, W wall	0.013
D15	Room 133, E wall	0.000
D16	Room 134, E wall	0.008
D17	Room 134, W wall	0.000
D18	Room 106, E wall	0.006
D19	Room 106, N wall	0.000
D20	Room 113, E wall	0.005
D21	Room 124A	0.000
D22	Blank	NA
D23	Room 126A, E wall	0.000
D24	Room 125, S wall	0.004

CFA 633, Rooms 132-136, 106, 113, 124A, 126A, 125

FULL RESULTS TABLE

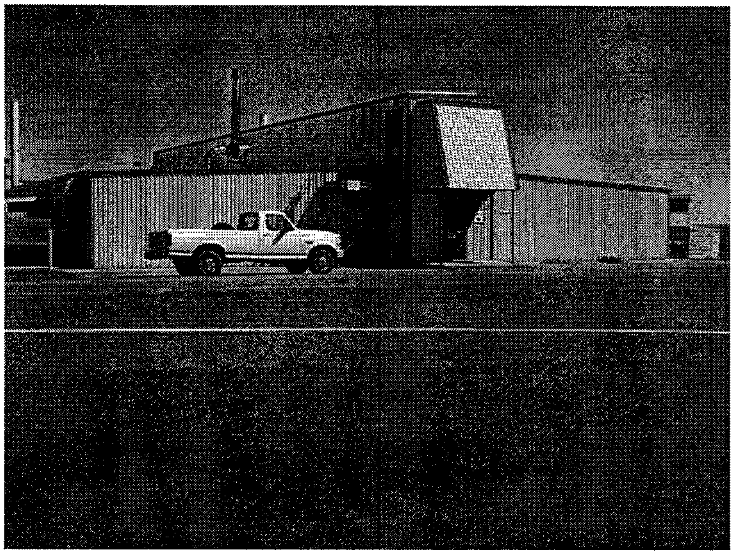
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
D01	0.008	26.00	9.70	3250	1213	0.37
D02	0.006	32.00	6.50	5333	1083	0.20
D03	0.008	82.00	9.10	10250	1138	0.11
Blank	0.000	0.00	0.00			
D05	0.010	2.40	10.00	240	1000	4.17
D06	0.015	12.00	21.00	800	1400	1.75
D07	0.008	1.60	15.00	200	1875	9.38
D08	0.008	6.60	6.60	825	825	1.00
D09	0.067	41.00	65.00	612	970	1.59
D10	0.000	1.90	4.90			2.58
D11	0.005	23.00	8.20	4600	1640	0.36
D12	0.011	3.10	9.50	282	864	3.06
D13	0.004	3.30	5.40	825	1350	1.64
D14	0.013	8.40	10.00	646	769	1.19
D15	0.000	1.60	2.70			1.69
D16	0.008	7.40	7.90	925	988	1.07
D17	0.000	2.20	3.70			1.68
D18	0.006	3.70	6.40	617	1067	1.73
D19	0.000	3.20	3.80			1.19
D20	0.005	0.96	8.20	192	1640	8.54
D21	0.000	0.31	0.20			0.65
Blank	0.000	0.00	0.00			
D23	0.000	0.88	4.50			5.11
D24	0.004	3.60	6.70	900	1675	1.86
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

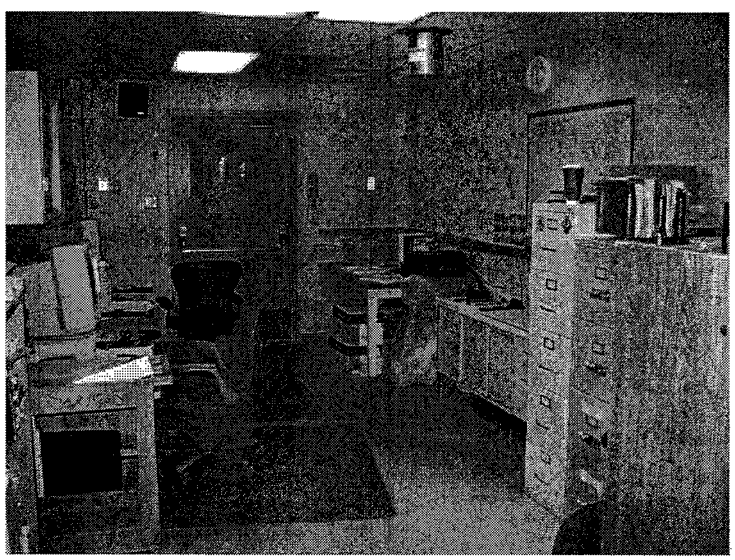
CFA 633, Rooms 132-136, 106, 113, 124A, 126A, 125

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
D01	Room 135, N wall	Floor	W side of room	100 sq cm	1
D02	Room 135, W wall	Storage	shelf under perchloric acid lab hood	100 sq cm	1
D03	Room 135, W wall	Infrastructure	conduit run	1'" x 13"	1
D04	Blank	NA	N/A	N/A	1
D05	Room 135, E wall, N end	Storage	lab bench counter top	100 sq cm	1
D06	Room 135, S wall	Floor	W side of room	100 sq cm	1
D07	Room 135, E wall	Miscellaneous	window sill	100 sq cm	1
D08	Room 135, W wall	Storage	inside drawer between the 2 lab hoods	100 sq cm	1
D09	Room 135, W wall	Process	top of lab hood ventilation exhaust duct	4" x 4"	2
D10	Room 135, W wall	Process	bottom ledge of lab hood face "HF 200150"	100 sq cm	1
D11	Room 135, E wall, S end	Storage	lab bench counter top	100 sq cm	1
D12	Room 136, W wall	Storage	lab bench counter top	100 sq cm	1
D13	Room 132, N wall	Storage	storage rack shelf	100 sq cm	1
D14	Room 132, W wall	Infrastructure	fire alarm panel box	100 sq cm	1
D15	Room 133, E wall	Storage	shelf of wall mounted cabinet	100 sq cm	2
D16	Room 134, E wall	Process	bottom ledge of lab hood face	100 sq cm	1
D17	Room 134, W wall	Storage	lab bench counter top	100 sq cm	1
D18	Room 106, E wall	Process	AC / water chiller unit	3" x 5-1/2"	1
D19	Room 106, N wall	Floor	mid wall	100 sq cm	1
D20	Room 113, E wall	Storage	built-in shelving	100 sq cm	1
D21	Room 124A	Process	inside vault on shelf	100 sq cm	1
D22	Blank	NA	N/A	N/A	1
D23	Room 126A, E wall	Process	top of well (N)	100 sq cm	1
D24	Room 125, S wall	Infrastructure	inside local exhaust ventilation duct	100 sq cm	1

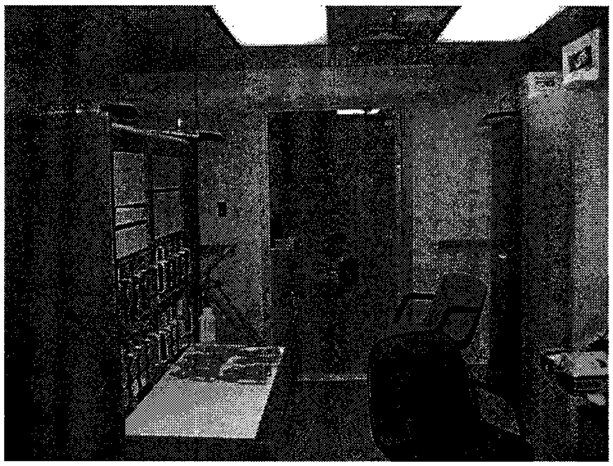
SURVEY RESULTS and CONCLUSIONS
for
CFA 625; Rooms 150, 170





CFA 625; Rooms 150, 170

The highest result at this location was only approximately 25% of the criterion level and all others were negligible.



CFA 625; Rooms 150, 170

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
C01	Room 150, E wall	0.013
C02	Room 150, E wall	0.004
C03	Blank	NA
C04	Room 150, N wall	0.000
C05	Room 150, E wall	0.000
C06	Room 150, N wall	0.000
C07	Room 150, N wall	0.000
C08	Room 150, N wall	0.000
C09	Room 150, W wall	0.029
C10	Room 150, W wall	0.000
C11	Room 150, S wall	0.000
C12	Room 150, S wall	0.000
C13	Room 170, W wall	0.000
C14	Room 170, N wall	0.000
C15	Room 170, N wall	0.009
C16	Room 170, E wall	0.000
C17	Room 170, E wall	0.009
C18	Room 170, N wall	0.032
C19	Room 170, S wall	0.000
C20	Room 150, W wall	0.053
C21	Room 170, W wall	0.007
C22	Room 170, S wall	0.000
C23	Blank	NA
C24	Room 150, E wall	0.000

CFA 625; Rooms 150, 170

FULL RESULTS TABLE

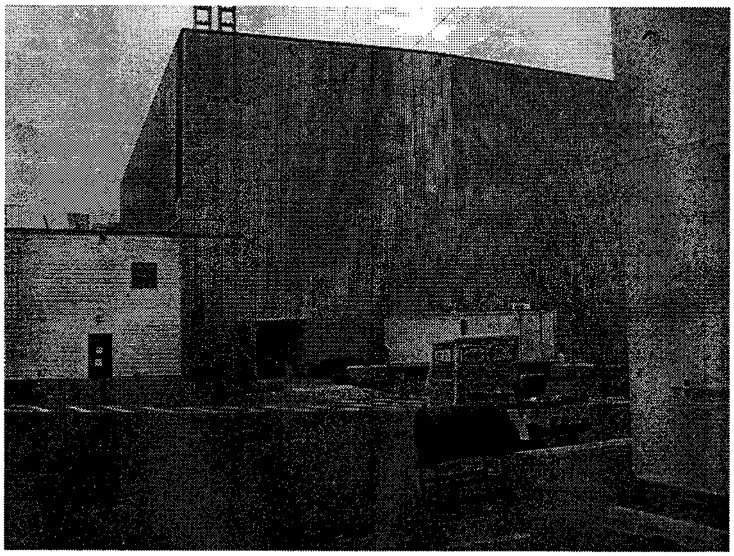
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
C01	0.013	9.90	47.00	762	3615	4.75
C02	0.004	6.30	2.90	1575	725	0.46
Blank	0.000	**0.28**	0.00			0.00
C04	0.000	0.59	0.60			1.02
C05	0.000	5.90	2.00			0.34
C06	0.000	0.08	0.00			0.00
C07	0.000	1.90	1.70			0.89
C08	0.000	2.70	1.40			0.52
C09	0.030	25.00	13.00	833	433	0.52
C10	0.000	0.49	0.64			1.31
C11	0.000	1.50	0.64			0.43
C12	0.000	2.90	2.00			0.69
C13	0.000	1.80	2.40			1.33
C14	0.000	2.10	1.20			0.57
C15	0.009	5.70	5.60	633	622	0.98
C16	0.000	1.50	1.40			0.93
C17	0.009	5.50	20.00	611	2222	3.64
C18	0.025	25.00	14.00	1000	560	0.56
C19	0.000	2.90	2.00			0.69
C20	0.053	29.00	24.00	547	453	0.83
C21	0.007	3.80	4.50	543	643	1.18
C22	0.000	1.30	1.00			0.77
Blank	0.000	0.00	0.00			
C24	0.000	4.50	3.20			0.71
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

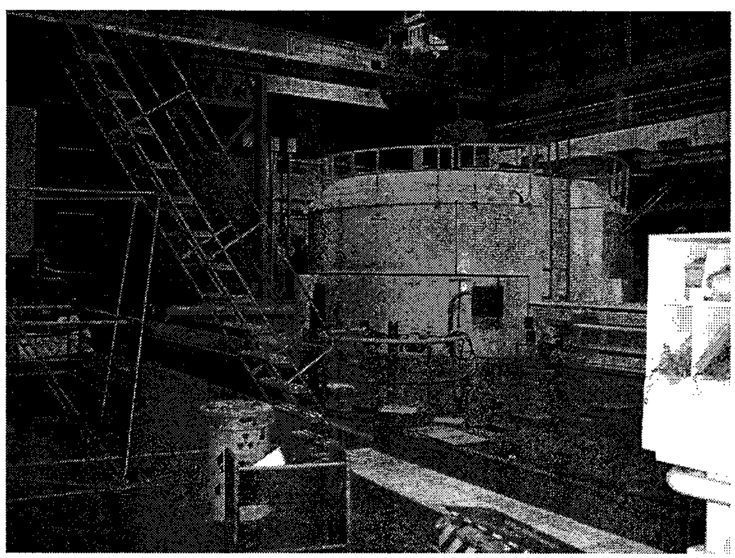
CFA 625; Rooms 150, 170

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
C01	Room 150, E wall	Miscellaneous	door to hallway, top of casing	1/2" x 32"	1
C02	Room 150, E wall	Infrastructure	electrical outlet conduit run	1-1/2" x 10"	1
C03	Blank	NA	N/A	N/A	1
C04	Room 150, N wall	Floor	under bookcase	100 sq cm	1
C05	Room 150, E wall	Infrastructure	thermostat control box	2-1/4" x 3"	1
C06	Room 150, N wall	Storage	shelf in cabinet 4	100 sq cm	1
C07	Room 150, N wall	Infrastructure	electrical outlet conduit run	1-1/2" x 10"	1
C08	Room 150, N wall	Miscellaneous	top of storage cabinet 3	100 sq cm	1
C09	Room 150, W wall	Miscellaneous	door to Room 155, top of casing	1/2" x 32"	1
C10	Room 150, W wall	Wall	7-1/2 ft AFL	100 sq cm	1
C11	Room 150, S wall	Infrastructure	electrical outlet conduit run	1-1/2" x 10"	1
C12	Room 150, S wall	Miscellaneous	top of file cabinet	100 sq cm	1
C13	Room 170, W wall	Miscellaneous	door to Room 175, top of casing	1/2" x 32"	1
C14	Room 170, N wall	Infrastructure	electrical outlet conduit run	1-1/2" x 10"	1
C15	Room 170, N wall	Miscellaneous	top of wall mounted bookcase	100 sq cm	1
C16	Room 170, E wall	Infrastructure	thermostat control box	2-1/4" x 3"	1
C17	Room 170, E wall	Miscellaneous	door to hallway, top of casing	1/2" x 32"	1
C18	Room 170, N wall	Infrastructure	nitrogen line standoff	1-1/2" x 8"	2
C19	Room 170, S wall	Infrastructure	electrical outlet conduit run	1-1/2" x 10"	1
C20	Room 150, W wall	Infrastructure	top of speaker box	100 sq cm	3
C21	Room 170, W wall	Miscellaneous	top of door to Room 175	1-3/4" x 9"	1
C22	Room 170, S wall	Infrastructure	electrical outlet conduit run	1-1/2" x 10"	1
C23	Blank	NA	N/A	N/A	1
C24	Room 150, E wall	Miscellaneous	top of door to hallway	1-3/4" x 9"	1

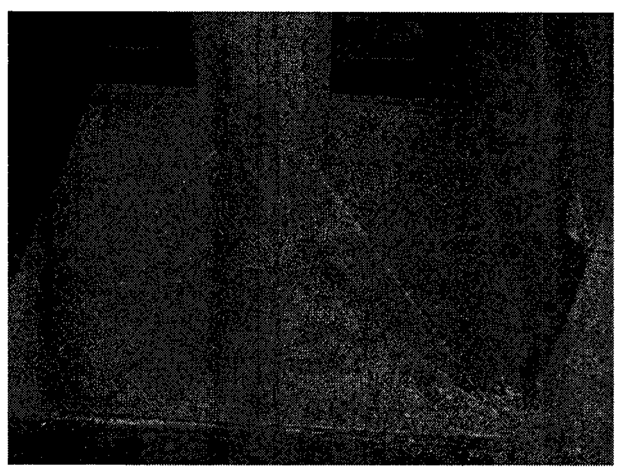
SURVEY RESULTS and CONCLUSIONS
for
TRA 642, ETR reactor building





TRA 642, ETR reactor building

The highest result at this location was only approximately 25% of the criterion level and all others were negligible.



TRA 642, ETR reactor building

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
U01	Main floor, SW end	0.000
U02	Main floor, SW end	0.012
U03	Main floor, N wall	0.000
U04	Main floor, E wall	0.023
U05	1st Basement, NW quadrant	0.050
U06	1st Basement, E wall	0.000
U07	Blank	NA
U08	1st Basement, mezzanine	0.016
U09	2nd Basement-S, E end	0.000
U10	2nd Basement-S, E end	0.000
U11	2nd Basement-N, W end	0.000
U12	2nd Basement-N, E end	0.000
U13	2nd Basement-N, NW corner	0.000
U14	2nd Basement-N, NW corner	0.000
U15	2nd Basement-N, NE end	0.000
U16	1st Basement, S wall	0.000
U17	1st Basement, S side	0.000
U18	1st Basement, SW end	0.000
U19	Blank	NA
U20	1st Basement, NE end	0.000
U21	Main floor, SE corner	0.000
U22	Main floor, E wall	0.012
U23	Main floor, N wall	0.022
U24	Main floor, N side	0.000

TRA 642, ETR reactor building

FULL RESULTS TABLE

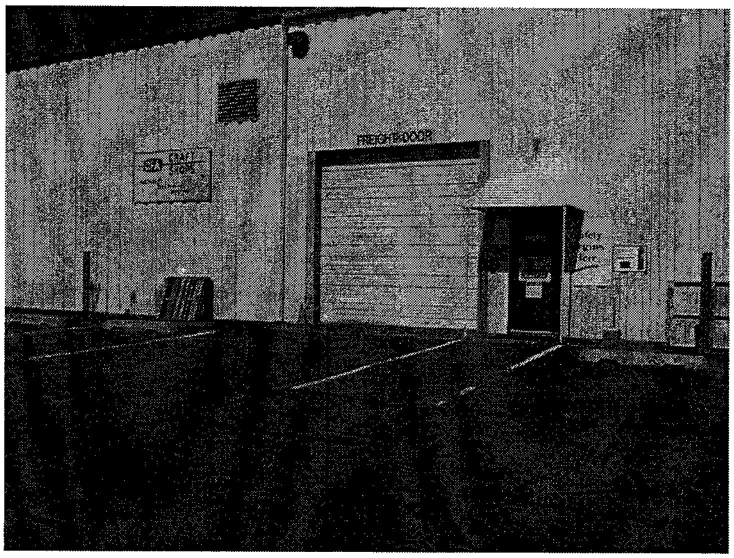
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
U01	0.000	6.90	8.70			1.26
U02	0.013	10.00	11.00	769	846	1.10
U03	0.000	15.00	13.00			0.87
U04	0.023	21.00	18.00	913	783	0.86
U05	0.050	66.00	47.00	1320	940	0.71
U06	0.000	5.00	4.60			0.92
Blank	0.000	**0.29**	0.00			0.00
U08	0.019	34.00	28.00	1789	1474	0.82
U09	0.000	4.50	3.40			0.76
U10	0.000	5.10	6.40			1.25
U11	0.000	5.80	4.20			0.72
U12	0.000	17.00	14.00			0.82
U13	0.000	44.00	4.50			0.10
U14	0.000	8.20	7.30			0.89
U15	0.000	5.90	3.70			0.63
U16	0.000	2.90	3.70			1.28
U17	0.000	4.00	6.80			1.70
U18	0.000	8.10	5.70			0.70
Blank	0.000	0.00	0.00			
U20	0.000	16.00	6.50			0.41
U21	0.000	2.90	2.00			0.69
U22	0.012	15.00	11.00	1250	917	0.73
U23	0.025	38.00	36.00	1520	1440	0.95
U24	0.000	2.90	3.40			1.17
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

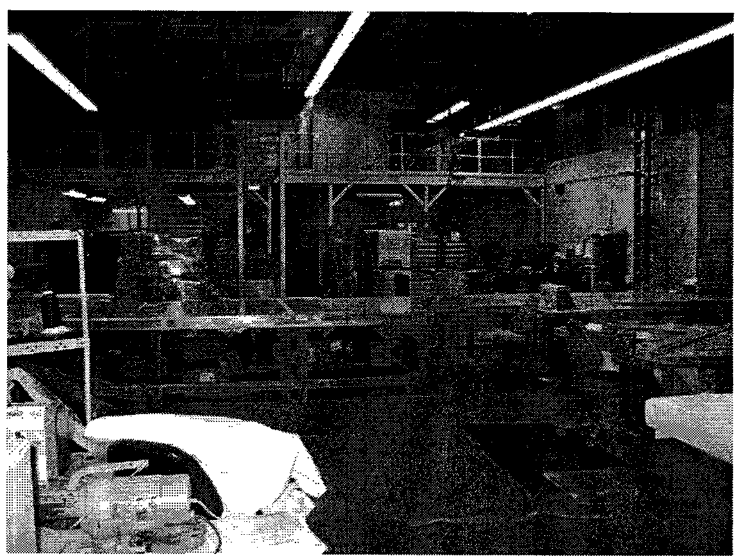
TRA 642, ETR reactor building

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
U01	Main floor, SW end	Infrastructure	light fixture	3" x 5-1/2"	1
U02	Main floor, SW end	Infrastructure	light fixture	1-3/4" x 10"	1
U03	Main floor, N wall	Infrastructure	transformer 826-72	100 sq cm	1
U04	Main floor, E wall	Infrastructure	power supply box	100 sq cm	1
U05	1st Basement, NW quadrant	Infrastructure	transformer T4	100 sq cm	2
U06	1st Basement, E wall	Infrastructure	power panel	4" x 4"	1
U07	Blank	NA	N/A	N/A	1
U08	1st Basement, mezzanine	Infrastructure	light fixture, W end	3" x 6"	1
U09	2nd Basement-S, E end	Process	ECC catch tank	4" x 4"	1
U10	2nd Basement-S, E end	Infrastructure	telephone station	100 sq cm	1
U11	2nd Basement-N, W end	Process	tank 98TRA00240	4" x 4"	1
U12	2nd Basement-N, E end	Infrastructure	base for stand for power supply C13/G16	100 sq cm	1
U13	2nd Basement-N, NW corner	Storage	inside wall mounted "ETR Operations" box	100 sq cm	1
U14	2nd Basement-N, NW corner	Storage	work bench, lower shelf	100 sq cm	1
U15	2nd Basement-N, NE end	Floor	concrete surround for TRA-CS-500	100 sq cm	1
U16	1st Basement, S wall	Floor	behind control console bank	100 sq cm	1
U17	1st Basement, S side	Miscellaneous	window sill exterior of office	1/2" x 32"	1
U18	1st Basement, SW end	Floor	near mezzanine steps	100 sq cm	1
U19	Blank	NA	N/A	N/A	1
U20	1st Basement, NE end	Storage	inside wooden cabinet	100 sq cm	1
U21	Main floor, SE corner	Miscellaneous	door to generator room	1-3/4" x 10"	1
U22	Main floor, E wall	Infrastructure	lighting panel LP-X	100 sq cm	1
U23	Main floor, N wall	Storage	flange of large shipping container	3" x 6"	1
U24	Main floor, N side	Floor	opening to basement, inside railing	100 sq cm	1

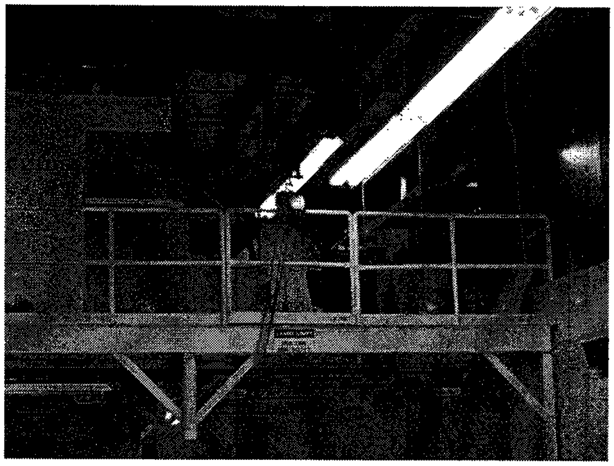
SURVEY RESULTS and CONCLUSIONS
for
CFA 621

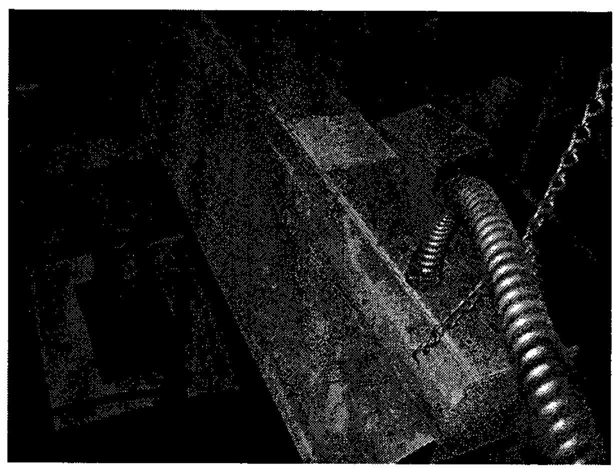




CFA 621

The highest result at this location was only approximately 25% of the criterion level and all others were negligible.





CFA 621

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
A01	Blank	NA
A02	Main floor	0.000
A03	Main floor	0.010
A04	Main floor	0.017
A05	Main floor	0.000
A06	Main floor	0.000
A07	Main floor	0.046
A08	Main floor	0.026
A09	Main floor	0.000
A10	Main floor	0.000
A11	Main floor	0.000
A12	Main floor	0.000
A13	Main floor, under mezzanine	0.000
A14	Main floor, under mezzanine	0.000
A15	Main floor, under mezzanine	0.000
A16	Main floor, under mezzanine	0.000
A17	Main floor, under mezzanine	0.020
A18	Main floor, under mezzanine	0.000
A19	Mezzanine	0.013
A20	Mezzanine	0.000
A21	Mezzanine	0.000
A22	Mezzanine	0.000
A23	Mezzanine	0.000
A24	Blank	NA

CFA 621

FULL RESULTS TABLE

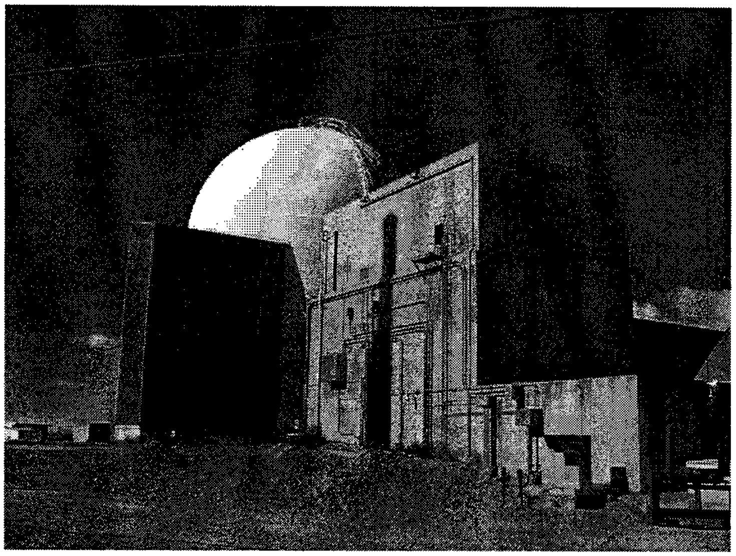
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
Blank	0.000	0.00	0.00			
A02	0.000	40.00	5.20			0.13
A03	0.011	44.00	12.00	4000	1091	0.27
A04	0.017	190.00	16.00	11176	941	0.08
A05	0.000	10.00	5.60			0.56
A06	0.000	41.00	3.00			0.07
A07	0.046	570.00	66.00	12391	1435	0.12
A08	0.027	150.00	29.00	5556	1074	0.19
A09	0.000	3.30	1.40			0.42
A10	0.000	67.00	4.60			0.07
A11	0.000	120.00	14.00			0.12
A12	0.000	4.20	1.90			0.45
A13	0.000	34.00	11.00			0.32
A14	0.000	10.00	2.30			0.23
A15	0.000	7.00	1.30			0.19
A16	0.000	1.60	1.40			0.88
A17	0.019	180.00	29.00	9474	1526	0.16
A18	0.000	4.60	0.99			0.22
A19	0.013	83.00	16.00	6385	1231	0.19
A20	0.000	33.00	3.90			0.12
A21	0.000	140.00	9.60			0.07
A22	0.000	34.00	8.10			0.24
A23	0.000	350.00	15.00			0.04
Blank	0.000	0.30	0.00			0.00
LOQ	0.010	0.200	0.200			
LOD	0.004	0.06	0.05			

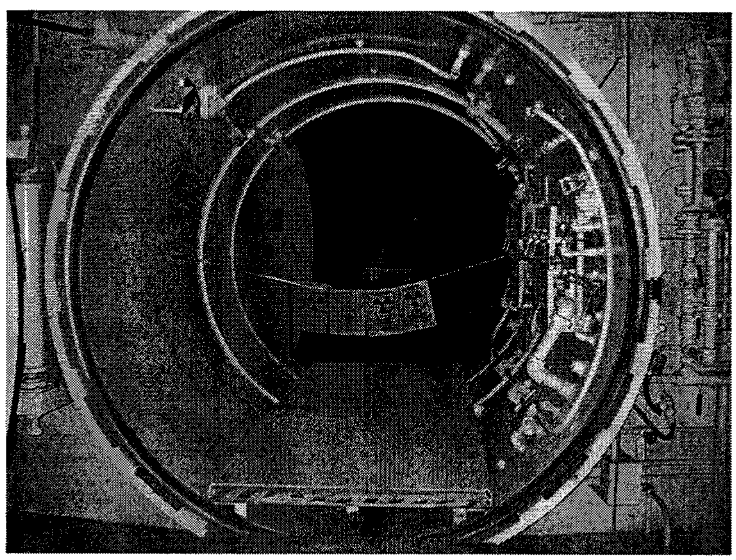
CFA 621

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
A01	Blank	NA	N/A	N/A	1
A02	Main floor	Floor	E wall Room 111	100 sqcm	1
A03	Main floor	Miscellaneous	door to Room 111	1-3/4" x 10"	1
A04	Main floor	Infrastructure	electrical "Panel S"	100 sqcm	1
A05	Main floor	Storage	N wall, counter of work bench	100 sqcm	1
A06	Main floor	Floor	under hoist rail	100 sqcm	1
A07	Main floor	Infrastructure	light fixture, W row	100 sqcm	3
A08	Main floor	Infrastructure	light fixture, mid row	4" x 4"	2
A09	Main floor	Floor	NW corner	100 sqcm	1
A10	Main floor	Floor	W wall	100 sqcm	1
A11	Main floor	Storage	W wall, steel bench, grinder	100 sqcm	1
A12	Main floor	Miscellaneous	top of hardware storage cabinet	100 sqcm	1
A13	Main floor, under mezzanine	Infrastructure	bracing beam, SE end	3" x 6"	1
A14	Main floor, under mezzanine	Floor	W wall	100 sqcm	1
A15	Main floor, under mezzanine	Miscellaneous	top of brown locker	100 sqcm	1
A16	Main floor, under mezzanine	Storage	inside brown locker	100 sqcm	1
A17	Main floor, under mezzanine	Infrastructure	light fixture	1-1/2" x 10"	2
A18	Main floor, under mezzanine	Floor	E wall	100 sqcm	1
A19	Mezzanine	Infrastructure	top of HVAC	100 sqcm	1
A20	Mezzanine	Miscellaneous	window sill	1-3/4" x 10"	1
A21	Mezzanine	Floor	NW corner	100 sqcm	1
A22	Mezzanine	Storage	storage rack, NW corner	2-1/2" x 7"	1
A23	Mezzanine	Infrastructure	top of hoist support rail	100 sqcm	2
A24	Blank	NA	N/A	N/A	1

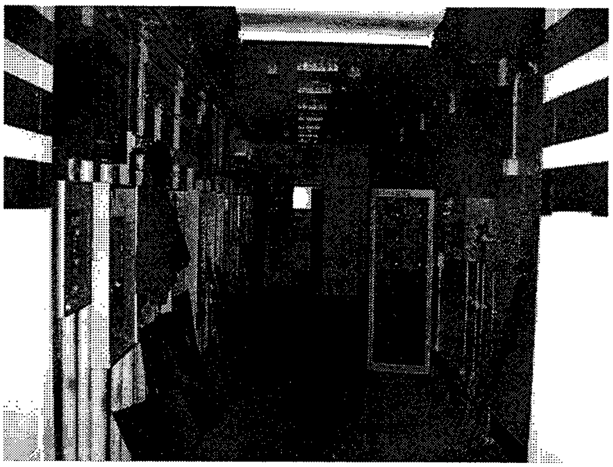
SURVEY RESULTS and CONCLUSIONS for TAN reactor (LOFT)

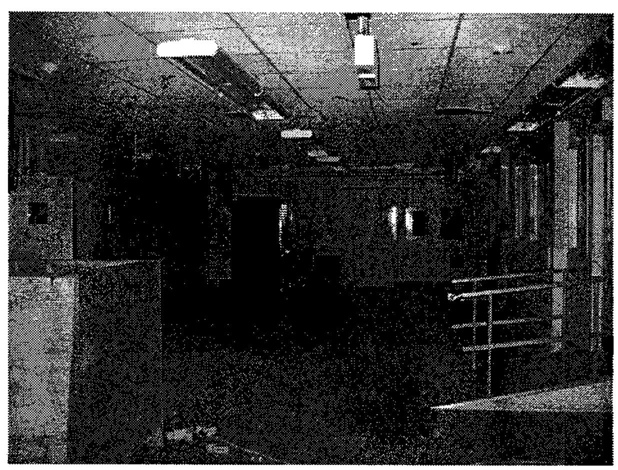




TAN reactor (LOFT)

This building has been totally abandoned. All results were negligible.





TAN reactor (LOFT)

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
S01	Room 123	0.000
S02	Room 123	0.010
S03	Room 123	0.007
S04	Room 123	0.019
S05	Blank	0.000
S06	Room 123	0.000
S07	Room 123, E wall	0.000
S08	Room 123, N wall	0.000
S09	Room 123, W wall	0.000
S10	Room 123, S wall	0.008
S11	Room 123, W wall	0.005
S12	Room 123, E wall	0.005
S13	Room 123A	0.000
S14	Room 123A	0.000
S15	Room 123A	0.000
S16	Room 123A, S wall	0.020
S17	Blank	0.000
S18	Room 123A, N wall	0.000
S19	Room 124	0.000
S20	Room 124	0.000
S21	Room 124	0.000
S22	Room 124	0.000
S23	Room 124, E wall	0.000
S24	Room 124, N wall	0.006

TAN reactor (LOFT)

FULL RESULTS TABLE

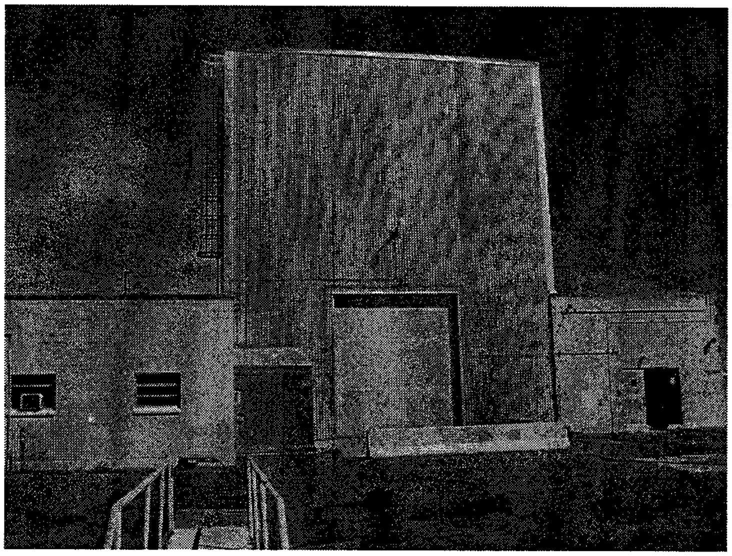
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
S01	0.000	1.90	0.99			0.52
S02	0.010	29.00	6.90	2900	690	0.24
S03	0.007	11.00	5.60	1571	800	0.51
S04	0.020	21.00	11.00	1050	550	0.52
Blank	0.000	0.00	0.00			
S06	0.000	6.00	0.45			0.08
S07	0.000	2.90	1.10			0.38
S08	0.000	1.60	0.78			0.49
S09	0.000	3.60	1.70			0.47
S10	0.009	7.50	4.90	833	544	0.65
S11	0.005	3.00	3.00	600	600	1.00
S12	0.006	4.40	2.90	733	483	0.66
S13	0.000	40.00	0.47			0.01
S14	0.000	1.60	1.40			0.88
S15	0.000	6.40	1.00			0.16
S16	0.020	2500.00	19.00	125000	950	0.01
Blank	0.000	0.43	0.00			0.00
S18	0.000	2.80	1.60			0.57
S19	0.000	3.80	1.60			0.42
S20	0.000	2.70	0.85			0.31
S21	0.000	0.77	0.48			0.62
S22	0.000	6.10	0.96			0.16
S23	0.000	13.00	0.28			0.02
S24	0.006	4.70	2.90	783	483	0.62
LOQ	0.020	0.200	0.060			
LOD	0.005	0.060	0.020			

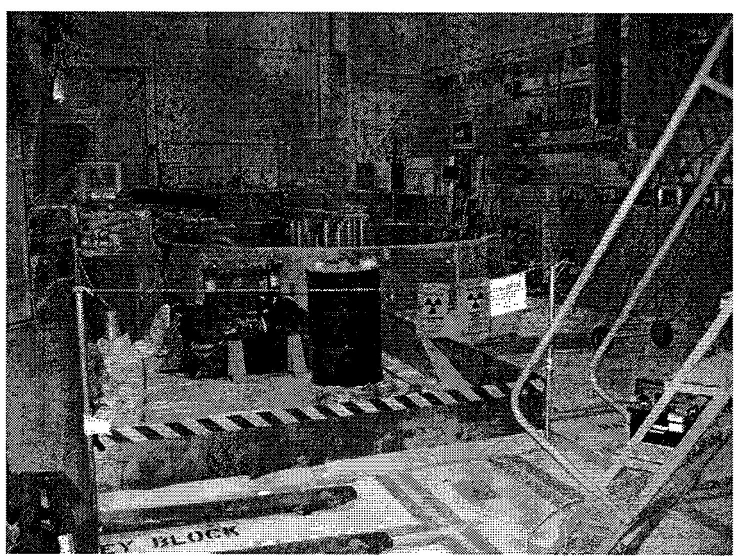
TAN reactor (LOFT)

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
S01	Room 123	Storage	work bench counter top	100 sq cm	1
S02	Room 123	Process	ledge inside panel "ECCS"	3-1/4" x 5"	1
S03	Room 123	Process	transmitter box inside panel "Prim. coolant"	3" x 5-1/4"	1
S04	Room 123	Process	bottom outside ledge B-T307-3	7/8" x 19"	1
S05	Blank	NA	N/A	N/A	1
S06	Room 123	Storage	inside file cabinet drawer	100 sq cm	1
S07	Room 123, E wall	Floor	behind controls	100 sq cm	1
S08	Room 123, N wall	Floor	behind controls	100 sq cm	1
S09	Room 123, W wall	Floor	behind controls	100 sq cm	1
S10	Room 123, S wall	Miscellaneous	window sill	2-3/4" x 6"	1
S11	Room 123, W wall	Infrastructure	conduit run	100 sq cm	1
S12	Room 123, E wall	Infrastructure	fire annunciator panel	3-3/4" x 5"	1
S13	Room 123A	Floor	W wall	100 sq cm	1
S14	Room 123A	Floor	N wall	100 sq cm	1
S15	Room 123A	Floor	S wall	100 sq cm	1
S16	Room 123A, S wall	Process	inside TPP-7	100 sq cm	2
S17	Blank	NA	N/A	N/A	1
S18	Room 123A, N wall	Infrastructure	H & V 10 control panel	100 sq cm	1
S19	Room 124	Floor	W side	100 sq cm	1
S20	Room 124	Floor	E side	100 sq cm	1
S21	Room 124	Floor	S side	100 sq cm	1
S22	Room 124	Floor	S side	100 sq cm	1
S23	Room 124, E wall	Infrastructure	inside PS-LA-4 box	4" x 4"	1
S24	Room 124, N wall	Infrastructure	TP-17	100 sq cm	1

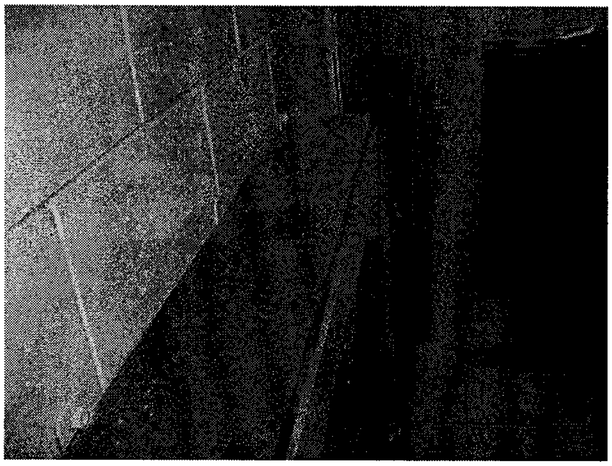
SURVEY RESULTS and CONCLUSIONS for PBF Reactor

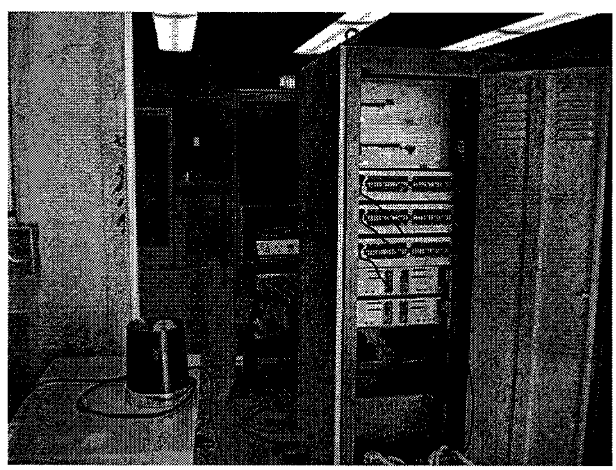




PBF Reactor

All results were negligible.





PBF Reactor

SUMMARY TABLE

No.	General Area	Be µg / 100 cm^2
P01	Process control room	0.000
P02	Blank	NA
P03	Process control room	0.004
P04	Process control room	0.000
P05	Process control room	0.000
P06	Process control room	0.005
P07	De-Min room	0.023
P08	De-Min room	0.000
P09	Loop process room	0.000
P10	Loop process room	0.000
P11	Instrument bunker	0.000
P12	Instrument bunker	0.000
P13	Instrument bunker	0.000
P14	Blank	NA
P15	Instrument bunker	0.000
P16	2nd Basement	0.000
P17	2nd Basement	0.000
P18	2nd Basement	0.000
P19	1st Basement	0.000
P20	1st Basement	0.000
P21	Instrument bunker	0.000
P22	Instrument bunker	0.000
P23	Main reactor floor	0.024
P24	Main reactor floor	0.000

PBF Reactor

FULL RESULTS TABLE

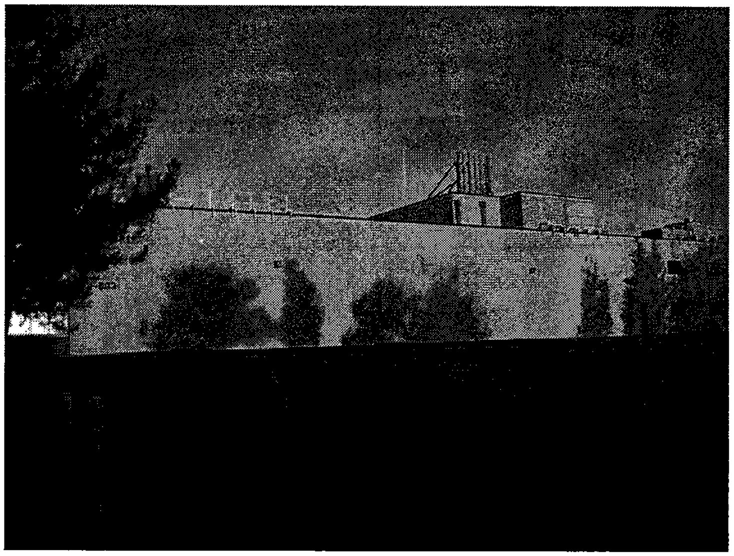
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
P01	0.000	15.00	1.30			0.09
Blank	0.000	0.94	0.00			0.00
P03	0.004	29.00	4.00	7250	1000	0.14
P04	0.000	1.70	0.97			0.57
P05	0.000	5.20	2.70			0.52
P06	0.005	5.00	2.80	1000	560	0.56
P07	0.022	7.90	11.00	359	500	1.39
P08	0.000	37.00	14.00			0.38
P09	0.000	9.30	0.92			0.10
P10	0.000	23.00	2.50			0.11
P11	0.000	1.80	0.22			0.12
P12	0.000	15.00	1.20			0.08
P13	0.000	19.00	0.50			0.03
Blank	0.000	0.00	0.00			
P15	0.000	23.00	0.79			0.03
P16	0.000	3.50	2.80			0.80
P17	0.000	47.00	3.10			0.07
P18	0.000	7.90	0.70			0.09
P19	0.000	44.00	7.70			0.18
P20	0.000	2.50	0.76			0.30
P21	0.000	1.80	0.23			0.13
P22	0.000	1.90	0.38			0.20
P23	0.024	22.00	24.00	917	1000	1.09
P24	0.000	3.60	0.76			0.21
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

PBF Reactor

SAMPLE DETAIL TABLE

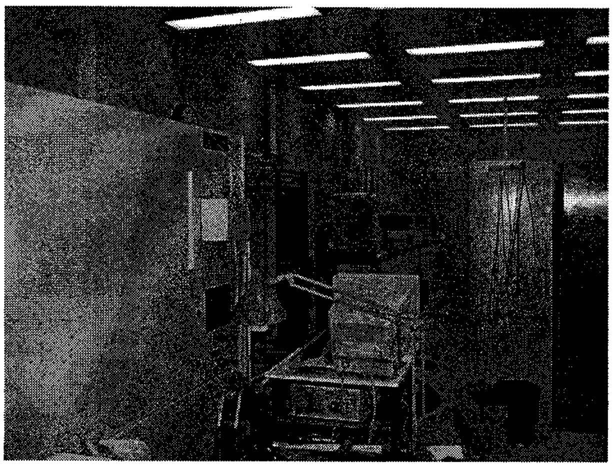
No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
P01	Process control room	Floor	S wall, J 26 panel	100 sq cm	1
P02	Blank	NA	N/A	N/A	1
P03	Process control room	Storage	wooden work bench	100 sq cm	1
P04	Process control room	Floor	NE corner	100 sq cm	1
P05	Process control room	Infrastructure	Panel J 15A	100 sq cm	1
P06	Process control room	Infrastructure	PPS box, Relay channel #1	100 sq cm	1
P07	De-Min room	Infrastructure	Panel PHE-320	3" x 5"	1
P08	De-Min room	Storage	inside drawer of work bench	100 sq cm	1
P09	Loop process room	Floor	N end	100 sq cm	1
P10	Loop process room	Miscellaneous	window sill	4" x 4"	1
P11	Instrument bunker	Storage	top of file cabinet	100 sq cm	1
P12	Instrument bunker	Process	Rack 4100 E	100 sq cm	1
P13	Instrument bunker	Floor	by Rack 4100 B	100 sq cm	1
P14	Blank	NA	N/A	N/A	1
P15	Instrument bunker	Infrastructure	Panel J7	100 sq cm	1
P16	2nd Basement	Floor	S end	100 sq cm	1
P17	2nd Basement	Storage	top of locker	100 sq cm	1
P18	2nd Basement	Process	wood shelf under poison injection system	100 sq cm	1
P19	1st Basement	Process	encapsulation box	100 sq cm	1
P20	1st Basement	Floor	W end	100 sq cm	1
P21	Instrument bunker	Process	work bench by Rack 4500 E, F	100 sq cm	1
P22	Instrument bunker	Process	work bench	100 sq cm	1
P23	Main reactor floor	Process	air compressor	100 sq cm	1
P24	Main reactor floor	Floor	S end	100 sq cm	1

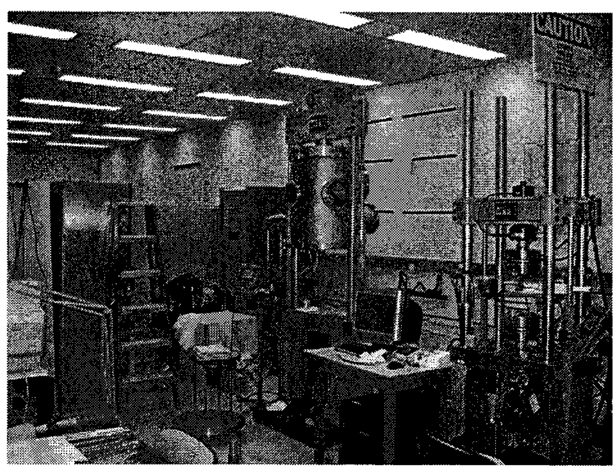
SURVEY RESULTS and CONCLUSIONS for IF 603, B-16



IF 603, B-16

All results were negligible.





IF 603, B-16

SUMMARY TABLE

No.	General Area	Be µg / 100 cm²
L01	S wall	0.000
L02	S wall	0.004
L03	S wall	0.000
L04	W wall	0.010
L05	NE corner	0.005
L06	SE corner	0.005
L07	N wall	0.006
L08	S wall	0.000
L09	E wall	0.005
L10	E wall	0.005
L11	Blank	NA
L12	S wall	0.000
L13	E end	0.000
L14	W wall	0.000
L15	Blank	NA
L16	NW corner	0.005
L17	W end	0.000
L18	S wall	0.000
L19	N wall	0.000
L20	Middle	0.000
L21	Middle	0.004
L22	S wall	0.000
L23	N end	0.000
L24	N wall	0.000

IF 603, B-16

FULL RESULTS TABLE

Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
L01	0.000	170.00	0.10			0.00
L02	0.005	1200.00	1.20	240000	240	0.00
L03	0.000	13.00	0.63			0.05
L04	0.010	28.00	2.30	2800	230	0.08
L05	0.006	170.00	1.70	28333	283	0.01
L06	0.005	250.00	1.90	50000	380	0.01
L07	0.007	94.00	4.70	13429	671	0.05
L08	0.000	100.00	0.94			0.01
L09	0.005	120.00	2.40	24000	480	0.02
L10	0.005	68.00	2.90	13600	580	0.04
Blank	0.000	**0.21**	0.00			0.00
L12	0.000	2.20	0.65			0.30
L13	0.000	14.00	0.00			0.00
L14	0.000	12.00	0.45			0.04
Blank	0.000	**0.08**	0.00			0.00
L16	0.005	24.00	2.00	4800	400	0.08
L17	0.000	15.00	0.10			0.01
L18	0.000	9.60	0.91			0.09
L19	0.000	530.00	1.60			0.00
L20	0.000	65.00	0.63			0.01
L21	0.004	69.00	4.80	17250	1200	0.07
L22	0.000	1.10	0.23			0.21
L23	0.000	2.30	2.50			1.09
L24	0.000	8.20	0.51			0.06
LOQ	0.010	0.200	0.200			
LOD	0.004	0.060	0.050			

IF 603, B-16

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
L01	S wall	Wall	near ceiling	100 sq cm	1
L02	S wall	Miscellaneous	the clock on the wall	3" x 6"	1
L03	S wall	Infrastructure	electrical outlet conduit run	1-3/4" x 10"	1
L04	W wall	Process	backsplash for lab bench	1" x 16"	1
L05	NE corner	Infrastructure	switch box	3" x 6"	1
L06	SE corner	Infrastructure	switch box	3" x 5"	1
L07	N wall	Infrastructure	electrical outlet conduit run	1-3/4" x 10"	1
L08	S wall	Infrastructure	electrical outlet conduit run	1-3/4" x 10"	1
L09	E wall	Miscellaneous	top of door	1-1/2" x 10"	1
L10	E wall	Miscellaneous	door closer, hallway side	2" x 8"	1
L11	Blank	NA	N/A	N/A	1
L12	S wall	Process	lab bench counter top	100 sq cm	1
L13	E end	Infrastructure	HVAC, supply, ceiling diffuser	4" x 4"	1
L14	W wall	Miscellaneous	paper towel dispenser	4" x 4"	1
L15	Blank	NA	N/A	N/A	1
L16	NW corner	Floor		100 sq cm	1
L17	W end	Infrastructure	HVAC, supply, ceiling diffuser	1" x 16"	1
L18	S wall	Floor		100 sq cm	1
L19	N wall	Infrastructure	propane pipeline	1" x 16"	1
L20	Middle	Floor		100 sq cm	1
L21	Middle	Miscellaneous	top of filing cabinet	100 sq cm	1
L22	S wall	Storage	shelf inside lab bench	100 sq cm	1
L23	N end	Storage	bookshelf	100 sq cm	1
L24	N wall	Floor	under drain pipe	100 sq cm	1

SURVEY RESULTS and CONCLUSIONS
for
CPP 627, Shift Lab (2nd floor)

CPP 627, Shift Lab (2nd floor)

The facility has been abandoned. All results were negligible.

CPP 627, Shift Lab (2nd floor)

SUMMARY TABLE

No.	General Area	Be μg / 100 cm^2
J01	S wall (Rad survey # 1)	0.006
J02	NW end (Rad survey # 2)	0.000
J03	N wall (Rad survey # 3)	0.000
J04	NW corner (Rad survey #4)	0.007
J05	W end (Rad survey # 5)	0.000
J06	SW end (Rad survey # 6)	0.000
J07	S wall (Rad survey # 7)	0.006
J08	S wall (Rad survey # 8)	0.000
J09	Blank	0.000
J10	S wall (Rad survey # 10)	0.006
J11	S end (Rad survey # 11)	0.000
J12	S wall (Rad survey # 12)	0.007
J13	N wall (Rad survey # 13)	0.000
J14	NE end (Rad survey # 14)	0.000
J15	NE end (Rad survey # 15)	0.000
J16	SE end (Rad survey # 18)	0.000
J17	Blank	0.000
J18	SE end (Rad survey # 19)	0.000
J19	NE corner (Rad survey # 20)	0.008
J20	E wall (Rad survey # 21)	0.000
J21	E wall (Rad survey # 22)	0.000
J22	SE corner (Rad survey # 23)	0.000
J23	SE end (Rad survey # 24)	0.006
J24	NE end (Rad survey # 25)	0.000

CPP 627, Shift Lab (2nd floor)

FULL RESULTS TABLE

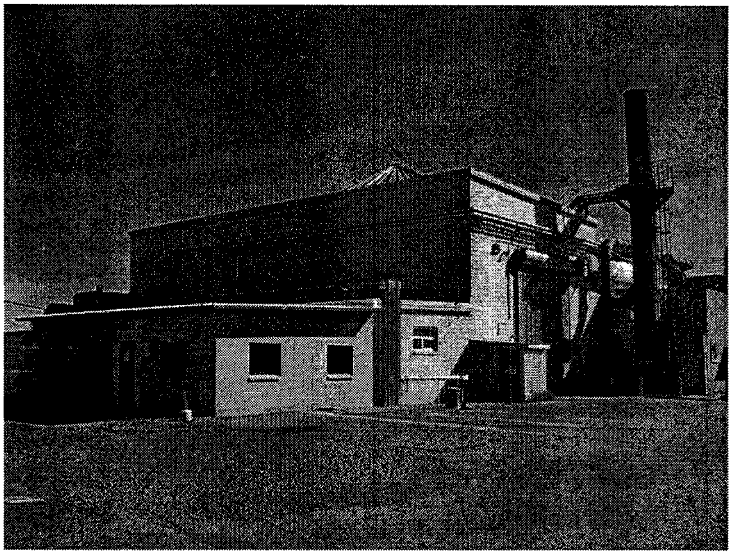
Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
J01	0.006	19.00	3.50	3167	583	0.18
J02	0.000	0.72	0.43			0.60
J03	0.000	4.70	1.60			0.34
J04	0.007	11.00	5.70	1571	814	0.52
J05	0.000	2.10	0.98			0.47
J06	0.000	6.10	2.90			0.48
J07	0.006	40.00	9.00	6667	1500	0.23
J08	0.000	4.70	1.60			0.34
Blank	0.000	0.00	0.00			
J10	0.006	13.00	3.50	2167	583	0.27
J11	0.000	10.00	3.70			0.37
J12	0.007	14.00	4.60	2000	657	0.33
J13	0.000	5.50	4.20			0.76
J14	0.000	2.30	1.70			0.74
J15	0.000	5.40	0.92			0.17
J16	0.000	4.10	1.00			0.24
Blank	0.000	0.00	0.00			
J18	0.000	3.00	2.20			0.73
J19	0.008	7.40	9.10	925	1138	1.23
J20	0.000	10.00	3.80			0.38
J21	0.000	6.10	2.40			0.39
J22	0.000	9.80	3.60			0.37
J23	0.006	5.20	7.00	867	1167	1.35
J24	0.000	6.80	1.70			0.25
LOQ	0.020	0.200	0.060			
LOD	0.005	0.060	0.020			

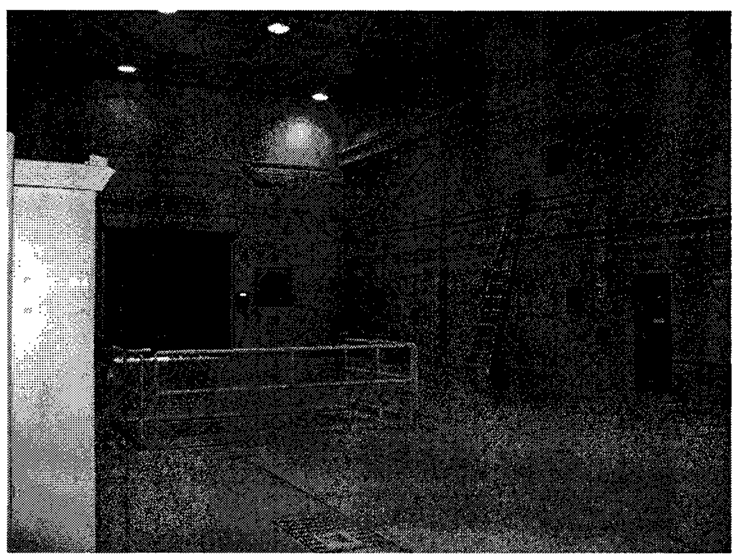
CPP 627, Shift Lab (2nd floor)

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
J01	S wall (Rad survey # 1)	Process	top of equipment transfer tunnel	100 sq cm	1
J02	NW end (Rad survey # 2)	Infrastructure	flange of E-W running roof support I-beam	100 sq cm	1
J03	N wall (Rad survey # 3)	Storage	cabinet under hood 604, bottom shelf	100 sq cm	1
J04	NW corner (Rad survey #4)	Infrastructure	HVAC, supply, ceiling diffuser	100 sq cm	1
J05	W end (Rad survey # 5)	Infrastructure	flange of E-W running roof support I-beam	100 sq cm	1
J06	SW end (Rad survey # 6)	Infrastructure	ventilation duct	100 sq cm	1
J07	S wall (Rad survey # 7)	Floor	behind lab bench cabinet	100 sq cm	1
J08	S wall (Rad survey # 8)	Process	top ledge of lab bench	100 sq cm	1
J09	Blank	NA	N/A	N/A	1
J10	S wall (Rad survey # 10)	Infrastructure	top of exhaust duct	100 sq cm	1
J11	S end (Rad survey # 11)	Infrastructure	flange of N-S running roof support I-beam	100 sq cm	1
J12	S wall (Rad survey # 12)	Process	top of hood RAF 602	100 sq cm	1
J13	N wall (Rad survey # 13)	Process	top of hood RAF 603	100 sq cm	1
J14	NE end (Rad survey # 14)	Infrastructure	light fixture	100 sq cm	1
J15	NE end (Rad survey # 15)	Floor	by hood RAF 601	100 sq cm	1
J16	SE end (Rad survey # 18)	Infrastructure	light fixture	100 sq cm	1
J17	Blank	NA	N/A	N/A	1
J18	SE end (Rad survey # 19)	Process	top of hood RAF 601	100 sq cm	1
J19	NE corner (Rad survey # 20)	Infrastructure	transformer	100 sq cm	1
J20	E wall (Rad survey # 21)	Infrastructure	light fixture	100 sq cm	1
J21	E wall (Rad survey # 22)	Infrastructure	electrical conduit run	100 sq cm	1
J22	SE corner (Rad survey # 23)	Floor		100 sq cm	1
J23	SE end (Rad survey # 24)	Infrastructure	top of ductwork that has been dismounted	100 sq cm	1
J24	NE end (Rad survey # 25)	Floor		100 sq cm	1

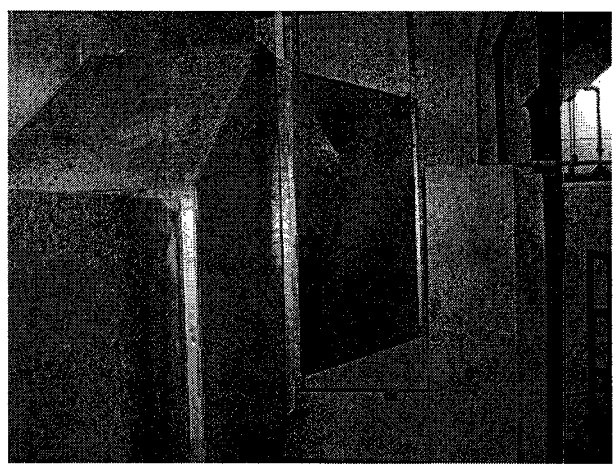
SURVEY RESULTS and CONCLUSIONS
for
PBF 609, Ash Handling





PBF 609, Ash Handling

The facility is not currently being used. This is the only location for which every sample beryllium result was non-detected.



PBF 609, Ash Handling

SUMMARY TABLE

No.	General Area	Be $\mu g / 100\ cm^2$
N01	Blank	NA
N02	Room B101, W wall	0.000
N03	Room B101, E wall	0.000
N04	Room B101, N wall	0.000
N05	Room B102, W wall	0.000
N06	Room B102, W wall	0.000
N07	Room B102, middle	0.000
N08	Room B105, S end	0.000
N09	Room B105, E wall	0.000
N10	Room B107, N wall	0.000
N11	Room B107, W wall	0.000
N12	Room B109, N wall	0.000
N13	Blank	NA
N14	Room B109, S wall	0.000
N15	Room B109, NE corner	0.000
N16	Room B109	0.000
N17	Room B106, E wall	0.000
N18	Room B106, SW corner	0.000
N19	Room B106, N wall	0.000
N20	Room B106, W wall	0.000
N21	Room 108A, N wall	0.000
N22	Room 108A, N wall	0.000
N23	Room 101A, W wall	0.000
N24	Room 101A, middle	0.000

PBF 609, Ash Handling

FULL RESULTS TABLE

Sample No.	Be µg	Cu µg	Ba µg	Cu / Be	Ba / Be	Ba / Cu
Blank	0.000	0.00	0.00			
N02	0.000	0.23	1.80			7.83
N03	0.000	2.10	4.00			1.90
N04	0.000	1.40	54.00			38.57
N05	0.000	0.22	1.20			5.45
N06	0.000	11.00	16.00			1.45
N07	0.000	0.24	2.90			12.08
N08	0.000	4.90	27.00			5.51
N09	0.000	14.00	38.00			2.71
N10	0.000	4.90	39.00			7.96
N11	0.000	4.70	15.00			3.19
N12	0.000	0.26	3.30			12.69
Blank	0.000	0.00	0.00			
N14	0.000	16.00	5.00			0.31
N15	0.000	0.27	1.60			5.93
N16	0.000	3.00	10.00			3.33
N17	0.000	2.80	16.00			5.71
N18	0.000	0.23	28.00			121.74
N19	0.000	0.24	1.30			5.42
N20	0.000	5.10	22.00			4.31
N21	0.000	1.60	11.00			6.88
N22	0.000	3.40	12.00			3.53
N23	0.000	67.00	19.00			0.28
N24	0.000	1.50	7.20			4.80
LOQ	0.020	0.200	0.060			
LOD	0.005	0.060	0.020			

PBF 609, Ash Handling

SAMPLE DETAIL TABLE

No.	General Area	HSA	Specific Surface	Sq Area Wiped	Smear Tabs-#
N01	Blank	NA	N/A	N/A	1
N02	Room B101, W wall	Process	top of small lab oven	100 sq cm	1
N03	Room B101, E wall	Storage	top of "Flammables" cabinet	100 sq cm	1
N04	Room B101, N wall	Floor		100 sq cm	1
N05	Room B102, W wall	Storage	work bench countertop	100 sq cm	1
N06	Room B102, W wall	Miscellaneous	top of door	1-3/4" x 10"	1
N07	Room B102, middle	Floor	middle	100 sq cm	1
N08	Room B105, S end	Infrastructure	top of respirator air manifold	4" x 4"	1
N09	Room B105, E wall	Infrastructure	top of speaker box	3-1/2" x 5"	1
N10	Room B107, N wall	Infrastructure	top of air duct, angled section	100 sq cm	1
N11	Room B107, W wall	Infrastructure	top of cold water supply pipe	3" x 5-1/2"	1
N12	Room B109, N wall	Floor		100 sq cm	1
N13	Blank	NA	N/A	N/A	1
N14	Room B109, S wall	Infrastructure	top of junction box	4" x 4"	1
N15	Room B109, NE corner	Storage	wall mounted corner shelf	100 sq cm	1
N16	Room B109	Miscellaneous	top of door	1-3/4" x 10"	1
N17	Room B106, E wall	Infrastructure	emergency lighting case	3" x 5-1/2"	1
N18	Room B106, SW corner	Floor		100 sq cm	1
N19	Room B106, N wall	Infrastructure	top of door hinge ledge	2" x 8"	1
N20	Room B106, W wall	Infrastructure	through-wall ventilation louvers (2)	3/8" x 21"	1
N21	Room 108A, N wall	Storage	top of "Flammables" cabinet	100 sq cm	1
N22	Room 108A, N wall	Infrastructure	light fixture	4" x 4"	2
N23	Room 101A, W wall	Storage	wall mounted shelving	100 sq cm	2
N24	Room 101A, middle	Floor	diamond plate	100 sq cm	1

APPENDIX A

5815.26.3

Argonne National Laboratory-West

Beryllium Control Program
RFS

Inventory

Beryllium Inventory

Radiation, Fire and Safety

Picture of Area

Location

Building:

Manager:

Phone:

Custodian:

Location in Building:

Quantity (lbs.)

Chemical Composition

% Beryllium:

Physical Form *Article* ☐ *Solid* ☐ *Powder* ☐ *Other* ☐

Uses

Exposed Personnel

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.

Engineering Controls	
Administrative Controls	
Storage Information	
Comments	

Beryllium Inventory

Radiation, Fire and Safety

Picture of Area

Location	
Building: 785 UFEF	
Manager: Bob Parks	
Phone: 533-7149	
Custodian: Boyd Christiansen	
Location in Building: Only found w/in the argon cell.	
Quantity (lbs.)	768 g
Chemical Composition	Be
% Beryllium:	
Physical Form	*Article* ☐ *Solid* ☒ *Powder* ☐ *Other* ☐
Solid block form, which is hot pressed into 13½ in. hexagonal metal case.	
Uses	Unknown
Exposed Personnel	none

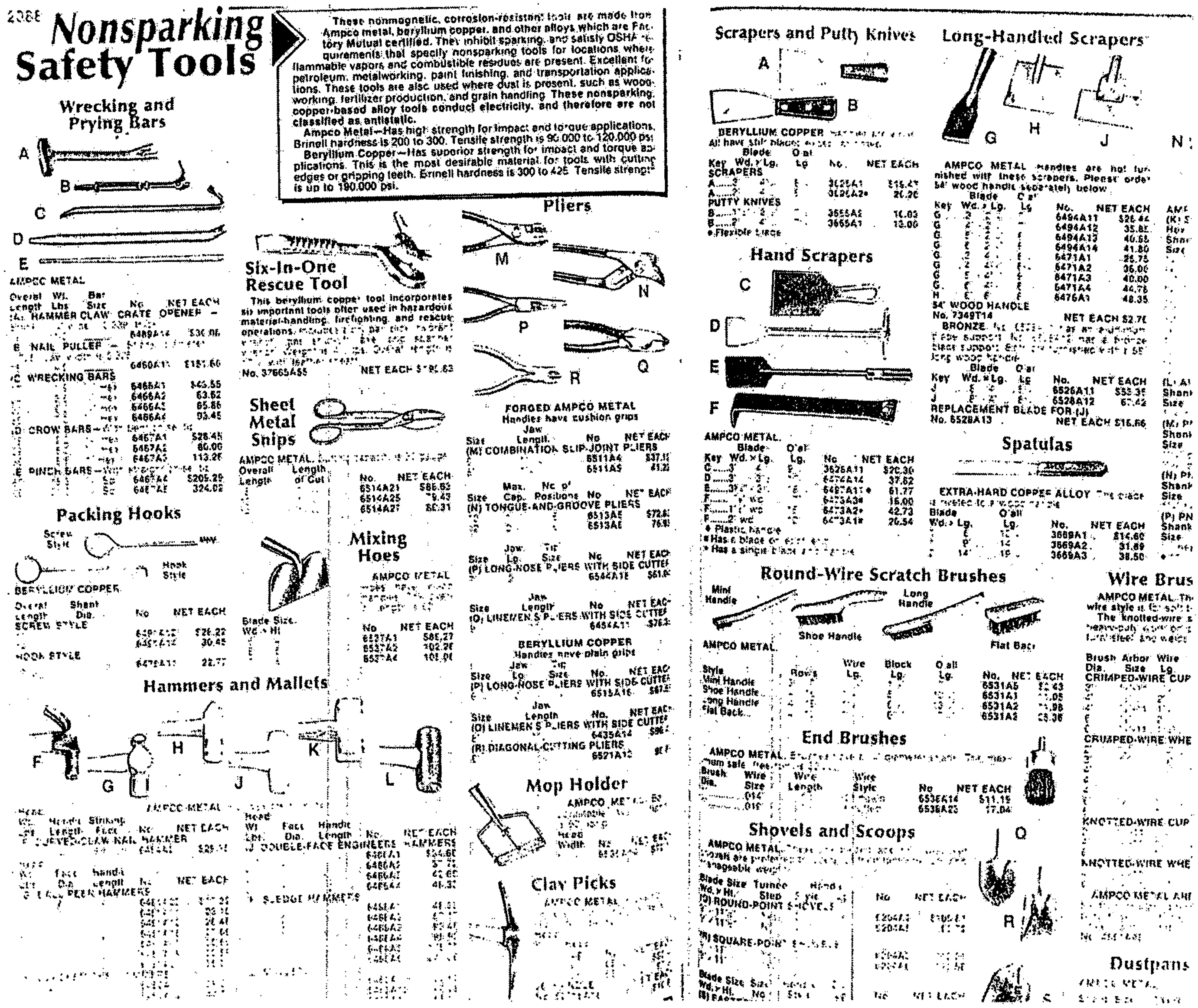
1.	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.

Engineering Controls	Found only in argon cell. Controls include 4 ft. thick walls.
Administrative Controls	—
Storage Information	—
Comments	Has never left the argon cell so no human contact. Due to radiation concern, human contact should never be a problem.

Beryllium Tools at SPF		
Description	Sizes	Quantity
Bung Wrenchs	---	2
Pipe Wrenchess	10"	2
Monkey Wrench	10"	1
Crescent Wrenchs	10"	3
Crescent Wrench	12"	1
Line Man Plier	medium	1
T Handle Socket	1 1/2"	1
Straight Screw Drivers	assorted	3
Philips Screw Drivers	assorted	3
Ball Peen Hammer	medium	1
Wire Brushs	large	4
Wire Brushs	small	4
Plier	medium	1
Open End Wrench	7/8—15/16"	1
Beryllium Tool at SCMS		
Open End Wrenchs	7/16—1/2"	3
Open End Wrench	9/16—5/8"	1
Open End Wrench	3/4—13/16"	1
Open End Wrench	1 1/16—25/32"	1
Open End Wrench	7/8—15/16"	1
Open End Wrenchs	1—1 1/8"	3
Open End Wrench	1 1/16—1 1/4"	1
Open End Wrench	15/16—1 1/16"	1
Box End Wrench	7/16—1/2"	1
Box End Wrench	1/2—9/16"	1

Beryllium Tools at SCMS (cont. 1)		
Description	Sizes	Quantity
Box End Wrench	5/8---3-4"	1
Box End Wrench	3/4---7/8"	1
Box End Wrench	7/8---15/16"	1
Box End Wrench	7/8---31/32"	1
Box End Wrench	1--- 1 1/8"	1
Box End Wrench	1 1/16--- 1 1/4"	1
Crescent Wrench	8"	1
Crescent Wrench	10"	1
Crescent Wrench	12"	1
Crescent Wrench	15"	1
Needle Nose Plier	medium	1
Straight Screw Driver	6"	1
Straight Screw Driver	8"	1
Scraper	1 1/4"	1
Scraper	3"	1
Wedges	—	2
Punch	#8	1
Punch	#4	1
Punch	#2	1
Chisel	5/8"	1
Chisel	7/8"	1
Socket Wrench	1/2"	1
Socket	7/16"	1
Socket	1/2"	1
Socket	9/16"	1

Beryllium Tool at SCMS (cont. 2)		
Description	Sizes	Quantity
Socket	5/8"	1
Socket	11/16"	1
Socket	3/4"	1
Socket	13/16"	1
Socket	7/8"	1
Socket	15/16"	1
Socket	1"	1
Socket	1 1/16"	1
Socket	1 1/8"	1
Socket	1 1/4"	1
Bung Wrenchs	—	3
Allen Wrench	1/8"	1
Allen Wrench	3/16"	1
Allen Wrench	7/32"	1
Allen Wrench	1/4"	1
Allen Wrench	5/16"	1
Allen Wrench	3/8"	1
Allen Wrench	7/16"	1
Allen Wrench	1/2"	1
Pipe Wrenchs	assorted	3



2088 Nonsparking Safety Tools

These nonmagnetic, corrosion-resistant tools are made from Ampco metal, beryllium copper, and other alloys which are Factory Mutual certified. They inhibit sparking, and satisfy OSHA requirements that specify nonsparking tools for locations where flammable vapors and combustible residues are present. Excellent for petroleum, metalworking, paint finishing, and transportation applications. These tools are also used where dust is present, such as woodworking, fertilizer production, and grain handling. These nonsparking, copper-based alloy tools conduct electricity, and therefore are not classified as antistatic.

Ampco Metal—Has high strength for impact and torque applications. Brinell hardness is 200 to 300. Tensile strength is 90,000 to 120,000 psi.

Beryllium Copper—Has superior strength for impact and torque applications. This is the most desirable material for tools with cutting edges or gripping teeth. Brinell hardness is 300 to 425. Tensile strength is up to 190,000 psi.

Wrecking and Prying Bars

Packing Hooks

Six-In-One Rescue Tool

This beryllium copper tool incorporates six important tools often used in hazardous material-handling, firefighting, and rescue operations.

No. 3766A55 NET EACH

Sheet Metal Snips

Mixing Hoes

Hammers and Mallets

Pliers

FORGED AMPCO METAL Handles have cushion grips

(M) COMBINATION SLIP-JOINT PLIERS

(N) TONGUE-AND-GROOVE PLIERS

(P) LONG-NOSE PLIERS WITH SIDE CUTTER

(Q) LINEMEN'S PLIERS WITH SIDE CUTTER

BERYLLIUM COPPER Handles have plain grips

(P) LONG-NOSE PLIERS WITH SIDE CUTTER

(Q) LINEMEN'S PLIERS WITH SIDE CUTTER

(R) DIAGONAL-CUTTING PLIERS

Mop Holder

Clay Picks

Scrapers and Putty Knives

BERYLLIUM COPPER

Hand Scrapers

Long-Handled Scrapers

AMPCO METAL Handles are not furnished with these scrapers. Please order wood handle separately below.

54" WOOD HANDLE

REPLACEMENT BLADE FOR (J)

Spatulas

EXTRA-HARD COPPER ALLOY

Round-Wire Scratch Brushes

End Brushes

Shovels and Scoops

Wire Brushes

CRIMPED-WIRE CUP

CRIMPED-WIRE WHEEL

KNOTTED-WIRE CUP

KNOTTED-WIRE WHEEL

Dustpans

Argonne National Laboratory-West

Beryllium Control Program
RFS

Sampling

Beryllium Surface Sampling Procedure

Purpose

To establish a standard procedure for sampling of any surface area for the presence of unbound beryllium particulate.

Sampling Methods

Whatman 41/Distilled Water
Pre-packaged Respirator Cleaning Wipes
High Volume Sampler

Sampling Procedure

All three of the above sampling methods involve the capture of unbound particulate from a surface. All methods require that an area to be sampled be defined or approximated. The most common area size sampled is one square foot. After obtaining a sample, place it in a clean bag or container. Record all pertinent data including the size of area, location, and physical observations on a sample sheet. Code the sample and the sheet.

The person obtaining the sample should wash their hands thoroughly before beginning this procedure. The person should avoid direct hand contact with any surface possibly contaminated with beryllium. Disposable gloves may be worn providing the same precaution is taken.

Whatman 41/Distilled Water Sampling Method

This method is best used on smooth surfaces due to the fragile nature of the filter when wetted. Wet the filter with distilled water and wipe the surface to be sampled using wiping strokes which contain any unbound particulate towards the center of the area. Repeat this step with as many filters as is necessary to capture the majority of this loose particulate. The number of filters used is at the discretion of the individual performing the sampling.

Pre-packaged Respirator Cleaning Wipes Method (Recommended Method)

These wipes are foil packaged moist towelettes which can be used on smooth, semi-smooth, or irregular shaped surfaces. These wipes hold together much better than the Whatmann filters and are the recommended method. Any pre-packaged moist wipe, compatible to the analytical digestion procedure, can be used. The wiping procedure is the same as Whatmann 41/distilled water.

High Volume Sampler Vacuum Method

When a surface is highly irregular, or is fabric or carpet, a high volume sampler with a Whatmann 41 filter can be used to capture the loose particulate from the surface. Use the sampler as a vacuum passing it over the pre-determined area being sampled. Be certain to keep it as close as possible to the surface without damaging the filter. Record the area size but do not record the flow rate or duration of sample as it is irrelevant to a mass per unit area sample. This method is not recommended for smooth or semi-smooth surfaces which can be wet wiped.

May 12, 1995

CLGREG01 Doc: 194777_1
Printed: 03-13-97 01:52

Beryllium Air Sampling Procedure

Purpose

The purpose of this procedure is to establish consistency in sampling methodology and sample strategy development to minimize systematic and random variation in sample results

Sampling Methods

Air sampling for beryllium is conducted using one or more of the following methods.

Traditional Methods
High volume
Lapel/personal
Continuous

Non-traditional Methods
Particle size
Real time monitoring

Equipment Preparation

Cleaning and storage

All sample pumps shall be cleaned prior to each day's use. Wiping the housing of the equipment with a damp cloth is generally sufficient. Unplug electric samplers before cleaning (attorney statement).

Filter holders shall be new or have been cleaned prior to use. Reusable filter holders are usually washed using a soap solution and scrub brush, rinsed, and allowed to air dry. When not in use, cleaned, new, or pre-loaded filter holders and filters must be stored in a non-production area inside a dust-tight enclosure, such as a zip lock bag, to prevent their contamination.

Tweezers used to handle filters should be cleaned before each day's use and as needed throughout the air sampling day

Inspection

Equipment components such as sampler housings, filter heads, tubing, electric cords, extension cords, storage boxes, equipment carts, etc. shall be inspected for damage, deterioration, cleanliness etc. at the beginning of each work day. Specifically, High volume sample heads must be inspected for deterioration of the gasket, and corrosion or poor alignment of the mating surfaces. This inspection is normally done during the cleaning process.

Minimum Calibration Frequency

Continuous samplers	Quarterly
High Volume samplers	Quarterly
Lapel/personal samplers	Daily
Any repaired sampler	Before initial use

Traditional Sample Methods

High Volume Method

A high volume air sampler draws air through a filter at a high rate of flow enabling the capture of beryllium at lower airborne concentrations. The current vacuum equipment draws air through a 10.5 centimeter diameter Whatmann 41 filter at a rate of about 200-400 liters per minute. The common types of air samples taken are the General Area (GA), Breathing Zone (BZ), and Process Sample (PS).

Low Flow Method

A low flow sampler normally consists of a low volume battery powered portable vacuum pump with a 0.8 micron pore size mixed cellulose ester filter/cartridge calibrated to a sampling rate of about 2 Lpm. The common types of air samples taken are the General Area (GA) and Breathing Zone (BZ).

Continuous Method

A continuous air sampler consists of an electric powered vacuum pump and a filter cassette where the flow is regulated with a critical orifice. A typical configuration is a vacuum pump and a 25 millimeter diameter Whatmann 41 filter/cassette calibrated to a flow of 10 to 20 liters per minute. This method is designed for sampling over long periods of time. The common types of air samples taken are the General Area (GA) and Process Sample (PS).

Sample Types

General Area Samples

General area samples are taken in the normal operating area around a specific process or activity. Samples taken using the high volume method are normally obtained for 30 minutes but can range from about 10 minutes to one hour in duration. Low flow samplers can be used for GA samples with durations of about one to eight hours. They are most often used in areas where the noise from a high volume sampler would be deemed unacceptable, such as in an office. Samples taken using the continuous method are usually obtained for 8 to 24 hours.

There are two basic types of general area samples. The first is used to account for non-specific activity time such as when an operator spends time at a stationary location such as a desk or chair. The second type is relative to the time in the work area surrounding a specific task or activity. This second type is often associated with a corresponding breathing zone sample.

Placement of the first type of general area sample is normally at breathing zone height on a stand or tripod located:

1. At the operator's desk, chair, etc.
2. Wherever the operator spends time when not performing a specific production task or activity.

Placement of the second type of general area sample should be downwind of the identified process or activity in areas such as:

1. Normal paths of operator travel when not wearing a respirator. GA samples should not represent emissions to which the operator is exposed when performing specific tasks requiring respiratory protection or specific close-in tasks normally sampled at the operators breathing zone.

2. In an aisle or area next to the operation which is frequented by other employees, especially if it is near an operator wearing a respirator.

3. As a general rule, a general area sample is obtained within six to ten feet of a breathing zone sampling location.

Breathing Zone Samples

Breathing zone (BZ) samples are obtained within a one foot radius of an operator's head.

Breathing zone samples collected using the high volume method are usually taken during periods of high potential or actual exposure. They are often taken during respirator required tasks. On difficult operations where the activity of sampling may pose a hazard to the person sampling or being sampled the sample may be taken at a location equivalent to the operator's position relative to the potential source of the airborne beryllium. Sample duration should be the complete time it takes to perform the operation or in case of a prolonged operation, at least five minutes. If an operation takes less than one minute to perform, sampling time should be a minimum of one minute.
CAUTION: Persons obtaining air samples must always wear the required respiratory protection and other personal protective gear for the task being performed.

Breathing zone samples taken using low flow samplers are usually taken to be representative of a worker's exposure during an entire work shift. A low flow pump is worn on a belt while the filter cartridge is located on the person's lapel and connected to the pump with a length of plastic tubing. It is recommended that low flow samplers not be used for sampling periods for less than one hour, especially if the potential exposure is believe to be low.

Continuous Samples

Continuous samples are taken in an area which normally represents a general area sampling location. However, continuous samplers can be used to audit equipment or areas not generally associated with an operator's normal path of travel. They may also be used to determine exposure potential before, during, or after an area evacuation.

Process Samples

High volume, low flow or continuous sampling pumps may be used to collect this type sample. Process samples are usually taken within inches of a potential source to identify and/or assess a rate of emission for the contaminant being sampled. This information is used to identify sources, estimate potential worst case exposures, and to evaluate or initiate engineering controls.

Field Sample Procedures

High Volume Method

1. **Wash hands prior to assembling filters. Assemble filter heads in an area where the potential for process related contaminated is reasonably low. With clean tweezers, place one filter paper in the top section of the sampling head and thread the two sections snugly together. Several sampling heads can be made up in advance and stored in an dust tight container or plastic bag. Thread the sampling head onto the sampler. Check for binding of the filter paper. Record the sampler number and flow rate. Proceed to take the sample and note the start time to the second. It is most convenient to start and stop samplers at minute points.**

2. After the sample has been taken, remove the sample head from the pump by smoothly unscrewing the head. Unscrew the filter assembly in a horizontal position. Remove the filter paper with clean tweezers and put the filter paper into a pre-numbered cellophane bag. **Grasp filters from only the unexposed outer edge.** Close/seal the bag.

Low Flow Method

Use pre-loaded numbered or coded filter cassettes. Clean hands before handling cassettes. Assemble the pump to the filter cassette using Tygon tubing of adequate length. Cassette filter quick connect fittings are recommended. Be certain the Tygon tubing has an adequate number of clips to facilitate the tubing placement when sampling on people (usual minimum is three). The inlet plug on the filter cassette should not be removed until ready to begin sampling. Place the pump on the individual at a location comfortable to the wearer. Provide a belt if one is not available. Pump placement should take into account how it might interfere with the wearer's motions, the presence of heat or chemicals, the wearing of other work equipment such as tool belts, etc. Particular care must be taken when affixing the Tygon tubing to the wearer's clothing. Make sure the tubing stays close to the body so it does not snag or pose a safety hazard. At times person's wearing finer clothing may need to be sampled. Care should be taken to avoid snagging fine fabrics. Another option is to have the person wear an overgarment such as a lab coat to which the sampler can be attached. The cassette must be attached within the breathing zone of the wearer. In special instances, such as welding, the cassette must be placed so it remains in the breathing zone under the welding helmet.

After taking the sample, remove the cassette and cap both ends.

Continuous Method

Use pre-loaded numbered or coded open-face filter cassettes. Clean hands before handling cassettes. Assemble the pump to the filter cassette using Tygon tubing of adequate length. Cassette filter quick connect fittings are recommended. Be certain the Tygon tubing or electrical extension cords are located out of the way of production activities. Be certain the pump is adequately secured so it cannot be easily dislodged posing a potential safety hazard.

All Methods

Record all pertinent information on the sampling record sheet noting the sample number, date, start and stop times, location and operation, sampler flow rate, sample duration, and if applicable, operator name and clock number. Also record any pertinent conditions which might influence the sample results.

Note: Filters which:

contact an object such as hands, the person being sampled, are directly contaminated by process spray, chips etc.;

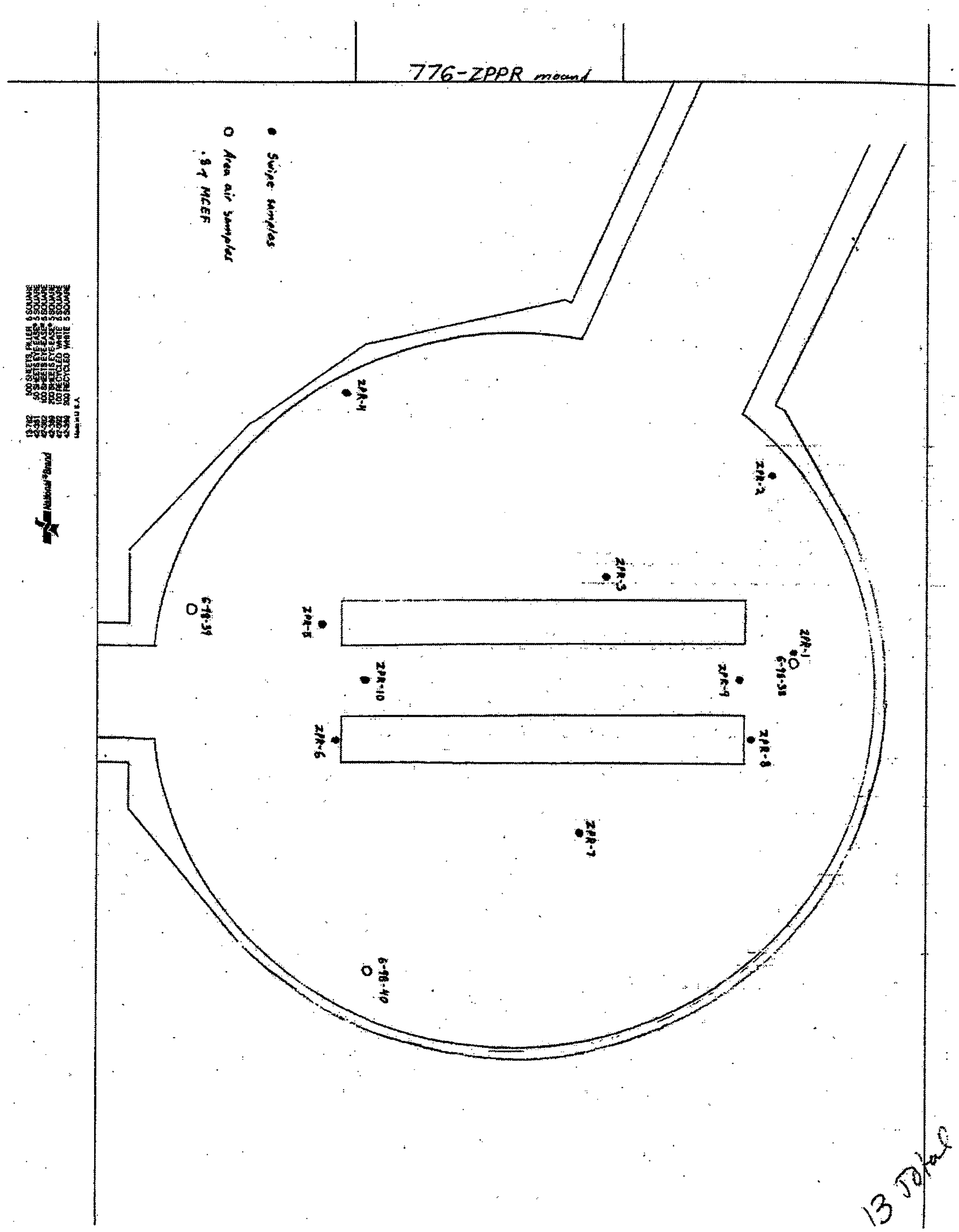
develop a hole or do not seal during the sampling process;

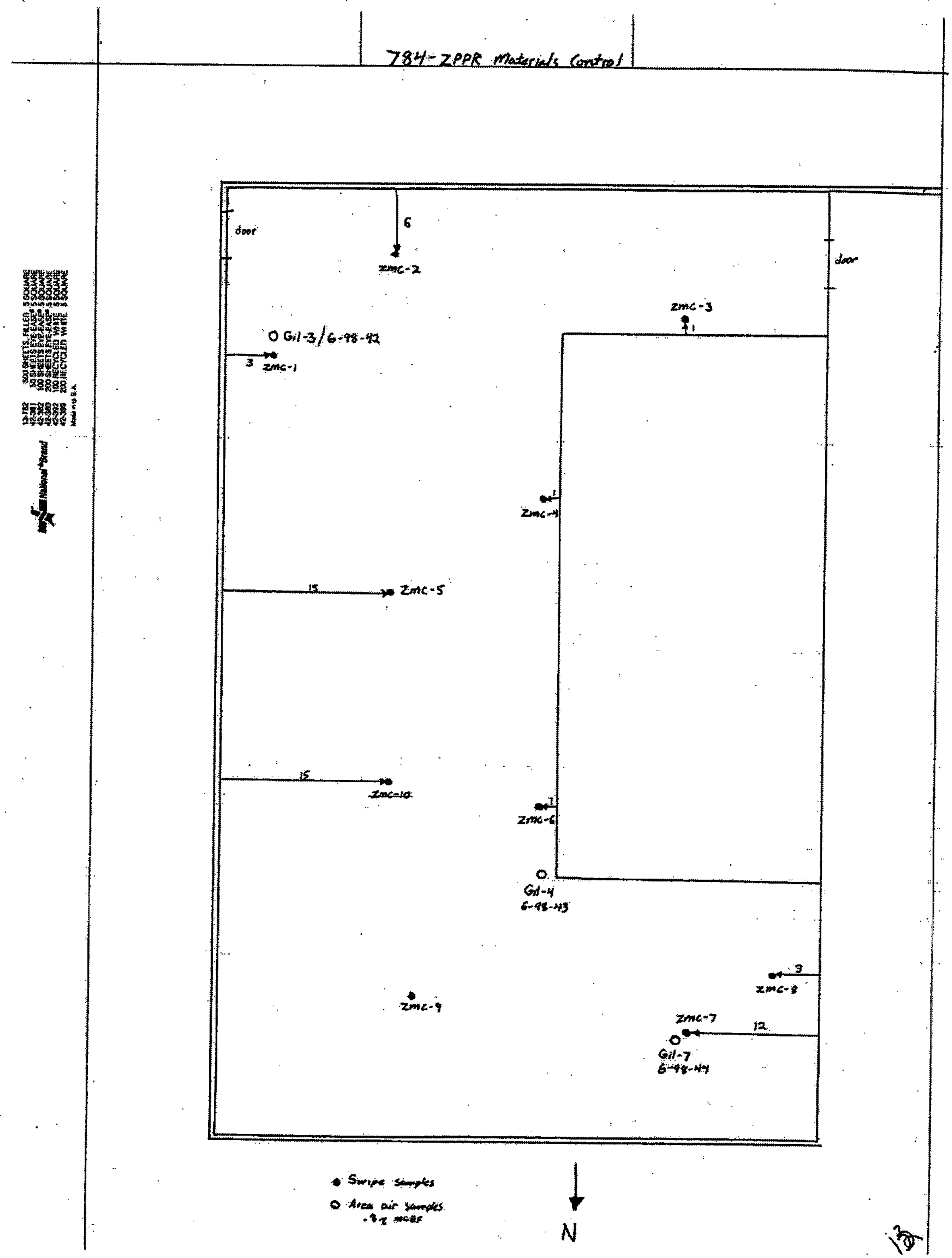
are in a cracked cassette;

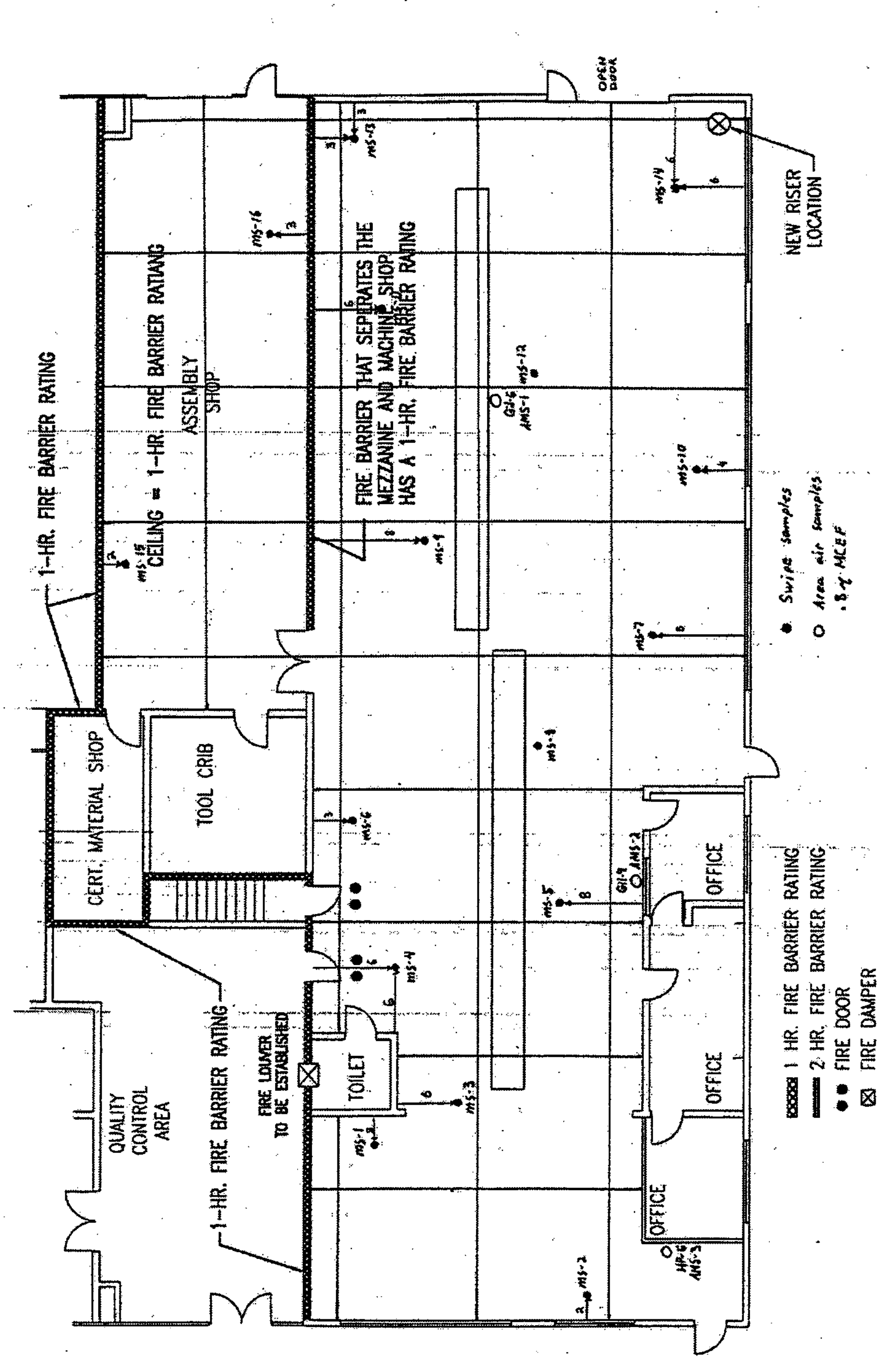
are used in a pump which failed;

are potentially contaminated such as when a sampler is accidentally knocked over or struck sharply by an object;

Shall be Discarded without analysis


776-ZPPR mound
● Swipe samples
O Area air samples
.8 μ MCEF
ZPR-1
ZPR-2
ZPR-3
ZPR-4
ZPR-5
ZPR-6
ZPR-7
ZPR-8
ZPR-9
ZPR-10
6-98-38
6-98-39
6-98-40
13 Total


784-ZPPR Materials Control
door
6
zmc-2
door
zmc-3
O Gil-3/6-98-42
3 zmc-1
Zmc-4
15
Zmc-5
15
zmc-10
Zmc-6
Gil-4
6-98-43
3
zmc-8
zmc-9
zmc-7
12
Gil-7
6-98-44
Swipe samples
Area air samples
N



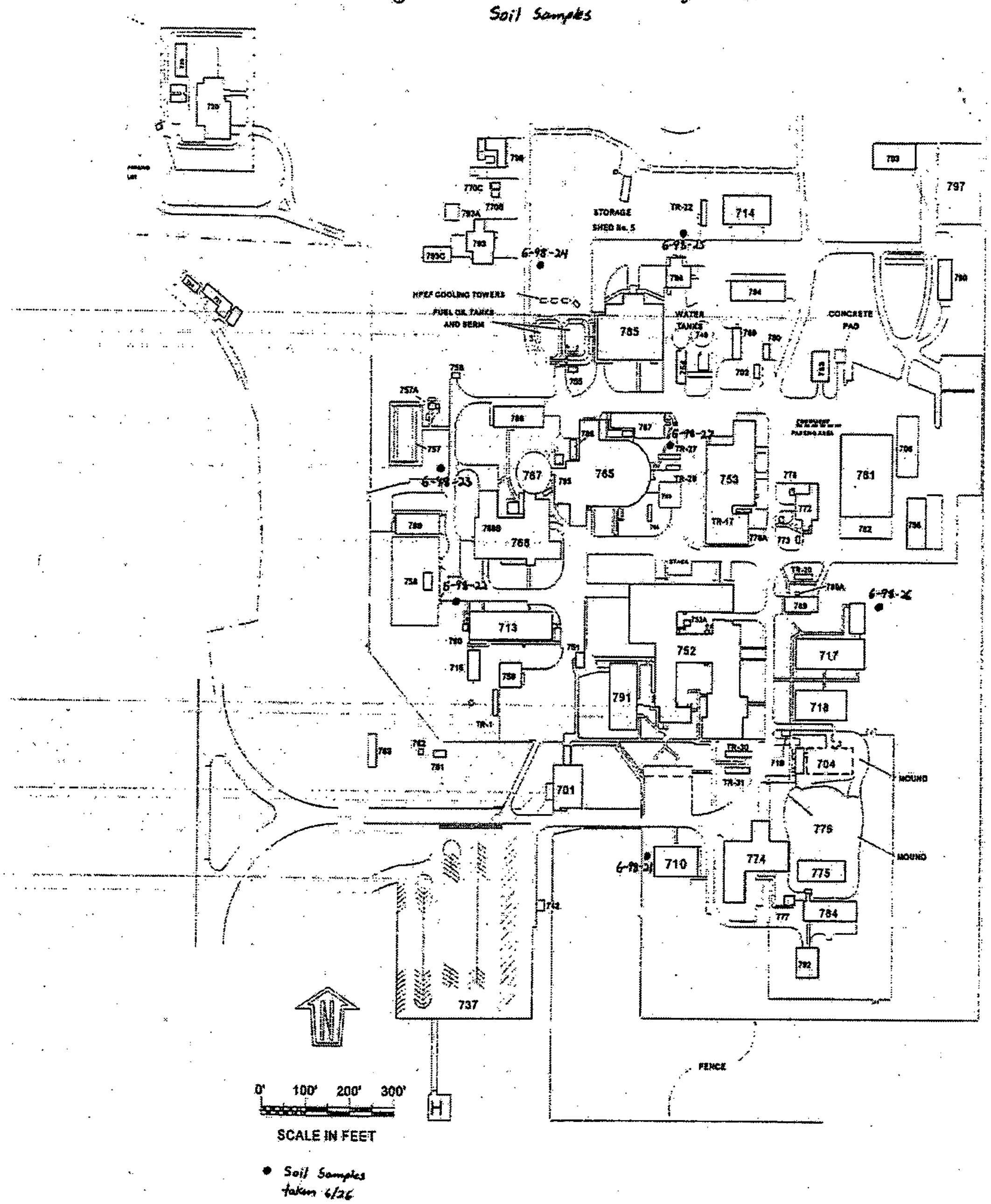
BUILDING 782 - MACHINE SHOP

JUNE 13, 1994/FED
782-005.DWG (PLN-37)

0 1 3 5FT.

Argonne National Laboratory-West

Soil Samples



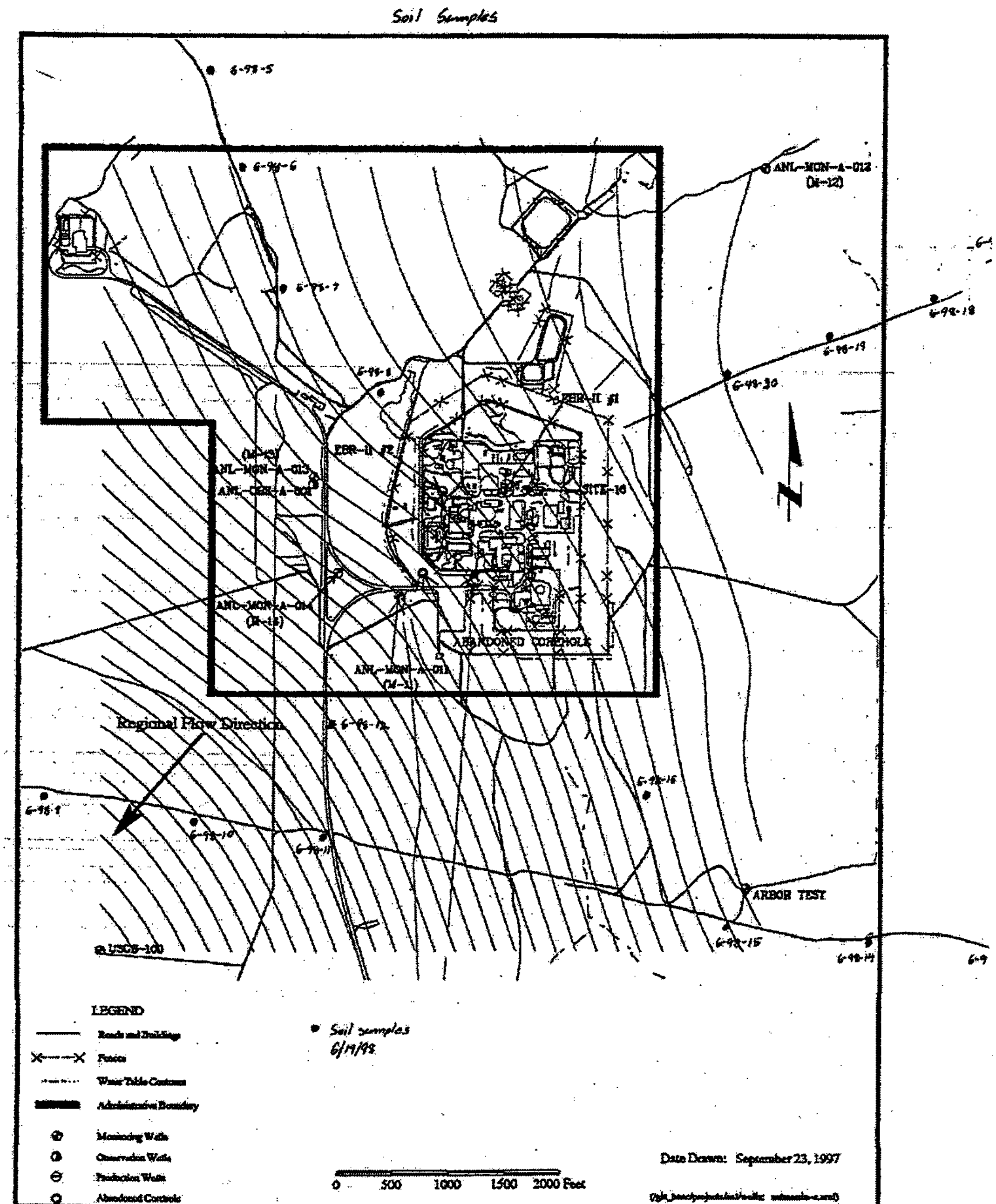


Figure 3-3. Locations of Wells in the ANL–W Area.

METHOD 6020

INDUCTIVELY COUPLED PLASMA - MASS SPECTROMETRY

1.0 SCOPE AND APPLICATION

1.1 Inductively coupled plasma-mass spectrometry (ICP-MS) is applicable to the determination of sub-μg/L concentrations of a large number of elements in water samples and in waste extracts or digests [1,2]. When dissolved constituents are required, samples must be filtered and acid-preserved prior to analysis. No digestion is required prior to analysis for dissolved elements in water samples. Acid digestion prior to filtration and analysis is required for groundwater, aqueous samples, industrial wastes, soils, sludges, sediments, and other solid wastes for which total (acid-leachable) elements are required.

1.2 ICP-MS has been applied to the determination of over 60 elements in various matrices. Analytes for which EPA has demonstrated the acceptability of Method 6020 in a multi-laboratory study on solid wastes are listed in Table 1. Acceptability of the method for an element was based upon the multi-laboratory performance compared with that of either furnace atomic absorption spectroscopy or inductively coupled plasma-atomic emission spectroscopy. It should be noted that the multi-laboratory study was conducted in 1986. Multi-laboratory performance data for the listed elements (and others) are provided in Section 9. Instrument detection limits, sensitivities, and linear ranges will vary with the matrices, instrumentation, and operating conditions. In relatively simple matrices, detection limits will generally be below 0.02 μg/L.

1.3 If Method 6020 is used to determine any analyte not listed in Table 1, it is the responsibility of the analyst to demonstrate the accuracy and precision of the Method in the waste to be analyzed. The analyst is always required to monitor potential sources of interferences and take appropriate action to ensure data of known quality (see Section 8.4).

1.4 Use of this method is restricted to spectroscopists who are knowledgeable in the recognition and in the correction of spectral, chemical, and physical interferences in ICP-MS.

1.5 An appropriate internal standard is required for each analyte determined by ICP-MS. Recommended internal standards are ^{6}Li, ^{45}Sc, ^{89}Y, ^{103}Rh, ^{115}In, ^{159}Tb, ^{165}Ho, and ^{209}Bi. The lithium internal standard should have an enriched abundance of ^{6}Li, so that interference from lithium native to the sample is minimized. Other elements may need to be used as internal standards when samples contain significant amounts of the recommended internal standards.

2.0 SUMMARY OF METHOD

2.1 Prior to analysis, samples which require total ("acid-leachable") values must be digested using appropriate sample preparation methods (such as Methods 3005 - 3051).

2.2 Method 6020 describes the multi-elemental determination of analytes by ICP-MS. The method measures ions produced by a radio-frequency inductively coupled plasma. Analyte species originating in a liquid are nebulized and the resulting aerosol transported by argon gas into the plasma torch. The ions produced are entrained in the plasma gas and introduced, by means of an interface, into a mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-charge ratios and quantified with a channel electron multiplier. Interferences must be assessed and valid corrections applied or the data flagged to indicate problems. Interference correction must include compensation for background ions contributed by the plasma gas, reagents, and constituents of the sample matrix.

3.0 INTERFERENCES

3.1 Isobaric elemental interferences in ICP-MS are caused by isotopes of different elements forming atomic ions with the same nominal mass-to-charge ratio (m/z). A data system must be used to correct for these interferences. This involves determining the signal for another isotope of the interfering element and subtracting the appropriate signal from the analyte isotope signal. Since commercial ICP-MS instruments nominally provide unit resolution at 10% of the peak height, very high ion currents at adjacent masses can also contribute to ion signals at the mass of interest. Although this type of interference is uncommon, it is not easily corrected, and samples exhibiting a significant problem of this type could require resolution improvement, matrix separation, or analysis using another verified and documented isoptope, or use of another method.

3.2 Isobaric molecular and doubly-charged ion interferences in ICP-MS are caused by ions consisting of more than one atom or charge, respectively. Most isobaric interferences that could affect ICP-MS determinations have been identified in the literature [3,4]. Examples include $ArCl^+$ ions on the ^{75}As signal and MoO^+ ions on the cadmium isotopes. While the approach used to correct for molecular isobaric interferences is demonstrated below using the natural isotope abundances from the literature [5], the most precise coefficients for an instrument can be determined from the ratio of the net isotope signals observed for a standard solution at a concentration providing suitable (<1 percent) counting statistics. Because the ^{35}Cl natural abundance of 75.77 percent is 3.13 times the ^{37}Cl abundance of 24.23 percent, the chloride correction for arsenic can be calculated (approximately) as follows (where the $^{38}Ar^{37}Cl^+$ contribution at m/z 75 is a negligible 0.06 percent of the $^{40}Ar^{35}Cl^+$ signal):

corrected arsenic signal (using natural isotopes abundances for coefficient approximations) =

(m/z 75 signal) - (3.13) (m/z 77 signal) + (2.73) (m/z 82 signal), (where the final term adjusts for any selenium contribution at 77 m/z),

NOTE: Arsenic values can be biased high by this type of equation when the net signal at m/z 82 is caused by ions other than $^{82}Se^+$, (e.g., $^{81}BrH^+$ from bromine wastes [6]).

Similarly,

corrected cadmium signal (using natural isotopes abundances for coefficient approximations) =

(m/z 114 signal) - (0.027)(m/z 118 signal) - (1.63)(m/z 108 signal), (where last 2 terms adjust for any tin or MoO^+ contributions at m/z 114).

NOTE: Cadmium values will be biased low by this type of equation when $^{92}ZrO^+$ ions contribute at m/z 108, but use of m/z 111 for Cd is even subject to direct ($^{94}ZrOH^+$) and indirect ($^{90}ZrO^+$) additive interferences when Zr is present.

NOTE: As for the arsenic equation above, the coefficients in the Cd equation are ONLY illustrative. The most appropriate coefficients for an instrument can be determined from the ratio of the net isotope signals observed for a standard solution at a concentration providing suitable (<1 percent) counting precision.

The accuracy of these types of equations is based upon the constancy of the OBSERVED isotopic ratios for the interfering species. Corrections that presume a constant fraction of a molecular ion relative to the "parent" ion have not been found [7] to be reliable, e.g., oxide levels can vary. If a correction for an oxide ion is based upon the ratio of parent-to-oxide ion intensities, the correction must be adjusted for the degree of oxide formation by the use of an appropriate oxide internal standard previously demonstrated to form a similar level of oxide as the interferant. This type of correction has been reported [7] for oxide-ion corrections using ThO^+/Th^+ for the determination of rare earth elements. The use of aerosol desolvation and/or mixed plasmas have been shown to greatly reduce molecular interferences [8]. These techniques can be used provided that method detection limits, accuracy, and precision requirements for analysis of the samples can be met.

3.3 Physical interferences are associated with the sample nebulization and transport processes as well as with ion-transmission efficiencies. Nebulization and transport processes can be affected if a matrix component causes a change in surface tension or viscosity. Changes in matrix composition can cause significant signal suppression or enhancement [9]. Dissolved solids can deposit on the nebulizer tip of a pneumatic nebulizer and on the interface skimmers (reducing the orifice size and the instrument performance). Total solid levels below 0.2% (2,000 mg/L) have been currently recommended [10] to minimize solid deposition. An internal standard can be used to correct for physical interferences, if it is carefully matched to the analyte so that the two elements are similarly affected by matrix changes [11]. When the intensity level of an internal standard is less than 30 percent or greater than 120 percent of the intensity of the first standard used during calibration, the sample must be reanalyzed after a fivefold (1+4) or greater dilution has been performed.

3.4 Memory interferences can occur when there are large concentration differences between samples or standards which are analyzed sequentially. Sample deposition on the sampler and skimmer cones, spray chamber design, and the type of nebulizer affect the extent of the memory interferences which are observed. The rinse period between samples must be long enough to eliminate significant memory interference.

4.0 APPARATUS AND MATERIALS

4.1 Inductively coupled plasma-mass spectrometer:

4.1.1 A system capable of providing resolution, better than or equal to amu at 10% peak height is required. The system must have a mass range from at least 6 to 240 amu and a data system that allows corrections for isobaric interferences and the application of the internal standard technique. Use of a mass-flow controller for the nebulizer argon and a peristaltic pump for the sample solution are recommended.

4.1.2 Argon gas supply: high-purity grade (99.99%).

5.0 REAGENTS

5.1 Acids used in the preparation of standards and for sample processing must be of high purity. Redistilled acids are recommended because of the high sensitivity of ICP-MS. Nitric acid at less than 2 per cent (v/v) is required for ICP-MS to minimize damage to the interface and to minimize isobaric molecular-ion interferences with the analytes. Many more molecular-ion interferences are observed on the analytes when hydrochloric and sulfuric acids are used [3,4]. Concentrations of antimony and silver between 50-500 µg/L require 1% (v/v) HCl for stability; for concentrations above 500 µg/L Ag, additional HCl will be needed.

5.2 Reagent water: All references to water in the method refer to reagent water unless otherwise specified. Refer to Chapter One for a definition of reagent water.

5.3 Standard stock solutions may be purchased or prepared from ultra-high purity grade chemicals or metals (99.99 or greater purity). See Method 6010A, Section 5.3, for instructions on preparing standard solutions from solids.

5.3.1 Bismuth internal standard solution, stock, 1 mL = 100 µg Bi: Dissolve 0.1115 g Bi_2O_3 in a minimum amount of dilute HNO_3 . Add 10 mL conc. HNO_3 and dilute to 1,000 mL with reagent water.

5.3.2 Holmium internal standard solution, stock, 1 mL = 100 µg Ho: Dissolve 0.1757 g $Ho_2(CO_3)_2 5H_2O$ in 10 mL reagent water and 10 mL HNO_3. After dissolution is complete, warm the solution to degas. Add 10 mL conc. HNO_3 and dilute to 1,000 mL with reagent water.

5.3.3 Indium internal standard solution, stock, 1 mL = 100 µg In: Dissolve 0.1000 g indium metal in 10 mL conc. HNO_3. Dilute to 1,000 mL with reagent water.

5.3.4 Lithium internal standard solution, stock, 1 mL = 100 µg ^6Li: Dissolve 0.6312 g 95-atom-% ^6Li, Li_2CO_3 in 10 mL of reagent water and 10 mL HNO_3. After dissolution is complete, warm the solution to degas. Add 10 mL conc. HNO_3 and dilute to 1,000 mL with reagent water.

5.3.5 Rhodium internal standard solution, stock, 1 mL = 100 µg Rh: Dissolve 0.3593 g ammonium hexachlororhodate (III) $(NH_4)_3RhCl_6$ in 10 mL reagent water. Add 100 mL conc. HCl and dilute to 1,000 mL with reagent water.

5.3.6 Scandium internal standard solution, stock, 1 mL = 100 µg Sc: Dissolve 0.15343 g Sc_2O_3 in 10 mL (1+1) hot HNO_3. Add 5 mL conc. HNO_3 and dilute to 1,000 mL with reagent water.

5.3.7 Terbium internal standard solution, stock, 1 mL = 100 µg Tb: Dissolve 0.1828 g $Tb_2(CO_3)_3 \cdot 5H_2O$ in 10 mL (1+1) HNO_3. After dissolution is complete, warm the solution to degas. Add 5 mL conc. HNO_3 and dilute to 1,000 mL with reagent water.

5.3.8 Yttrium internal standard solution, stock, 1 mL = 100 µg Y: Dissolve 0.2316 g $Y_2(CO_3)_3 \cdot 3H_2O$ in 10 mL (1+1) HNO_3. Add 5 mL conc. HNO_3 and dilute to 1,000 mL with reagent water.

5.3.9 Titanium solution, stock, 1 mL = 100 µg Ti: Dissolve 0.4133 g $(NH_4)_2TiF_6$ in reagent water. Add 2 drops conc. HF and dilute to 1,000 mL with reagent water.

5.3.10 Molybdenum solution, stock, 1 mL = 100 µg Mo: Dissolve 0.2043 g $(NH_4)_2MoO_4$ in reagent water. Dilute to 1,000 mL with reagent water.

5.4 Mixed calibration standard solutions are prepared by diluting the stock-standard solutions to levels in the linear range for the instrument in a solvent consisting of 1 percent (v/v) HNO_3 in reagent water. The calibration standard solutions must contain a suitable concentration of an appropriate internal standard for each analyte. Internal standards may be added on-line at the time of analysis using a second channel of the peristaltic pump and an appropriate mixing manifold.) Generally, an internal standard should be no more than 50 amu removed from the analyte. Recommended internal standards include ^6Li, ^{45}Sc, ^{89}Y, ^{103}Rh, ^{115}In, ^{159}Tb, ^{169}Ho, and ^{209}Bi. Prior to preparing the mixed standards, each stock solution must be analyzed separately to determine possible spectral interferences or the presence of impurities. Care must be taken when preparing the mixed standards that the elements are compatible and stable. Transfer the mixed standard solutions to freshly acid-cleaned FEP fluorocarbon bottles for storage. Fresh mixed standards must be prepared as needed with the realization that concentrations can change on aging. Calibration standards must be initially verified using a quality control standard (see Section 5.7) and monitored weekly for stability.

5.5 Blanks: Three types of blanks are required for the analysis. The calibration blank is used in establishing the calibration curve. The preparation blank is used to monitor for possible contamination resulting from the sample preparation procedure. The rinse blank is used to flush the system between all samples and standards.

5.5.1 The calibration blank consists of the same concentration(s) of the same acid(s) used to prepare the final dilution of the calibrating solutions of the analytes [often 1 percent HNO_3 (v/v) in reagent water] along with the selected concentrations of internal standards such that there is an appropriate internal standard element for each of the analytes. Use of HCl for antimony and silver is cited in Section 5.1

5.5.2 The preparation (or reagent) blank must be carried through the complete preparation procedure and contain the same volumes of reagents as the sample solutions.

5.5.3 The rinse blank consists of 1 to 2 percent HNO_3 (v/v) in reagent water. Prepare a sufficient quantity to flush the system between standards and samples.

NOTE: The ICS solutions in Table 2 are intended to evaluate corrections for known interferences on only the analytes in Table 1. If Method 6020 is used to determine an element not listed in Table 1, it is the responsibility of the analyst to modify the ICS solutions, or prepare an alternative ICS solution, to allow adequate verification of correction of interferences on the unlisted element (see section 8.4).

5.6 The interference check solution (ICS) is prepared to contain known concentrations of interfering elements that will demonstrate the magnitude of interferences and provide an adequate test of any corrections. Chloride in the ICS provides a means to evaluate software corrections for chloride-related interferences such as $^{35}Cl^{16}O^+$ on $^{51}V^+$ and $^{40}Ar^{35}Cl^+$ on $^{75}As^+$. Iron is used to demonstrate adequate resolution of the spectrometer for the determination of manganese. Molybdenum serves to indicate oxide effects on cadmium isotopes. The other components are present to evaluate the ability of the measurement system to correct for various molecular-ion isobaric interferences. The ICS is used to verify that the interference levels are corrected by the data system within quality control limits.

5.6.1 These solutions must be prepared from ultra-pure reagents. They can be obtained commercially or prepared by the following procedure.

5.6.1.1 Mixed ICS solution I may be prepared by adding 13.903 g $Al(NO_3)_3 \cdot 9H_2O$, 2.498 g $CaCO_3$ (dried at 180 C for 1 h before weighing), 1.000 g Fe, 1.658 g MgO, 2.305 g Na_2CO_3, and 1.767 g K_2CO_3 to 25 mL of reagent water. Slowly add 40 mL of (1+1) HNO_3. After dissolution is complete, warm the solution to degas. Cool and dilute to 1,000 mL with reagent water.

5.6.1.2 Mixed ICS solution II may be prepared by slowly adding 7.444 g 85 % H_3PO_4, 6.373 g 96% H_2SO_4, 40.024 g 37% HCl, and 10.664 g citric acid $C_6O_7H_8$ to 100 mL of reagent water. Dilute to 1,000 mL with reagent water.

5.6.1.3 Mixed ICS solution III may be prepared by adding 1.00 mL each of 100-µg/mL arsenic, cadmium, chromium, cobalt, copper, manganese, nickel, silver, and zinc stock solutions to about

50 mL reagent water. Add 2.0 mL concentrated HNO_3, and dilute to 100.0 mL with reagent water.

5.6.1.4 Working ICS Solutions

5.6.1.4.1 ICS-A may be prepared by adding 10.0 mL of mixed ICS solution I (5.7.1.1), 2.0 mL each of 100-μg/mL titanium stock solution (5.3.9) and molybdenum stock solution (5.3.10), and 5.0 mL of mixed ICS solution II (5.7.1.2). Dilute to 100 mL with reagent water. ICS solution A must be prepared fresh weekly.

5.6.1.4.2 ICS-AB may be prepared by adding 10.0 mL of mixed ICS solution I (5.7.1.1), 2.0 mL each of 100-μg/mL titanium stock solution (5.3.9) and molybdenum stock solution (5.3.10), 5.0 mL of mixed ICS solution II (5.7.1.2), and 2.0 mL of Mixed ICS solution III (5.7.1.3). Dilute to 100 mL with reagent water. Although the ICS solution AB must be prepared fresh weekly, the analyst should be aware that the solution may precipitate silver more quickly.

5.7 The quality control standard is the initial calibration verification solution (ICV), which must be prepared in the same acid matrix as the calibration standards. This solution must be an independent standard near the midpoint of the linear range at a concentration other than that used for instrument calibration. An independent standard is defined as a standard composed of the analytes from a source different from those used in the standards for instrument calibration.

5.8 Mass spectrometer tuning solution. A solution containing elements representing all of the mass regions of interest (for example, 10 μg/L of Li, Co, In, and Tl) must be prepared to verify that the resolution and mass calibration of the instrument are within the required specifications (see Section 7.5). This solution is also used to verify that the instrument has reached thermal stability (See Section 7.4).

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 Sample collection procedures should address the considerations described in Chapter Nine of this Manual.

6.2 See the introductory material in Chapter Three, Inorganic Analytes, Sections 3.1.3 for information on sample handling and preservation. Only polyethylene or fluorocarbon (TFE or PFA) containers are recommended for use in Method 6020.

7.0 PROCEDURE

7.1 Solubilization and digestion procedures are presented in the Sample Preparation Methods (e.g., Methods 3005 - 3051).

7.2 Initiate appropriate operating configuration of the instruments computer according to the instrument manufacturer's instructions.

7.3 Set up the instrument with the proper operating parameters according to the instrument manufacturer's instructions.

7.4 Operating conditions: The analyst should follow the instructions provided by the instrument manufacturer. Allow at least 30 minutes for the instrument to equilibrate before analyzing any samples. This must be verified by analyzing a tuning solution (Section 5.8) at least four times with relative standard deviations of ≤ 5% for the analytes contained in the tuning solution.

> NOTE: Precautions must be taken to protect the channel electron multiplier from high ion currents. The channel electron multiplier suffers from fatigue after being exposed to high ion currents. This fatigue can last from several seconds to hours depending on the extent of exposure. During this time period, response factors are constantly changing, which invalidates the calibration curve, causes instability, and invalidates sample analyses.

7.5 Conduct mass calibration and resolution checks in the mass regions of interest. The mass calibration and resolution parameters are required criteria which must be met prior to any samples being analyzed. If the mass calibration differs more than 0.1 amu from the true value, then the mass calibration must be adjusted to the correct value. The resolution must also be verified to be less than 0.9 amu full width at 10 percent peak height.

7.6 Calibrate the instrument for the analytes of interest (recommended isotopes for the analytes in Table 1 are provided in Table 3), using the calibration blank and at least a single initial calibration standard according to the instrument manufacturer's procedure. Flush the system with the rinse blank (5.5.3) between each standard solution. Use the average of at leastthree integrations for both calibration and sample analyses.

7.7 All masses which could affect data quality should be monitored to determine potential effects from matrix components on the analyte peaks. The recommended isotopes to be monitored are liste in Table 3.

7.8 Immediately after the calibration has been established, the calibration must be verified and documented for every analyte by the analysis of the calibration verification solution (Section 5.7). When measurements exceed ± 10% of the accepted value, the analyses must be terminated, the problem corrected, the instrument recalibrated, and the new calibration verified. Any samples analyzed under an out-of-control calibration must be reanalyzed. During the course of an analytical run, the instrument may be "resloped" or recalibrated to correct for instrument drift. A recalibration must then be followed immediately by a new analysis of a CCV and CCB before any further samples may be analyzed.

7.9 Flush the system with the rinse blank solution (5.5.3) until the signal levels return to the method's levels of quantitation (usually about 30 seconds) before the analysis of each sample (see Section 7.7). Nebulize each sample until a steady-state signal is achieved (usually about 30 seconds) prior to collecting data. Analyze the calibration verification solution (Section 5.6) and the calibration blank (Section 5.5.1) at a frequency of at least once every 10 analytical samples. Flow-injection systems may be used as long as they can meet the performance criteria of this method.

7.10 Dilute and reanalyze samples that are more concentrated than the linear range for an analyte (or species needed for a correction) or measure an alternate less-abundant isotope. The linearity at the alternate mass must be confirmed by appropriate calibration (see Sec. 7.6 and 7.8).

7.11 Calculations: The quantitative values shall be reported in appropriate units, such as micrograms per liter (µg/L) for aqueous samples and milligrams per kilogram (mg/kg) for solid samples. If dilutions were performed, the appropriate corrections must be applied to the sample values.

7.11.1 If appropriate, or required, calculate results for solids on a dry-weight basis as follows:

(1) A separate determination of percent solids must be performed.

(2) The concentrations determined in the digest are to be reported on the basis of the dry weight of the sample.

$$\text{Concentration (dry weight)(mg/kg)} = \frac{C \times V}{W \times S}$$

Where,

C = Digest Concentration (mg/L)
V = Final volume in liters after sample preparation
W = Weight in kg of wet sample

$$S = \frac{\%\ \text{Solids}}{100}$$

Calculations should include appropriate interference corrections (see Section 3.2 for examples), internal-standard normalization, and the summation of signals at 206, 207, and 208 m/z for lead (to compensate for any differences in the abundances of these isotopes between samples and standards).

8.0 QUALITY CONTROL

8.1 All quality control data should be maintained and be available for easy reference or inspection.

8.2 Instrument Detection Limits (IDLs) in µg/L can be estimated by calculating the average of the standard deviations of the three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day. Each measurement must be performed as though it were a separate analytical sample (i.e., each measurement must be followed by a rinse and/or any other procedure normally performed between the analysis of separate samples). IDLs must be determined at least every three months and kept with the instrument log book. Refer to Chapter One for additional guidance.

8.3 The intensities of all internal standards must be monitored for every analysis. When the intensity of any internal standard fails to fall between 30 and 120 percent of the intensity of that internal standard in the initial calibration standard, the following procedure is followed. The sample must be diluted fivefold (1+4) and reanalyzed with the addition of appropriate amounts of internal standards. This procedure must be repeated until the internal-standard intensities fall within the prescribed window. The intensity levels of the internal standards for the calibration blank (Section 5.5.1) and instrument check standard (Section 5.6) must agree within ± 20 percent of the intensity level of the internal standard of the original calibration solution. If they do not agree, terminate the analysis, correct the problem, recalibrate, verify the new calibration, and reanalyze the affected samples.

8.4 To obtain analyte data of known quality, it is necessary to measure more than the analytes of interest in order to apply corrections or to determine whether interference corrections are necessary. If the concentrations of interference sources (such as C, Cl, Mo, Zr, W) are such that, at the correction factor, the analyte is less than the limit of quantification and the concentration of interferents are insignificant, then the data may go uncorrected. Note that monitoring the interference sources does not necessarily require monitoring the interferant itself, but that a molecular species may be monitored to indicate the presence of the interferent. When correction equations are used, all QC criteria must also be met. Extensive QC for interference corrections are required at all times. The monitored masses must include those elements whose hydrogen, oxygen, hydroxyl, chlorine, nitrogen, carbon and sulfur molecular ions could impact the analytes of interest. Unsuspected interferences may be detected by adding pure major matrix components to a sample to observe any impact on the analyte signals. When an interference source is present, the sample elements impacted must be flagged to indicate (a) the percentage interference correction applied to the data or (b) an uncorrected interference by virtue of the elemental equation used for quantitation. The isotope proportions for an element or molecular-ion cluster provide information useful for quality assurance.

NOTE: Only isobaric elemental, molecular, and doubly charged interference corrections which use the observed isotopic-response ratios or parent-to-oxide ratios (provided an oxide internal standard is used as described in Section 3.2) for each instrument system are acceptable corrections for use in Method 6020.

8.5 Dilution Test: If the analyte concentration is within the linear dynamic range of the instrument and sufficiently high (minimally, a factor of at least 100 times greater than the concentration in the reagent blank, refer to Section 5.5.2), an analysis of a fivefold (1+4) dilution must agree within ± 10% of the original determination. If not, an interference effect must be suspected. One dilution test must be included for each twenty samples (or less) of each matrix in a batch.

8.6 Post-Digestion Spike Addition: An analyte spike added to a portion of a prepared sample, or its dilution, should be recovered to within 75 to 125 percent of the known value or within the laboratory derived acceptance criteria. The spike addition should be based on the indigenous concentration of each element of interest in the sample. If the spike is not recovered within the specified limits, the sample must be diluted and reanalyzed to compensate for the matrix effect. Results must agree to within 10% of the original determination. The use of a standard-addition analysis procedure may also be used to compensate for this effect (Refer to Method 7000).

8.7 A Laboratory Control Sample (LCS) should be analyzed for each analyte using the same sample preparations, analytical methods and QA/QC procedures employed for the test samples. One LCS should be prepared and analyzed for each sample batch at a frequency of one LCS for each 20 samples or less.

8.8 Check the instrument calibration by analyzing appropriate quality control solutions as follows:

8.8.1 Check instrument calibration using a calibration blank (Section 5.5.1) and the initial calibration verification solution (Sections 5.7 and 7.9).

8.8.2 Verify calibration at a frequency of every 10 analytical samples with the instrument check standard (Section 5.6) and the calibration blank (Section 5.5.1). These solutions must also be analyzed for each analyte at the beginning of the analysis and after the last sample.

8.8.3 The results of the initial calibration verification solution and the instrument check standard must agree within ± 10% of the expected value. If not, terminate the analysis, correct the problem, and recalibrate the instrument. Any sample analyzed under an out-of-control calibration must be reanalyzed.

8.8.4 The results of the calibration blank must be less than 3 times the current IDL for each element. If this is not the case, the reason for the out-of-control condition must be found and corrected, and affected samples must be reanalyzed. If the laboratory consistently has concentrations greater than 3 times the IDL, the IDL may be indicative of an estimated IDL and should be re-evaluated.

8.9 Verify the magnitude of elemental and molecular-ion isobaric interferences and the adequacy of any corrections at the beginning of an analytical run or once every 12 hours, whichever is more frequent. Do this by analyzing the interference check solutions A and AB. The analyst should be aware that precipitation from solution AB may occur with some elements, specifically silver. Refer to Section 3.0 for a discussion on intereferences and potential solutions to those intereferences if additional guidance is needed.

8.10 Analyze one duplicate sample for every matrix in a batch at a frequency of one matrix duplicate for every 20 samples.

8.10.1 The relative percent difference (RPD) between duplicate determinations must be calculated as follows:

$$RPD = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \times 100$$

where:

RPD = relative percent difference.
D_1 = first sample value.
D_2 = second sample value (duplicate)

A control limit of 20% RPD should not be exceeded for analyte values greater than 100 times the instrumental detection limit. If this limit is exceeded, the reason for the out-of-control situation must be found and corrected, and any samples analyzed during the out-of-control condition must be reanalyzed.

9.0 METHOD PERFORMANCE

9.1 In an EPA multi-laboratory study, 10 laboratories applied the ICP-MS technique to both aqueous and solid samples. TABLE 4 summarizes the method performance data for aqueous samples. Performance data for solid samples is provided in TABLE 5.

10.0 REFERENCES

1. Horlick, G., et al., Spectrochim. Acta 40B, 1555 (1985).
2. Gray, A.L., Spectrochim. Acta 40B, 1525 (1985); 41B, 151 (1986).
3. Tan, S.H., and Horlick, G., Appl. Spectrosc. 40, 445 (1986).
4. Vaughan, M.A., and Horlick, G., Appl. Spectrosc. 40, 434 (1986).
5. Holden, N.E., "Table of the Isotopes," in Lide, D.R., Ed., CRC Handbook of Chemistry and Physics, 74th Ed., CRC Press, Boca Raton, FL, 1993.
6. Hinners, T.A., Heithmar, E., Rissmann, E., and Smith, D., Winter Conference on Plasma Spectrochemistry, Abstract THP18; p. 237, San Diego, CA (1994).
7. Lichte, F.E., et al., Anal. Chem. 59, 1150 (1987).
8. Evans E.H., and Ebdon, L., J. Anal. At. Spectrom. 4, 299 (1989).
9. Beauchemin, D., et al., Spectrochim. Acta 42B, 467 (1987).
10. Houk, R.S., Anal. Chem. 58, 97A (1986).
11. Thompson, J.J., and Houk, R.S., Appl. Spectrosc. 41, 801 (1987).

TABLE 1. ELEMENTS APPROVED FOR ICP-MS DETERMINATION

Element	CAS* #
Aluminum	7429-90-5
Antimony	7440-36-0
Arsenic	7440-38-2
Barium	7440-39-3
Beryllium	7440-41-7
Cadmium	7440-43-9
Chromium	7440-47-3
Cobalt	7440-48-4
Copper	7440-50-8
Lead	7439-92-1
Manganese	7439-96-5
Nickel	7440-02-0
Silver	7440-22-4
Thallium	7440-28-0
Zinc	7440-66-6

TABLE 2. RECOMMENDED INTERFERENCE CHECK SAMPLE COMPONENTS AND CONCENTRATIONS

Solution component	Solution A Concentration(mg/L)	Solution AB Concentration (mg/L)
Al	100.0	100.0
Ca	100.0	100.0
Fe	100.0	100.0
Mg	100.0	100.0
Na	100.0	100.0
P	100.0	100.0
K	100.0	100.0
S	100.0	100.0
C	200.0	200.0
Cl	1000.0	1000.0
Mo	2.0	2.0
Ti	2.0	2.0
As	0.0	0.0200
Cd	0.0	0.0200
Cr	0.0	0.0200
Co	0.0	0.0200
Cu	0.0	0.0200
Mn	0.0	0.0200
Ni	0.0	0.0200
Ag	0.0	0.0200
Zn	0.0	0.0200

TABLE 3. RECOMMENDED ISOTOPES FOR SELECTED ELEMENTS

Mass	Element of interest
27	Aluminum
121, 123	Antimony
75	Arsenic
138, 137, 136, 135, 134	Barium
9	Beryllium
209	Bismuth (IS)
114, 112, 111, 110, 113, 116, 106	Cadmium
42, 43, 44, 46, 48	Calcium (I)
35, 37, (77, 82)[a]	Chlorine (I)
52, 53, 50, 54	Chromium
59	Cobalt
63, 65	Copper
165	Holmium (IS)
115, 113	Indium (IS)
56, 54, 57, 58	Iron (I)
139	Lanthanum (I)
208, 207, 206, 204	Lead
6[b], 7	Lithium (IS)
24, 25, 26	Magnesium (I)
55	Manganese
98, 96, 92, 97, 94, (108)[a]	Molybdenum (I)
58, 60, 62, 61, 64	Nickel
39	Potassium (I)
103	Rhodium (IS)
45	Scandium (IS)
107, 109	Silver
23	Sodium (I)
159	Terbium (IS)
205, 203	Thallium
120, 118	Tin (I)
89	Yttrium (IS)
64, 66, 68, 67, 70	Zinc

NOTE: Method 6020 is recommended for only those analytes listed in Table 1. Other elements are included in this table because they are potential interferents (labeled I) in the determination of recommended analytes, or because they are commonly used internal standards (labeled IS). Isotopes are listed in descending order of natural abundance. The most generally useful isotopes are underlined and in boldface, although certain matrices may require the use of alternative isotopes. [a] These masses are also useful for interference correction (Section 3.2). [b] Internal standard must be enriched in the ^{6}Li isotope. This minimizes interference from indigenous lithium.

TABLE 4. ICP-MS MULTI-LABORATORY PRECISION AND ACCURACY DATA FOR AQUEOUS SOLUTIONS

Element	Comparability[a] Range	%RSD Range	N[b]	S[c]
Aluminum	95 - 100	11 - 14	14 - 14	4
Antimony	[d]	5.0 - 7.6	16 - 16	3
Arsenic	97 - 114	7.1 - 48	12 - 14	4
Barium	91 - 99	4.3 - 9.0	16 - 16	5
Beryllium	103 - 107	8.6 - 14	13 - 14	3
Cadmium	98 - 102	4.6 - 7.2	18 - 20	3
Calcium	99 - 107	5.7 - 23	17 - 18	5
Chromium	95 - 105	13 - 27	16 - 18	4
Cobalt	101 - 104	8.2 - 8.5	18 - 18	3
Copper	85 - 101	6.1 - 27	17 - 18	5
Iron	91 - 900	11 - 150	10 - 12	5
Lead	71 - 137	11 - 23	17 - 18	6
Magnesium	98 - 102	10 - 15	16 - 16	5
Manganese	95 - 101	8.8 - 15	18 - 18	4
Nickel	98 - 101	6.1 - 6.7	18 - 18	2
Potassium	101 - 114	9.9 - 19	11 - 12	5
Selenium	102 - 107	15 - 25	12 - 12	3
Silver	104 - 105	5.2 - 7.7	13 - 16	2
Sodium	82 - 104	24 - 43	9 - 10	5
Thallium	88 - 97	9.7 - 12	18 - 18	3
Vanadium	107 - 142	23 - 68	8 - 13	3
Zinc	93 - 102	6.8 - 17	16 - 18	5

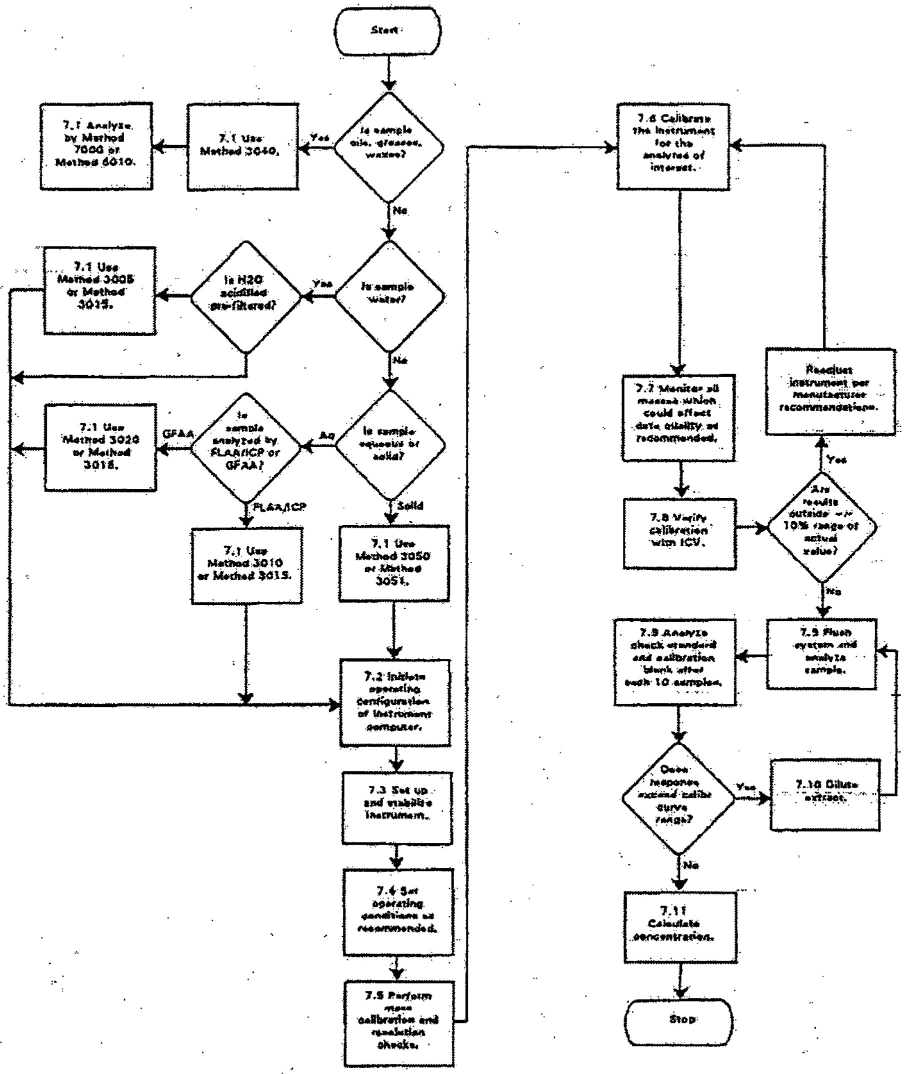
[a] Comparability refers to the percent agreement of mean ICP-MS values to those of the reference technique. [b] N is the range of the number of ICP-MS measurements where the analyte values exceed the limit of quantitation (3.3 times the average IDL value). [c] S is the number of samples with results greater than the limit of quantitation. [d] No comparability values are provided for antimony because of evidence that the reference data is affected by an interference.

TABLE 5. ICP-MS MULTI-LABORATORY PRECISION AND ACCURACY DATA FOR SOLID MATRICES

Element	Comparability[a] Range	%RSD Range	N[b]	S[c]
Aluminum	83 - 101	11 - 39	13 - 14	7
Antimony	d	12 - 21	15 - 16	2
Arsenic	79 - 102	12 - 23	16 - 16	7
Barium	100 - 102	4.3 - 17	15 - 16	7
Beryllium	50 - 87	19 - 34	12 - 14	5
Cadmium	93 - 100	6.2 - 25	19 - 20	5
Calcium	95 - 109	4.1 - 27	15 - 17	7
Chromium	77 - 98	11 - 32	17 - 18	7
Cobalt	43 - 102	15 - 30	17 - 18	6
Copper	90 - 109	9.0 - 25	18 - 18	7
Iron	87 - 99	6.7 - 21	12 - 12	7
Lead	90 - 104	5.9 - 28	15 - 18	7
Magnesium	89 - 111	7.6 - 37	15 - 16	7
Manganese	80 - 108	11 - 40	16 - 18	7
Nickel	87 - 117	9.2 - 29	16 - 18	7
Potassium	97 - 137	11 - 62	10 - 12	5
Selenium	81	39	12	1
Silver	43 - 112	12 - 33	15 - 15	3
Sodium	100 - 146	14 - 77	8 - 10	5
Thallium	91	33	18	1
Vanadium	83 - 147	20 - 70	6 - 14	7
Zinc	84 - 124	14 - 42	18 - 18	7

[a] Comparability refers to the percent agreement of mean ICP-MS values to those of the reference technique. [b] N is the range of the number of ICP-MS measurements where the analyte values exceed the limit of quantitation (3.3 times the average IDL value). [c] S is the number of samples with results greater than the limit of quantitation. [d] No comparability values are provided for antimony because of evidence that the reference data is affected by an interference.

METHOD 6020
INDUCTIVELY COUPLED PLASMA - MASS SPECTROMETRY



SURVEY RESULTS and CONCLUSIONS
For Baseline Beryllium Sampling for
MFC-775,776,782, 784
Performed on 4/21/2008-4/22/2008

Beryllium surface contamination sampling of potential legacy contaminated facilities was conducted by ANL Industrial Hygiene personnel in 1998. The method of sampling and analysis performed was in compliance with standards in effect at that time for beryllium. During a recent review of these beryllium area wipe samples for surface contamination, it was identified that the sensitivity for the analytical level of detection for the samples was $4ug/100cm^2$. Current wipe sample analytical sensitivity is expected to ensure surface contamination levels are not > 0.2 $ug/100cm^2$, which is the current level for free release in 10 CFR 850 *Chronic Beryllium Disease Prevention.*

In response, the areas identified in the 1998 sampling report, MFC-775,776,782 and 784 were re-sampled using the protocol identified in PLN-1747 "Idaho National Engineering and Environmental Laboratory Site Beryllium Contamination Sampling and Analysis Plan". This sampling was performed on 4/21/2008-4/22/2008. This report gives a summary of the analytical results and conclusions.

SURVEY RESULTS and CONCLUSIONS For MFC-775

MFC-775 is also known as the Zero Power Physics Reactor (ZPPR) work room. This building was used for assembly of experiments for the ZPPR reactor. This work included handling beryllium and beryllium oxide plates. All beryllium wipe samples were below the analytical reporting limit or limit of quantification. (No Pictures Available)

SUMMARY TABLE MFC-775

Sample No.	General Area	Be µg / 100 cm^2
775-01	Floor (By West entrance)	<0.023
775-02	Floor (Center North wall)	<0.023
775-03	Floor (North East corner)	<0.023
775-04	Floor (East Wall)	<0.023
775-05	Floor (South East corner)	<0.023
775-06	Floor (East side of hoods)	<0.023
775-07	Floor (South West corner)	<0.023
775-08	Blank	<0.023
775-09	Floor (North West of hoods)	<0.023
775-10	Top of port	<0.023
775-11	Top of brown box	<0.023
775-12	Top of lead apron storage cabinet	<0.023
775-13	Top of air duct	<0.023
775-14	Top of RMA storage cabinet	<0.023
775-15	Intake vent	<0.023
775-16	Inside north hood	<0.023
775-17	Top of north hood	<0.023
775-18	Top of drum hood	<0.023
775-19	Window south hood	<0.023
775-20	Top of white box	<0.023
775-21	Top of old high rad sign	<0.023
775-22	Blank	<0.023
775-23	Top of south hood	<0.023
775-24	Top of old micro balance	<0.023
Sampling Performed 4/21/2008	**Reporting Limit/LOQ**	**0.023**

FULL RESULTS TABLE
MFC-775

Sample No.	Be µg	Cu µg	Ba µg
775-01	<0.023	1.5	1.4
775-02	<0.023	1.2	2.0
775-03	<0.023	1.4	2.3
775-04	<0.023	1.5	2.0
775-05	<0.023	3.6	1.5
775-06	<0.023	0.6	0.96
775-07	<0.023	1.5	1.5
775-08	<0.023	<0.26	<0.28
775-09	<0.023	3.9	6.9
775-10	<0.023	2.4	4.8
775-11	<0.023	7.6	7.3
775-12	<0.023	5.6	6.9
775-13	<0.023	1.9	1.6
775-14	<0.023	20	28
775-15	<0.023	11	12
775-16	<0.023	3.9	10
775-17	<0.023	1.1	5.2
775-18	<0.023	0.76	1.6
775-19	<0.023	2.3	6.4
775-20	<0.023	7.2	38
775-21	<0.023	3.7	16
775-22	<0.023	<0.26	<0.28
775-23	<0.023	7.4	20
775-24	<0.023	12	11
LOQ	0.023	0.26	0.28

SURVEY RESULTS and CONCLUSIONS
For
MFC-776

MFC-776 is also known as the Zero Power Physics Reactor (ZPPR) reactor building or ZPPR reactor cell. Materials used in the reactor included beryllium and beryllium oxide plates. All beryllium wipe samples were below the analytical reporting limit or limit of quantification. (No Pictures Available)

SUMMARY TABLE
MFC-776

Sample No.	General Area	Be µg / 100 cm^2
776-01	Floor (West entrance)	<0.023
776-02	Floor (South West by wall)	<0.023
776-03	Floor (South by wall)	<0.023
776-04	Floor (South East by wall)	<0.023
776-05	Floor (East of reactor cells)	<0.023
776-06	Floor (East by wall)	<0.023
776-07	Floor (North East by wall)	<0.023
776-08	Floor (West of West entrance)	<0.023
776-09	Floor (South West by wall)	<0.023
776-10	Second beam	<0.023
776-11	HEPA filter housing	<0.023
776-12	Electrical box on wall top	<0.023
776-13	Intake vent	<0.023
776-14	Blank	<0.023
776-15	Outside box hole of reactor cell East side	<0.023
776-16	Intake vent	<0.023
776-17	Intake vent	<0.023
776-18	Outside box hole of reactor cell West side	<0.023
776-19	Top of electrical box	<0.023
776-20	Side of reactor face on NW side	<0.023
776-21	Top of work room contamination sign	<0.023
776-22	Side of reactor face on SW side	<0.023
776-23	Pit floor (center of room)	<0.023
776-24	Blank	<0.023
Sampling Performed 4/21/2008	**Reporting Limit/LOQ**	**0.023**

FULL RESULTS TABLE
MFC-776

Sample No.	Be µg	Cu µg	Ba µg
776-01	<0.023	5.8	5.7
776-02	<0.023	9.5	6.0
776-03	<0.023	4.4	1.3
776-04	<0.023	4.7	2.5
776-05	<0.023	1.6	0.53
776-06	<0.023	8.3	5.7
776-07	<0.023	8.0	2.6
776-08	<0.023	2.8	0.57
776-09	<0.023	0.27	<0.28
776-10	<0.023	0.83	<0.28
776-11	<0.023	<0.26	<0.28
776-12	<0.023	45	3.6
776-13	<0.023	58	5.2
776-14	<0.023	<0.26	<0.28
776-15	<0.023	32	4.4
776-16	<0.023	31	1.8
776-17	<0.023	21	0.44
776-18	<0.023	1.5	<0.28
776-19	<0.023	0.39	0.40
776-20	<0.023	<0.26	<0.28
776-21	<0.023	0.93	0.74
776-22	<0.023	<0.26	<0.28
776-23	<0.023	5.5	0.81
776-24	<0.023	<0.26	<0.28
LOQ	0.023	0.26	0.28

SURVEY RESULTS and CONCLUSIONS
For
MFC-782

MFC-782 is a precision machine shop that in the past has handled and machined beryllium alloys. One sample (782-18) had a detectable level of beryllium, but this level was below the Department of Energy free release limit of 0.2 ug/100cm^2. All other beryllium wipe samples were below the analytical reporting limit or limit of quantification.

Sample # 782-18

SUMMARY TABLE
MFC-782

Sample No.	General Area	Be µg / 100 cm^2
782-01	Room 100 top of small furnace	<0.023
782-02	Room 100 top of green parts cabinet	<0.023
782-03	Room 100 on floor between lathe and cabinet	<0.023
782-04	Room 100 floor in tool crib	<0.023
782-05	Room 100 material control area top of center shelf	<0.023
782-06	Backside of shear on floor	<0.023
782-07	Shear motor top	<0.023
782-08	Window sill	<0.023
782-09	Top of metal blocks	<0.023
782-10	Floor behind band saw	<0.023
782-11	Metal plate behind vertical beam	<0.023
782-12	Bead blast room top of oven	<0.023
782-13	Top of lathe P021676	<0.023
782-14	Top of monarch lathe	<0.023
782-15	Blank	<0.023
782-16	Top of safety glass cabinet	<0.023
782-17	7' up on vertical beam by CNC lathe	<0.023
782-18	Flat area behind Fire Extinguisher sign south door	0.028
782-19	Top of red box in NW corner of shop	<0.023
782-20	Ledge of window SW side of shop	<0.023
782-21	Blank	<0.023
782-22	Top of restroom	<0.023
782-23	Top of squawk box	<0.023
782-24	Top of enclosed offices	<0.023
Sampling Performed 4/22/2008	**Reporting Limit/LOQ**	**0.023**

FULL RESULTS TABLE
MFC-782

Sample No.	Be µg	Cu µg	Ba µg
782-01	<0.023	45	5.3
782-02	<0.023	76	9.9
782-03	<0.023	2.9	<0.28
782-04	<0.023	4.2	0.71
782-05	<0.023	0.33	1.2
782-06	<0.023	1.6	0.46
782-07	<0.023	7.2	0.85
782-08	<0.023	7.3	3.2
782-09	<0.023	11	0.5
782-10	<0.023	6.3	0.82
782-11	<0.023	110	9.0
782-12	<0.023	2.2	4.2
782-13	<0.023	13	2.3
782-14	<0.023	11	0.53
782-15	<0.023	<0.26	<0.28
782-16	<0.023	42	5.7
782-17	<0.023	13	7.6
782-18	<0.028	90	20
782-19	<0.023	59	6.7
782-20	<0.023	30	6
782-21	<0.023	<0.26	<0.28
782-22	<0.023	15	2.5
782-23	<0.023	110	16
782-24	<0.023	75	17
LOQ	0.023	0.26	0.28

SURVEY RESULTS and CONCLUSIONS
For
MFC-784

MFC-784 is a storage facility for materials that were used in the ZPPR facility. Materials stored here include beryllium and beryllium oxide. Two samples (784-08 and 784-10) had a detectable level of beryllium, but these levels are below the Department of Energy free release limit of 0.2 ug/100cm^2. All other beryllium wipe samples were below the analytical reporting limit or limit of quantification. (No Pictures Available)

SUMMARY TABLE
MFC-784

Sample No.	General Area	Be µg / 100 cm^2
784-01	TF135 Box	<0.023
784-02	Top of electrical box	<0.023
784-03	Top of yellow storage box	<0.023
784-04	Table top	<0.023
784-05	Floor by drum pallet	<0.023
784-06	Top of tru-temp oven	<0.023
784-07	Floor	<0.023
784-08	Window sill	0.04
784-09	Top of large yellow fire extinguisher	<0.023
784-10	Top of green computer	0.028
784-11	Floor	<0.023
784-12	Gun cleaning room floor	<0.023
784-13	Gun cleaning room floor	<0.023
784-14	Gun cleaning room top of electrical cabinet	<0.023
784-15	Blank	<0.023
784-16	Contamination Area floor	<0.023
784-17	Contamination Area green storage box	<0.023
784-18	Contamination Area shelving	<0.023
784-19	Contamination Area boxes in corner	<0.023
784-20	Contamination Area on top of borated poly sheets	<0.023
784-21	Contamination Area plastic wrapped Be boxes	<0.023
784-22	Blank	<0.023
784-23	Contamination Area by door	<0.023
784-24	Contamination Area upside down carts	<0.023
Sampling Performed 4/21/2008	**Reporting Limit/LOQ**	**0.023**

FULL RESULTS TABLE
MFC-784

Sample No.	Be µg	Cu µg	Ba µg
784-01	<0.023	4.4	4.3
784-02	<0.023	4.0	3.8
784-03	<0.023	2.9	2.9
784-04	<0.023	11	5.3
784-05	<0.023	17	5
784-06	<0.023	1.3	1.7
784-07	<0.023	1.8	1.3
784-08	0.04	17	15
784-09	<0.023	5.8	4.8
784-10	0.028	12	11
784-11	<0.023	6.4	4.3
784-12	<0.023	31	9.4
784-13	<0.023	210	19
784-14	<0.023	79	16
784-15	<0.023	<0.26	<0.28
784-16	<0.023	6.9	8.0
784-17	<0.023	2.7	3.2
784-18	<0.023	4.6	6.5
784-19	<0.023	1.6	2.5
784-20	<0.023	2.2	3.8
784-21	<0.023	3.2	5.7
784-22	<0.023	<0.26	<0.28
784-23	<0.023	3.9	4.6
784-24	<0.023	1.5	4.2
LOQ	0.023	0.26	0.28

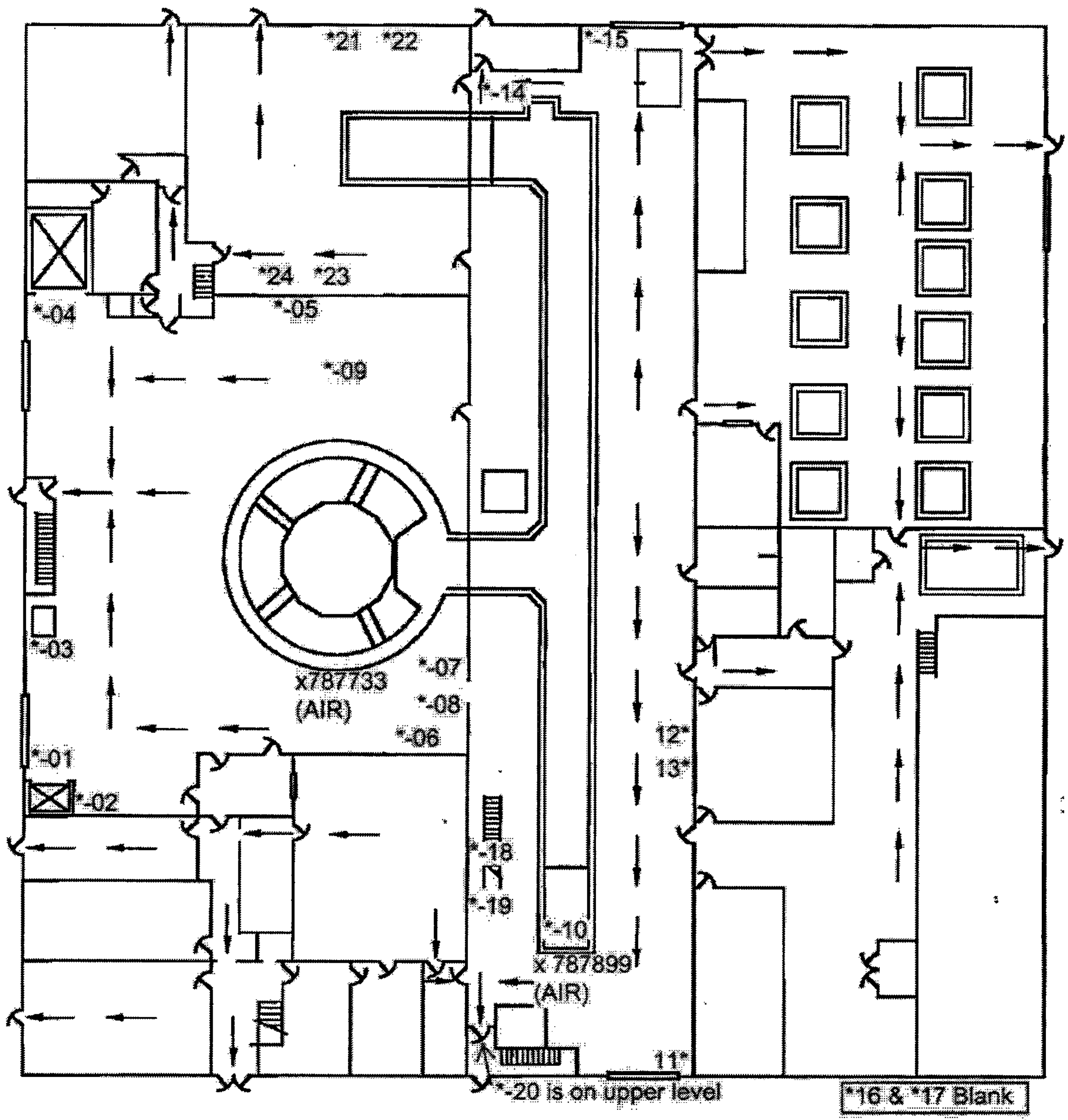
APPENDIX B

SURVEY RESULTS and CONCLUSIONS For ATR-670 and TRA-662

ATR-670 and TRA 662 were sampled for potential beryllium contamination during the months of January and April 2010. ATR-670 contains the Advanced Test Reactor and associated beryllium reflector shields (and outer shim control cylinders) configured as part of the reactor core. Irradiated reflector shields removed from the reactor core are also stored within the underwater storage canal within ATR-670. TRA-662 was originally designed as a receiving and storage building. It currently serves as the "ATR Sponsors Warehouse" dedicated to ATR parts and supplies storage and receiving and a large component machine shop. During the operation of the Engineering Test Reactor (ETR) it was likely used to store the reflector shields prior to core change-outs. These two locations were not included in the original characterization study due to the controls (under water storage and crated/wrapped shields) considered to be measures that would adequately prevent beryllium exposure potentials. The following sampling was completed in response to allegations of beryllium contamination within these locations as expressed by a past employee. In all cases, sampling results found levels to be well below regulatory limits.

SUMMARY TABLE
ATR-670

Sample No.	General Area	Wipe Be µg / 100 cm²	Area/Air Be ug / m³
670-01	Top of fire riser flange SE corner	<0.023	
670-02	Top of Electrical Box by elevator	0.029	
670-03	Top of beam by south tool storage area	<0.023	
670-04	Top of drain pipe (roof) SW corner	<0.023	
670-05	Leak rate control box, West wall	<0.023	
670-06	NE corner under overhead ladder to crane	<0.023	
670-07	Top of Ram analog read out	<0.023	
670-08	Top of electrical junction box below phone	<0.023	
670-09	Flat surface above blue air hose reel	<0.023	
670-10	East parapet wall top	<0.023	
670-11	Cinder block wall by east rollup door (top)	0.028	
670-12	Top of roll up window	<0.023	
670-13	Diagonal support beam	<0.023	
670-14	Floor by canal	<0.023	
670-15	West wall, cinderblock West rollup door drainpipe	<0.023	
670-16	Blank	<0.023	
670-17	Blank	<0.023	
670-18	Horizontal beam south wall under stairs	<0.023	
670-19	Top of old radiation monitor, near top of stairs	<0.023	
670-20	HVAC ducting	<0.023	
670-21	Electrical junction box, West wall	<0.023	
670-22	Diagonal beam, West wall	<0.023	
670-23	Electrical control cabinet, East wall	<0.023	
670-24	Diagonal beam, East wall	<0.023	
670-28	South side of reactor top		<0.038
670-29	South side of canal, above beryllium storage		<0.036
Sampling Performed January 14, 2010	Reporting Limit/LOQ	0.023	Sample Specific

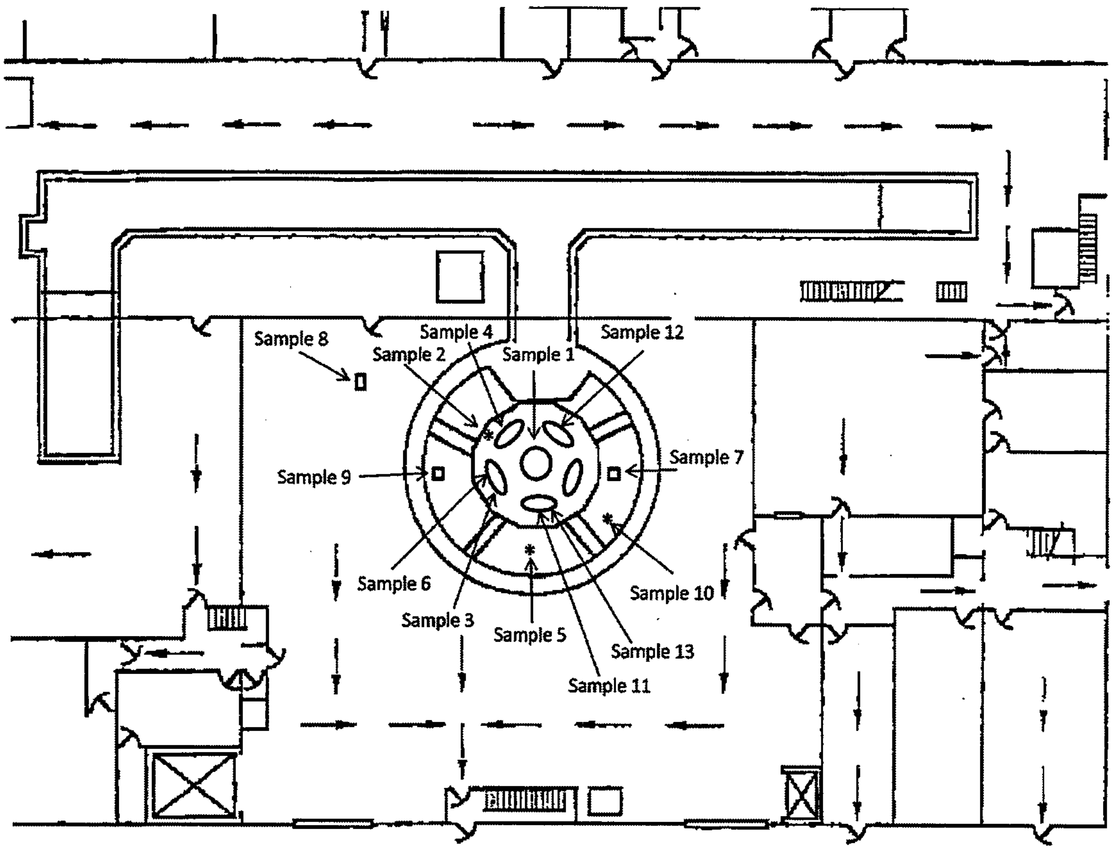


Building 670, Beryllium Sample Locations, 01/14/2010

Legend
* = Wipe Sample
x = Air Sample

SUMMARY TABLE
ATR-670

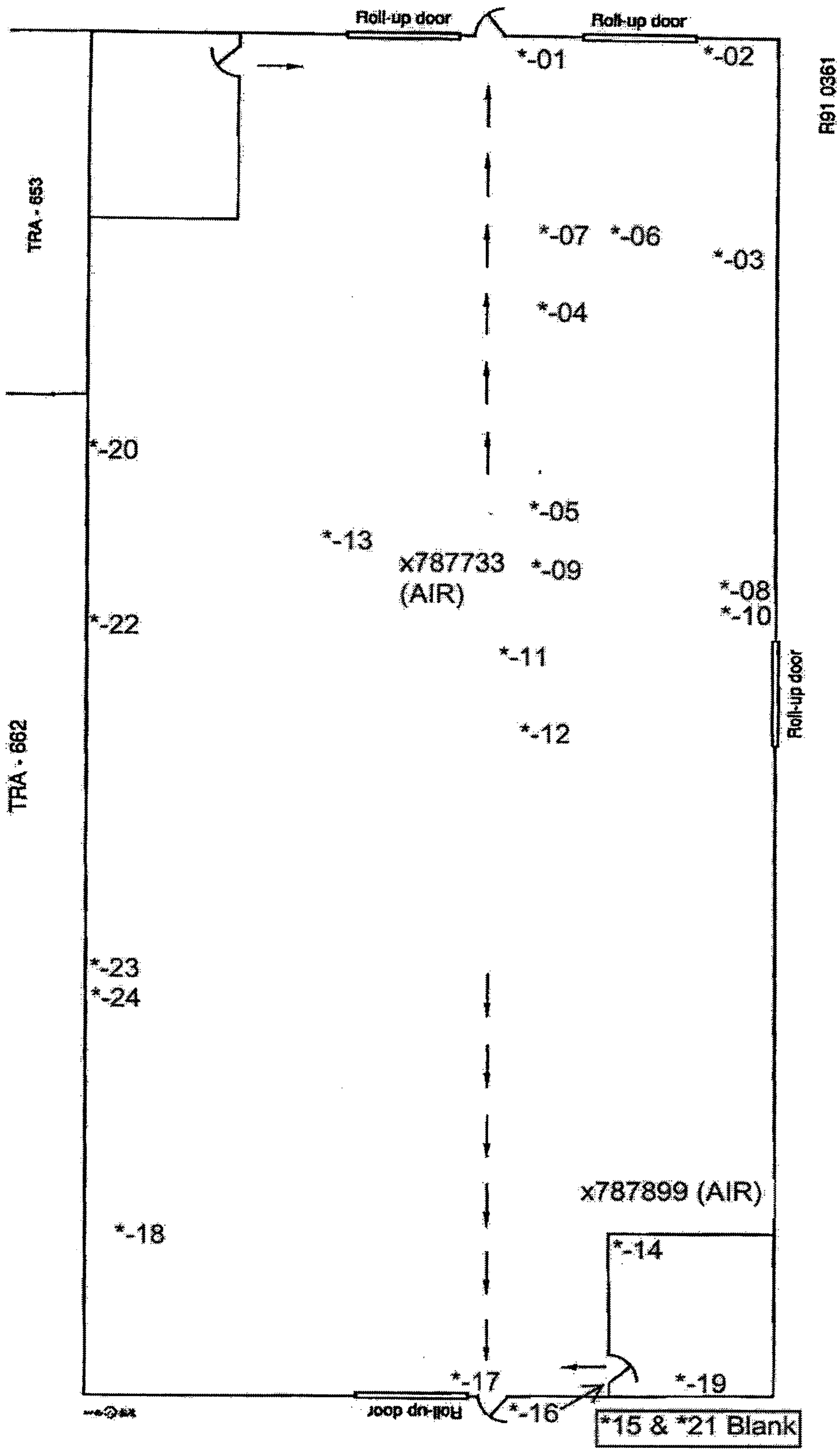
Sample No.	General Area	Wipe Be µg / 100 cm^2	Personal Be ug / m^3
670-01	Transfer Shield Plate, top	<0.0071	
670-02	N.W. Shield Block	<0.0071	
670-03	Hatch Cover #4, S.W. top of reactor vessel	<0.0071	
670-04	Hatch Cover #5, N.W. top of reactor vessel	<0.0071	
670-05	Reactor top, platform, top side	<0.0071	
670-06	Inside reactor port opening #4. Radiological readings 50,000 dpm.	0.01	
670-07	Sight Glass (prior to use)	<0.0071	
670-08	Socket Tool (note: Sample not decontamination. Additionally, the sample template could not be used. The 100 cm^2 wipe area was estimated.)	0.0095	
670-09	Sight glass, wet from primary water	<0.0071	
670-10	Beryllium camera mirror (note: This section of the mirror is the closest to the beryllium block)	0.0076	
670-11	Positive latch hook tool (note: The sample template could not be used. The 100 cm^2 wipe area was estimated.)	<0.0071	
670-12	North refueling port cover, top	<0.0071	
670-13	South refueling port cover, top	<0.0071	
Employee #1	Working on deck overseeing operations		<0.053
Employee #2	Working next to port for the majority of the shift		<0.053
Employee #3	Working next to North port for the majority of the shift		<0.053
Employee #1	Working on deck overseeing operations		<0.016
Employee #2	Working over port maneuvering camera		<0.016
Sampling Performed April 4-16, 2010	**Reporting Limit/LOQ**	**0.0071**	**Sample Specific**



ATR – BUILDING 670

SUMMARY TABLE
TRA-662

Sample No.	General Area	Wipe Be µg / 100 cm²	Area/Air Be ug / m³
662-01	Eyeglass holder, top	<0.023	
662-02	Electrical Box, (South East roll-up door)	<0.023	
662-03	Blue air hose reel, South Wall	0.034	
662-04	South side of crane	<0.023	
662-05	Top of the King, B7L	<0.023	
662-06	Back of Shear – SHR-MA-151	0.025	
662-07	Floor by large shear	<0.023	
662-08	Hear Here Box	<0.023	
662-09	Horizontal lathe	<0.023	
662-10	Behind beam and outer wall on floor	<0.023	
662-11	Floor between beam and floor	<0.023	
662-12	Large milling machine on west end	<0.023	
662-13	Floor by fence and fire extinguisher	<0.023	
662-14	Counter weights for sliding door	<0.023	
662-15	Blank	<0.023	
662-16	Floor	<0.023	
662-17	Electrical Box by rollup door	0.067	
662-18	Old shelf in bathroom	<0.023	
662-19	Ducting grill in resin storage	<0.023	
662-20	Top of electrical panel	<0.023	
662-21	Blank	<0.023	
662-22	Floor by stem lines	0.039	
662-23	Top of transformer	0.025	
662-24	Top of electrical panel.	<0.023	
662-25	Center of building, on storage rack		<0.050
662-26	SW corner of building, on machine shop side, on work bench		<0.048
662-27	Blank	<0.023	
Sampling Performed January 13, 2010	**Reporting Limit/LOQ**	**0.023**	**Sample Specific**



Building 662, Beryllium Sample Locations, 01/13/2010