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**IMPLEMENTATION PLAN FOR THE K-65 AND METAL OXIDE
RESIDUE SAMPLING PROJECT AT THE FEED MATERIALS
PRODUCTION CENTER - FERNALD, OHIO - REV. 4 - AUGUST
1988**

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**DOE-FN
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REPORT**

USEPA

IMPLEMENTATION PLAN FOR THE
K-65 AND METAL OXIDE
RESIDUE SAMPLING PROJECT

AT THE
FEED MATERIALS PRODUCTION CENTER

Fernald, Ohio



Revision 4
August 1988

U. S. DEPARTMENT OF ENERGY
OAK RIDGE OPERATIONS

RI/FS
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SECTION 1

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**SAMPLING AND ANALYSIS PLAN FOR
STORAGE SILOS 1, 2, AND 3
AT THE
U.S. DEPARTMENT OF ENERGY
FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO**

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SAMPLING AND ANALYSIS PLAN FOR STORAGE SILOS 1, 2, AND 3

1.0 INTRODUCTION

This plan covers the provisions for the sampling and analysis of materials contained in three concrete silos located in the Waste Storage Area at the U.S. Department of Energy's (DOE's) Feed Materials Production Center (FMPC). These storage silos have been used to store waste raffinate slurries (K-65 residues) and waste calcined raffinate powder (metal oxides) since 1952. Previous studies have been conducted on the K-65 residues in Silos 1 and 2. These studies have produced results with some variability, indicating that the residues are not a totally homogeneous material. Because of the variability in the analytical results, the data from previous sampling and analysis studies are not complete enough to adequately characterize the K-65 residues for purposes of evaluating remedial actions. Previous analyses conducted on the metal oxides in Silo 3 are likewise not sufficiently documented to adequately characterize those materials.

1.1 PURPOSE

The purpose of this Sampling and Analysis Plan is to define a statistically sound sampling and analysis approach to characterize the residue materials in Silos 1, 2, and 3. The plan will:

- o Develop an efficient and safe method for collecting samples from the three silos;
- o Specify analyses of the samples that will provide sufficient data to characterize the waste materials and evaluate final disposition options;
- o Specify methods to ensure protection of the public and the environment; and

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- o Specify controls to ensure the quality of the data resulting from laboratory analyses and physical tests, as well as controls to satisfy environmental protection requirements.

1.2 SCOPE

The sampling, analysis, and testing of materials contained in Storage Silos 1, 2, and 3 are required to obtain accurate chemical, radiological, and physical characteristics to support the assessment of alternatives for final disposition of the material. The work scope to accomplish this objective involves the furnishing of all necessary facilities, labor, technical and professional services, supervision, equipment, materials, and supplies to conduct the full scope of the sampling, analysis, and testing tasks.

This Sampling and Analysis Plan summarizes the technical approach to be used in completing the required tasks. Detailed methodological procedures for conducting the tasks have also been prepared and are submitted as Section 2.0 of the Implementation Plan. A listing of these procedures is provided in Table 1-1. Procedure K6501 provides a sequential overview of the sampling and analysis procedural requirements.

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TABLE 1-1
K-65 SAMPLING PROCEDURES

K6501	Sampling Operation Sequence
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2.0 SITE HISTORY

The three silos to be sampled are located west of the Production Area within the plant security fence as shown in Figure 2-1. The two reinforced concrete K-65 silos were constructed in 1951 and 1952. The silos are cylindrical, 36 feet high (26 feet and 8 inches at the dome well) and 80 feet in diameter, and are covered with a concrete dome.

The K-65 silos (Silos 1 and 2) are used for the storage of radium-bearing residues formed as by-products of uranium ore processing. The K-65 silos received the waste residues primarily between 1952 and 1958. The sources include slurry from the FMPC; 25,000 drums from a plant in St. Louis, Missouri; and 6000 drums from Niagara Falls, New York. The K-65 silos also received a small quantity of soil excavated from a drum-handling area previously located to the east of, and adjacent to, Silo 3.

The FMPC slurry was reported to contain an average concentration of radium of 311 mg per ton; the St. Louis drums, an average radium concentration of 500 mg per ton; and the New York drums, an average radium concentration of 624 mg per ton. Based on these values, it is estimated that the K-65 silos may contain as much as a combined total of 4.6 kg, or approximately 4600 Ci, of radium. This value differs from previous estimates of between 1.6 and 1.7 kg of radium in the silos.¹ The silos are also estimated to contain 11,200 kg of uranium. Radon flux measurements made in 1984

¹"Feasibility Investigation for Control of Radon Emission from the K-65 Silos," WMCO, July 10, 1987, Section 2.2.2.

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at various locations on the dome exterior ranged from 13 pCi/m²/sec to greater than 3 X 10⁷ pCi/m²/sec.

Table 2-1 provides analytical results from three previous sampling efforts of the raffinate slurry. These results were provided by Westinghouse Materials Company of Ohio (WMCO) for use in developing this Sampling and Analysis Plan. A comparison of the three sets of results indicates some degree of nonhomogeneity and uncertainty regarding the characteristics of the silo contents. Table 2-2 provides elemental characterization data of the K-65 waste.

Approximately 40 percent of the waste is composed of silicates. Other constituents comprising 1 percent or more of the waste include calcium, iron, magnesium, and lead. No data are available regarding organic constituents.

The materials in the K-65 silos have continuously generated radon gas. The gas accumulates under the silo dome, where it decays or escapes to the environment. The silos exchange gas with the surrounding atmosphere by diffusion through the concrete and release through existing cracks in the concrete. Gamma exposure rates were measured near the storage silos in 1986 and 1987 by Weston and WMCO, respectively. The results show a radiation field from Silos 1 and 2. More detail on the strength of the field can be found in the Addendum No. 2 to the Remedial Investigation/Feasibility Study (RI/FS) Health and Safety Plan (Revision 3), dated June 6, 1988.

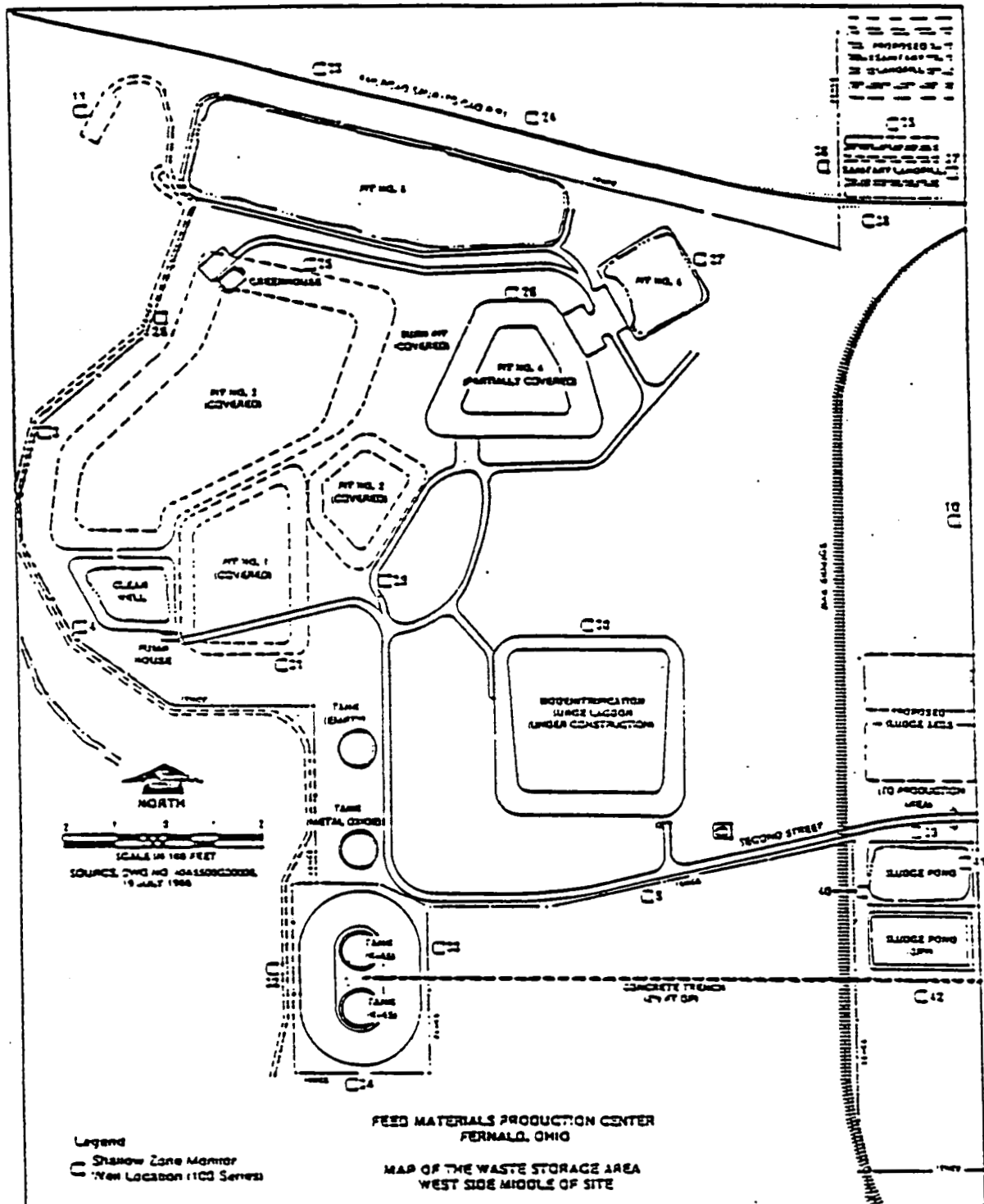


Figure 2-1. FMPC Waste Storage Area

Table 2-1. Characteristics of the K-65 Residues Stored in
Silos 1 and 2 at the FMPC, Fernald, Ohio

Characteristic	Reported Values		
	Litz ^a	NLO ^b	Vitro ^c
Dry wt, kg (tons)	-	8.79x10 ⁶ (9690)	1.59x10 ⁶
Estimated volume, m ³ (ft ³)	-	5,522 (195,000)	3,155
Density, kg/m ³ (lb/ft ³)	-	-	1,179
Uranium, ppm	1,800-3,200	600	2,110
Lead, ppm	60,000-70,000	48,000-52,000	94,900
Radium, ppb	280-360	200	300
Barium, ppm	50,000	-	45,300
Iron, ppm	13,000-18,000	-	-
Gold, ppm	65-78	<40-60	-
Platinum, ppm	0.9-1.4	-	-
Palladium, ppm	13-18	-	-
Silver, ppm	18	<20	-
Copper, ppm	500-800	400-600	-
Cobalt, ppm	1,600-2,000	1,500-2,000	-
Nickel, ppm	3,500-3,700	2,000-3,000	-

^aSource: Litz, 1974.^bSource: NLO, Inc., and Battelle Columbus Laboratories, 1980.^cSource: Vitro Corp., 1952.

Table 2-2. Elemental Characterization of the FMPC K-65 Wastes^a
September 1970

Constituent	Percentage	Weight (Metric Tons)
Metals:		
Ag	<0.002	0.176
Al	<0.875	77
As	<0.03	2.64
Au	<0.005	0.44
B	0.015	1.32
Ba	0.07	6.16
Be	ND*	-
Bi	ND*	-
Ca	3.89	342
Cd	ND*	-
Cl	No data	-
Co	0.175	15.4
Cr	0.012	1.06
Cu	0.05	4.4
F	No data	-
Fe	1.2	105.6
Hg	ND*	-
La	0.089	7.83
Mg	1.25	110
Mn	0.02	1.76
Mo	0.02	1.76
Na	0.7	61.6
Ni	0.225	19.8
Pb	5.1	448.8
PO ₄	ND*	-
Sb	ND*	-
Se	No data	-
SiO ₂	40.76	3,587
Sn	0.008	0.7
SO ₄	No data	-
Ti	0.07	6.16
V	0.021	1.85
Zn	ND*	-
Zr	0.02	1.76

Table 2-2. (Continued)

Constituent	Percentage	Weight (Metric Tons)
Rare Earths:		
Dy	0.003	0.26
Er	ND*	-
Eu	ND*	-
Gd	0.004	0.35
Ho	<0.0015	0.13
Lu	ND*	-
Sm	0.0048	0.42
Tb	ND*	-
Tm	<0.0008	0.07
Y	0.004	0.35
Yb	0.0006	0.05

^aPercentage and weight are based on sample analysis and do not account for total reported amount (8800 metric tons) of K-65 residues.

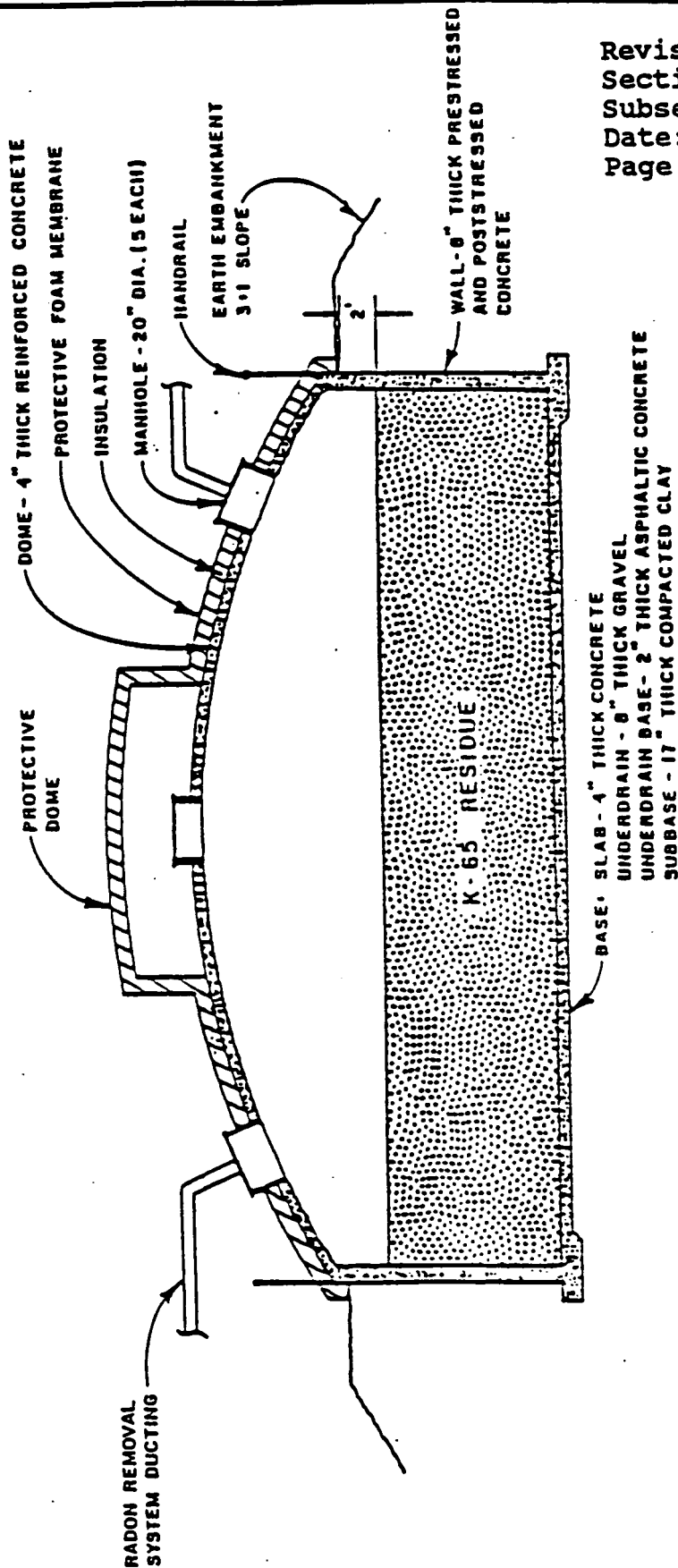
*ND = not detected.

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As early as 1956, external deterioration of the K-65 silos was observed. By 1963, large areas of concrete spalling occurred, exposing reinforcing wires which corroded and cracked. In 1964, an asphaltic sealant was applied to the external walls, and an earthen embankment was constructed around the silos to counterbalance the internal load and to reduce direct radiation from the residues in the silos. A structural evaluation of the silos (Camargo, 1985) concluded that the base slabs and walls are structurally stable under existing static loads and have a life expectancy of 5 to 10 years. The centermost 20-foot diameter portion of the dome was determined to be structurally unsound for any load greater than the existing static dead load, and there is no assigned life expectancy. Severe dome cracks have a high probability of eventually occurring due to weathering processes and may lead to partial dome collapse.

Several interim stabilization projects have recently been implemented at the K-65 silos. A radon removal system has been installed to reduce radon gas levels in the dome during recent and future remediation activities. The center dome portion has been covered with a 30-foot diameter plywood cap to provide secondary containment in the event of collapse of this section. The exterior dome surfaces have also been coated with rigid foam to provide weather protection and insulation. A typical cross section of the silos showing their anticipated condition prior to sampling is presented in Figure 2-2.

STARTING DATE: 3-24-88	DATE LAST REV.: 6-1-88	INITIATOR: K. SHELL	DRAWING NO.: 303317-A-C09
DRAWN BY: WALT MCILL	DRAWN BY: BILL SMITH	PROJ. MGR. D. HARMER.	PROJECT NO.: 303317.03



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FIGURE 2-2

TYPICAL CROSS-SECTION THROUGH SILOS 1 AND 2

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Silos 3 and 4 were constructed in mid-1952 and were designed to receive dry materials only. The waste raffinate slurries from refinery operations were dewatered in an evaporator and spray calcined to produce a dry waste form. The waste was blown into Silo 3 under pressure.

Silo 3 contains approximately 5100 cubic yards of calcined residues. Silo 3 is estimated to contain 18,000 kg of uranium, 15 Ci of radium, and an unknown quantity of thorium-230. Table 2-3 lists the elemental constituents from Silo 3.

Table 2-3. Nonradioactive, Inorganic Constituents of FMPC, Silo 3

Constituent	Silo 3 (metric ton)
Metals:	
Ag	<0.07
Al	98.67
Au	<0.14
B	0.70
Ba	0.70
Co	8.81
Cr	1.76
Cu	8.81
Fe	225.52
Mg	229.52
Mn	17.27
Mo	2.11
Na	133.90
Ni	22.90
Pb	8.81
PO ₄	683.62
Sb	<0.53
SiO ₂	461.62
Sn	1.41
SO ₄	692.08
Ti	2.11
V	3.52
Rare Earths:	
Dy	<0.11
Gd	<0.21
Ho	<0.11
Sm	<0.21
Tm	<0.07
Y	0.28
Yb	0.14

Ref: NLO, 1985

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3.0 SAMPLING RATIONALE

The objective of the overall silo sampling program is to adequately characterize the radiological and chemical composition of the silo contents to allow for the development and evaluation of alternative actions for the long-term disposition of the materials. As such, it is not only important to quantify the mean concentration of each contaminant of concern for comparison to regulatory standards, but also to determine the spatial variability of the concentrations and the degree of confidence in any resultant conclusions.

3.1 STATISTICAL BASIS FOR SAMPLING STRATEGY

Two approaches can be postulated for the statistical design of the silo sampling and analysis program. The first approach, referred to as procedure SW-846, is the statistical method recommended by the U.S. Environmental Protection Agency (EPA) for the determination of whether a solid waste is or is not hazardous in relation to regulatory threshold values. In particular, the upper limit of an 80 percent confidence interval for the population mean of a contaminant concentration is used to determine whether the contaminant exceeds the respective regulatory threshold value for that contaminant.

A requirement for the effective use of SW-846 in establishing an appropriate sample size is a prior estimation of the mean and standard deviation of the population to be sampled. Further, because the assumed mean must be compared to the regulatory threshold for use in the equation, any available data for use in approximating the mean must be consistent with the basis of the regulatory threshold. In the case of

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SW-846, this implies measured concentrations in an aqueous solution generated from EPA-approved extraction procedures. This latter constraint is important to the K-65 sampling program because no data exist on leachate quality from the silo contents that was generated using extraction procedures consistent with current EPA protocols.

An alternative procedure, termed the tolerance limit approach, can be applied without previous data if it is assumed that random sampling occurs. Under this assumption, the confidence level associated with a given tolerance limit being exceeded by at most a small percentage of concentrations can be determined as a function of sample size. Because this procedure has no basis in prior knowledge of the concentrations, it can result in a higher number of samples or less confidence for a given number of samples compared to SW-846.

3.2 RECOMMENDED NUMBER OF SAMPLES

A determination of the number of samples to be collected from the silos is dependent on both the spatial variability of silo contents and the closeness of mean leachate concentrations to regulatory threshold values. The latter issue cannot be addressed by the historical data base on the composition of the silo contents because all data are in terms of percent by weight of the solid matrix. All that can be done in this respect is to account for each regulated contaminant (under EPA's classification of "hazardous") for which data are available in the determination of the number of samples, as discussed below.

The spatial variability of the silo contents must consider

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both horizontal and vertical variability. The waste material was disposed in the silos from the top, so there is a high probability that the waste will be relatively homogeneous in the horizontal direction. It is being assumed, therefore, that four sampling locations per silo will provide sufficient horizontal coverage to account for any compositional variability in the horizontal direction.

Material variability in the vertical direction is most directly related to changes in the disposed material over time. Available data for preliminarily evaluating vertical variability are the laboratory results on four samples of K-65 residues collected between 1955 and 1958. These samples are believed to have been collected from the transfer line to the silos, and due to the three-year time frame, can be expected to be indicative of the variability in vertical composition as the silos were being filled.

The mean and standard deviation of these four samples for several metals (expressed as percent by weight) are presented in Table 3-1. Also given in the table is the recommended number of samples to be taken from each vertical core in accordance with the statistical procedure of SW-846. An underlying assumption in this calculation is that the expected mean concentration of each metal is equal to 50 percent of the regulatory threshold; the recommended number of samples would increase or decrease as the mean concentration is closer to or further from the threshold, respectively. Because actual concentrations may be orders of magnitude different from the regulatory threshold, it is highly unlikely that the actual values will fall between the assumed 50 percent level and the threshold. The required

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Table 3-1. Determination of Number of Samples: Method SW-846

Parameter (%)	Mean ($\bar{X}$)	Standard Deviation (S)	No. of Samples ^a
Ag	<0.002	N/A	--
Al	0.875	0.750	2.0
As	<0.03	N/A	--
Ba	0.073	0.032	0.5
Cd	ND	N/A	--
Cr	0.012	0.006	0.7
Ca	3.88	1.44	0.4
Cu	0.048	0.010	0.1
Hg	ND	N/A	--
Ni	0.225	0.055	0.2
Pb	5.10	0.20	<0.1
U	0.087	0.055	1.1
Radium (mg/ton)	277	148	0.8

^aAssumes that regulatory threshold = $2\bar{X}$

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number of samples will, therefore, not be expected to be greater than shown in Table 3-1.

The results reported in Table 3-1 indicate that only two samples from each core would be sufficient to satisfy the data objectives. This small number of samples can be explained primarily by the small standard deviation in the analyses, which would indicate a general lack of vertical variability over the 3-year time frame represented by the data. It is recognized, however, that the available data may not be fully representative of the entire silo conditions. The known disposal history would indicate that layered zones of nonhomogeneity can be expected. Consequently, a three-phased sampling program is proposed. Four sample cores will be taken from Silos #1 & 2 for analysis. Three sample cores will be taken from Silo #3 for analysis. Figures 3-1, 3-2, and 3-3 show the sectioning and sampling for this program.

In accordance with the minimum number of samples required under SW-846, four samples will be selected and analyzed from each of two cores (180 degrees apart) from a given silo to characterize the vertical composition of silo contents. Samples will be taken in a biased fashion from three zones exhibiting the greatest vertical variability in physical properties based on visual observations, as well as from the zone with the highest reading during the radiological scan of the core in the Examination Trailer. The latter sample will not only provide a measure of the "worst case" condition, but will also establish a degree of conservatism in the decision to take only four distinct vertical samples. If no significant vertical variability is apparent in a given

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core, three samples will be taken from the top, middle, and bottom of each core in addition to the point of highest reading.

To safeguard against missing a critical section, a composite sample will also be prepared from the same two cores. This sample will be formed by taking smaller diameter core samples (top to bottom) from the total length of all section. These smaller "cores" will be dried and mixed to make a homogeneous sample. The sectioning of these two cores will be based on changes in physical properties as visually determined, as well as significant changes in radiological activity based on the screening results. The resultant composite samples, therefore, can be considered as "biased" because they are formed from discrete zones of varying properties. This compositing scheme should account for any zone with extreme properties that are not conducive to visual observations or screening results (e.g., metals concentration).

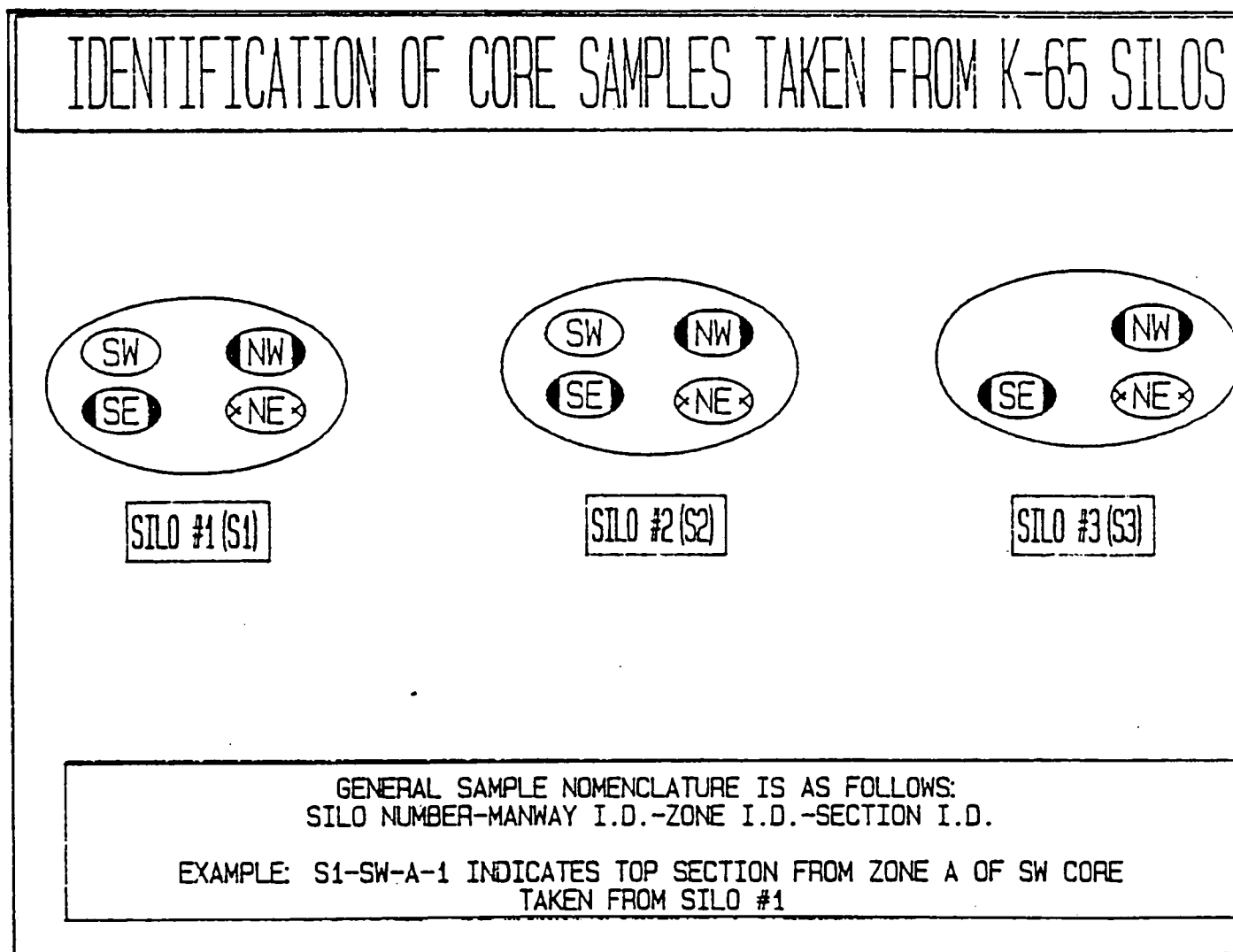
Another composite sample will be collected from the third core from each silo, which will be cut into 18-inch lengths. This sample will again be obtained by taking a small diameter core from the total length of each section. No specific allowance will be made for visual characteristics or radiological screening results.

No samples will be taken from the fourth core from each silo because these cores are intended for long-term archiving.

It must be noted that the results of the visual characterization, field screening, or laboratory analyses could increase the number of vertical samples to be analyzed

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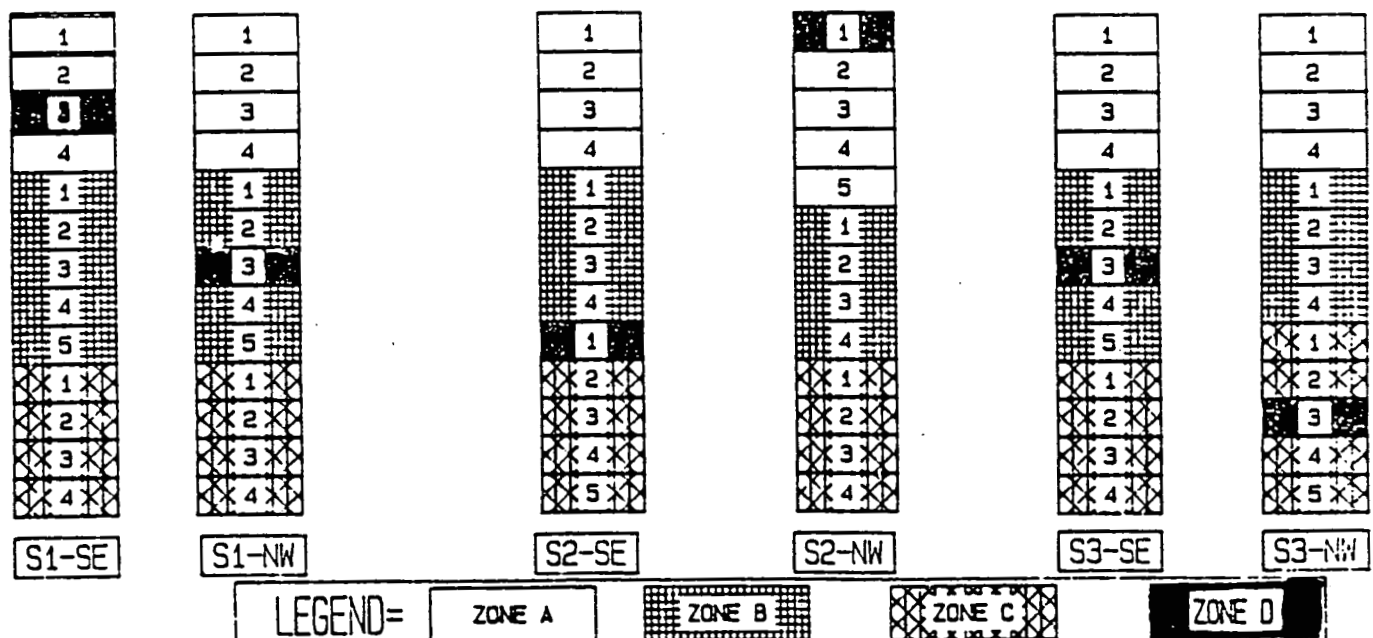
Figure 3-1



SECTIONING OF SE AND NW SAMPLE CORES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	5

* ADDITIONAL ANALYTICAL TESTS OF HSL ORGANICS, PCBs, AND PESTICIDES WILL BE REQUIRED ON ALL INDIVIDUAL ZONE SAMPLES OF ALL NW CORE SAMPLES.



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Figure 3-3

SECTIONING OF NE SAMPLE CORES

1
2
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12
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S1-NE-A

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S2-NE-A

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S3-NE-A

SAMPLE SECTIONS SPECIFIED ABOVE ARE 18" IN LENGTH. REPRESENTATIVE SAMPLES WILL BE TAKEN FROM EACH SECTION TO YIELD ONE COMPOSITE SAMPLE FROM EACH CORE (TOTAL OF THREE). ANALYSES TO BE PERFORMED ON THESE THREE COMPOSITE SAMPLES WILL BE FOR HSL INORGANICS, EP TOX, AND ISOTOPICS.

* ONLY ONE ZONE SPECIFIED PER CORE (A)

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core, three samples will be taken from the top, middle, and bottom of each core in addition to the point of highest reading.

To safeguard against missing a critical section, a composite sample will also be prepared from the same two cores. This sample will be formed by taking smaller diameter core samples (top to bottom) from the total length of all sections. These smaller "cores" will be dried and mixed to make a homogeneous sample. The sectioning of these two cores will be based on changes in physical properties as visually determined, as well as significant changes in radiological activity based on the screening results. The resultant composite samples, therefore, can be considered as "biased" because they are formed from discrete zones of varying properties. This compositing scheme should account for any zone with extreme properties that are not conducive to visual observations or screening results (e.g., metals concentration).

Another composite sample will be collected from the third core from each silo, which will be cut into 18-inch lengths. This sample will again be obtained by taking a small diameter core from the total length of each section. No specific allowance will be made for visual characteristics or radiological screening results.

No samples will be taken from the fourth core from each silo because these cores are intended for long-term archiving.

It must be noted that the results of the visual characterization, field screening, or laboratory analyses could increase the number of vertical samples to be analyzed

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from a given core. The remaining sections of each core will be archived and can be retrieved for additional analyses, if deemed necessary. The need for additional vertical samples could be identified during the course of this sampling and analysis program, or could arise during future points in the remedial action process (e.g., to confirm a critical design assumption).

3.3 RECOMMENDED NUMBER OF ANALYSES

The sampling program just described will result in eight distinct samples and three composite samples from each silo, resulting in 11 total samples from each silo. A total of 33 samples, therefore, will be collected from the three silos, along with quality control samples. An additional core will be collected from Silo 1 to conduct laboratory stabilization studies. Handling of this sample is described in Procedure K6507. Each sample will be analyzed for radiological parameters, Hazardous Substance List (HSL) inorganics, and EP toxicity metals as defined in Section 1, SubSection 4.7.1. Table 3-2 shows the core sections and analyses to be conducted.

There is presently no evidence that the residue materials contain wastes that would result in significant levels of HSL organics, polychlorinated biphenyls (PCBs), or pesticides. Consequently, only four samples from a single core will be analyzed for these chemicals to confirm their presence or absence in each of the three silos, resulting in a total of 12 analyses. The vertical sequencing of the samples for organic analysis is considered appropriate because of the greater potential for vertical nonhomogeneity rather than horizontal nonhomogeneity (i.e., a single sample from each

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Table 3-2

MINIMUM NUMBER SAMPLES GENERATED FROM K-65 PROJECT FOR SPECIFIED DETERMINATIONS.

SAMPLE NO.	CORE SECTIONS SAMPLED:	ANALYSES REQUESTED
1	S1-SE-A-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
2	S1-SE-B-1,2,3,4,& 5	HSL INORGANICS,EP TOX, & ISOTOPICS
3	S1-SE-C-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
4	S1-SE-D-3	HSL INORGANICS,EP TOX, & ISOTOPICS
5(COMP.)	S1-SE-A-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
	S1-SE-B-1,2,3,4,& 5	
	S1-SE-C-1,2,3,& 4	
6	S1-NW-A-1,2,3,& 4	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
7	S1-NW-B-1,2,3,4,& 5	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
8	S1-NW-C-1,2,3,& 4	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
9	S1-NW-D-3	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
10(COMP.)	S1-NW-A-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
	S1-NW-B-1,2,3,4,& 5	
	S1-NW-C-1,2,3,& 4	
11	S2-SE-A-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
12	S2-SE-B-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
13	S2-SE-C-1,2,3,4,& 5	HSL INORGANICS,EP TOX, & ISOTOPICS
14	S2-SE-D-1	HSL INORGANICS,EP TOX, & ISOTOPICS
15(COMP)	S2-SE-A-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPTICS
	S2-SE-B-1,2,3,& 4	
	S2-SE-C-1,2,3,4,& 5	
16	S2-NW-A-1,2,3,4,& 5	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
17	S2-NW-B-1,2,3,& 4	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
18	S2-NW-C-1,2,3,& 4	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
19	S2-NW-D-1	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
20(COMP)	S2-NW-A-1,2,3,4,& 5	HSL INORGANICS,EP TOX, & ISOTOPICS
	S2-NW-B-1,2,3,& 4	
	S2-NW-C-1,2,3,& 4	
21	S3-SE-A-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
22	S3-SE-B*-1,2,3,4,& 5	HSL INORGANICS,EP TOX, & ISOTOPICS
23	S3-SE-C-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
24	S3-SE-D-3	HSL INORGANICS,EP TOX, & ISOTOPICS
25(COMP)	S3-SE-A-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
	S3-SE-B*-1,2,3,4,& 5	
	S3-SE-C-1,2,3,& 4	
26	S3-NW-A-1,2,3,& 4	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
27	S3-NW-B-1,2,3,& 4	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES

FOR IDENTIFICATION OF SAMPLE CORE SECTIONS SAMPLED REFER TO SECTIONING OF SE/NW DIAGRAM

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Table 3-2 Cont.

MINIMUM NUMBER SAMPLES GENERATED FROM K-65 PROJECT FOR SPECIFIED DETERMINATIONS.

SAMPLE NO.	CORE SECTIONS SAMPLED:	ANALYSES REQUESTED
28	S3-NW-C-1,2,3,4,& 5	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
29	S3-NW-D-3	HSL INORGANICS,EP TOX,ISOTOPICS,HSL ORGANICS,PCBs, & PESTICIDES
30(COMP)	S3-NW-A-1,2,3,& 4	HSL INORGANICS,EP TOX, & ISOTOPICS
	S3-NW-B-1,2,3,& 4	
	S3-NW-C-1,2,3,4,& 5	
31	S1-NE-A-1 THRU 13	HSL INORGANICS,EP TOX, & ISOTOPICS
32	S2-NE-A-1 THRU 13	HSL INORGANICS,EP TOX, & ISOTOPICS
33	S3-NE-A-1 THRU 13	HSL INORGANICS,EP TOX, & ISOTOPICS

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core). Additional samples will be analyzed if these chemicals are found.

Composite samples will be used for the physical testing program described in Section 1, Subsection 4.7.2. The composite samples will be formed from individual samples taken from the same horizontal strata in each of the three sampled cores from a given silo. This compositing strategy will take advantage of the expected similarity of properties within each horizontal strata. Twelve composite samples are proposed, representing four horizontal layers in each of the three silos. The specific layers to be sampled will be those exhibiting the best combination of the following three properties:

- (1) present in all three cores at approximately the same depth;
- (2) relatively homogeneous within the layer but different from adjacent layers; and
- (3) of sufficient thickness to be of concern to the eventual evaluation of vertical heterogeneity.

If no such layers are present, composite samples will be formed from comparable depths from the top, middle, and bottom of each core, as well as from a fourth horizontal zone determined by the visual characterization of the cores. If necessary to properly account for significant layering, more than four composite samples may be collected.

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4.0 SAMPLING METHODOLOGY

Detailed operational procedures have been prepared for this sampling effort and are presented as Section 2.0 of the Implementation Plan. These procedures have been written in a detailed step-wise fashion so that the K-65 Sampling Task Manager, K-65 Sampling Task Team Leader, and sampling team members will have a clear understanding of the methodological approach. Included in the following sections are summaries of each major step in the sampling process: (1) Location Preparation, (2) Sampling Operations, (3) Sample Handling, (4) Decontamination Requirements, (5) Chain-of-Custody and Request for Analysis, (6) Sample Packaging and Shipping, and (7) Sample Analysis.

4.1 LOCATION PREPARATION

4.1.1 Preparation of Trailer and Laydown Area

An enclosed, 40-foot long trailer with rear access doors will be used as the controlled handling area for the sample cores. The location of the trailer and laydown area are shown in Figure 4-1. The Examination Trailer and laydown area will be away from Silos 1 and 2 in an area of comparatively low background radiation. This location is necessary to increase the sensitivity of radiation-measuring instruments during radiological scanning of the cores. Controlled ventilation through a HEPA filter must be provided during sample cutting and packaging. Temporary power will be required at the location.

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4.1.2 Delivery and Preparation of Sampling Equipment

All sampling equipment will be brought into the FMPC through the Main Security Gate and will be transferred through the plant to the laydown area. All incoming equipment will be inspected and inventoried before use. Required sampling equipment is discussed in Section 1, Subsection 5.0. Procedure K6503 will be followed for preparing the sampling equipment for use.

4.1.3 Delivery and Setup of Crane

Sampling operations require the use of a 165-ton crane equipped with a 140-foot long boom. An example of the required crane is shown in Figure 4-2. Due to its size, the crane will be delivered to the site in pieces, and assembled near Silo 4 at the site of the mock run. Setup and positioning of the crane will follow Procedure K6504. The crane vendor/supplier shall provide documentation of inspection and servicing of the crane to comply with Occupational Safety and Health Administration (OSHA), Sections 1910.180 and 1926.550 and with all relevant national consensus (ANSI) standards before the unit is allowed on site. Any identified deficiencies must be corrected prior to use. Load testing will be performed and documented in accordance with WMC0 Maintenance Instruction, CRA-000, "Cranes and Hoists Inspection".

The security fence in the immediate vicinity of the silos will be breached at several locations to allow access for the crane. WMC0 personnel will perform the dismantlement and reconstruction of the fence. A temporary security barrier around the breached fence shall be in place during

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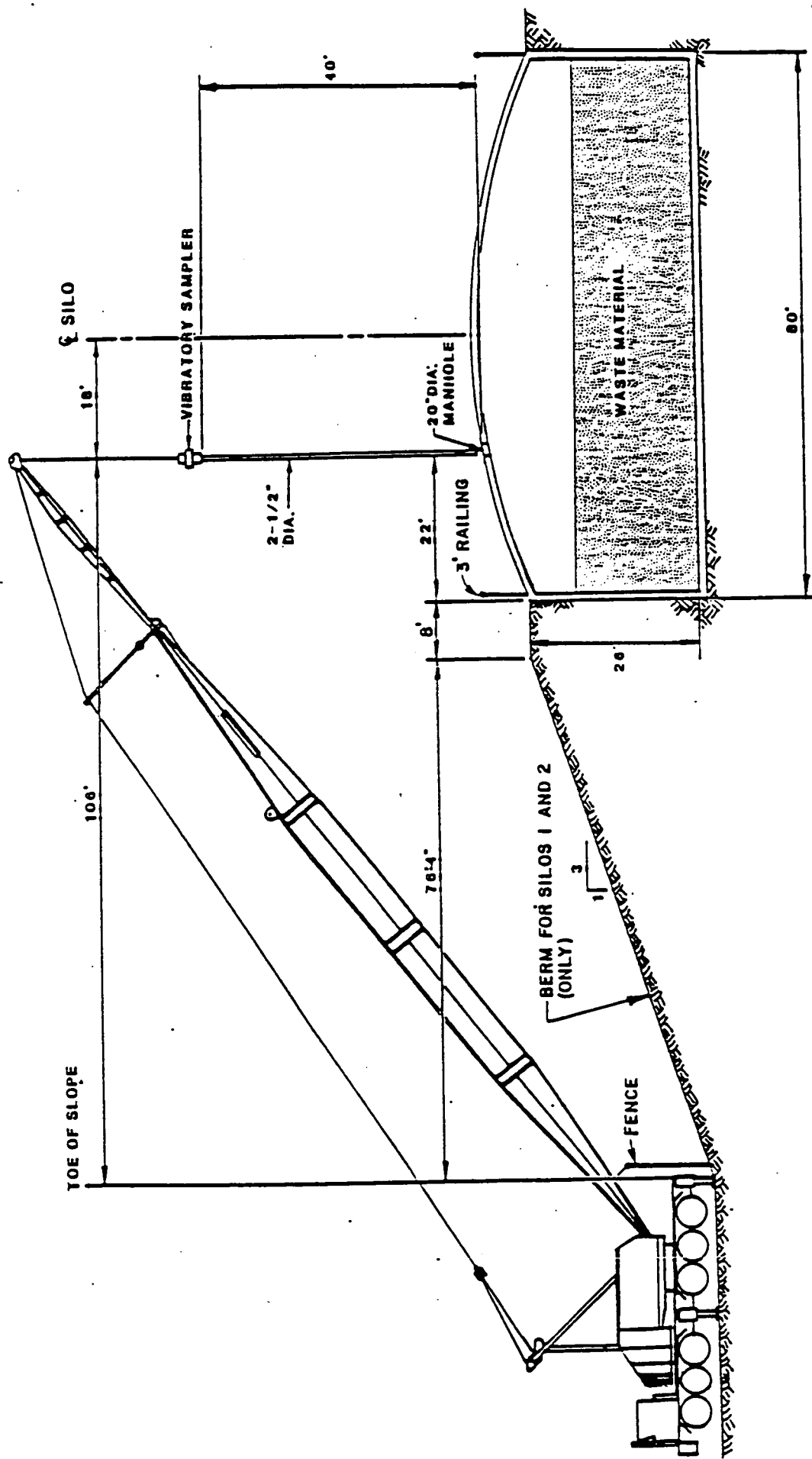


Figure 4-2

CONCEPTUAL POSITIONING OF CRANE AND SAMPLER

NOT TO SCALE

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reinstallation of a permanent fence. Only authorized personnel will be allowed access through the security fence.

4.1.4 Marking of Sample Ports

Before actual sampling operations, metal identification tags will be permanently affixed to all manhole ports on the silo domes in accordance with Procedure K6502. The tags will provide positive identification of the sampling locations for future reference. The ports will be assigned a unique number, consisting of the silo number and a 2-digit directional identifier (e.g., S1-SW for Silo 1, southwest quadrant).

4.2 SAMPLING OPERATIONS

Sampling operations will be conducted as three distinct activities. The activities are:

- o Mock sampling of Silo 4
- o Sampling of Silo 3
- o Sampling of Silos 1 and 2.

This progression of sampling was chosen because of the radiological and possibly hazardous nature of the K-65 residues in Silos 1 and 2. The mock sampling run will be conducted on Silo 4, which is empty, to demonstrate and refine the specialized sampling techniques, to test equipment operation, and to train personnel adequately, and to provide documentation to the impact assessment project file. Silo 3 will be sampled next because the metal oxides do not represent as great a health and safety concern as the K-65 residues. This sequence will further train the sampling personnel. The last activity will be the sampling of Silos 1 and 2.

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4.2.1 General Sampling Procedure

The sampling team will consist, at a minimum, of the 13 persons listed below with training records documented:

- o K-65 Sampling Task Leader
- o Crane operator
- o Two crane riggers
- o Vibra corer operator
- o Two sampling technicians
- o Environmental and radiological monitoring technician (ERMT)
- o Health physics engineer
- o Quality assurance (QA) engineer
- o Development engineer
- o Manager, Special Projects
- o Waste remediation environmental engineering engineer.

In addition, a security guard must be present if the K-65 fence is breached. Before sampling Silos 1 and 2, the radon removal system will be operated in accordance with Procedure K6510 on the silo to be sampled until the radon concentration has been reduced to the prescribed acceptable level for sampling (see Procedure K6510).

The two riggers will help to direct the crane operator to initially position the Vibra Corer unit as shown in Figure 4-2. One rigger will be located on the ground at the Vibra Corer pickup area, while the other will be located on the dome near the sample port. The rigger in the pickup area will guide the crane operator when picking up the clean Vibra Corer and when lowering the completed sample core onto a flatbed truck in the pickup area. The rigger on the silo will guide the crane operator while positioning the Vibra Corer over the open manhole during sampling operations, in accordance with Procedure K6507. Prior to this point, the

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manhole flanges on the silos will have been removed in accordance with Procedure K6505.

During the sampling of each silo, a bag-in bag-out procedure will be utilized. A containment bag will be placed over the closed manway. The manway cover will be removed. A 50' sleeve will cover the Vibra Corer and will be connected to this containment bag. The Vibra Corer will then be lowered to penetrate the residue, thereby collecting the continuous core sample. When the Vibra Corer has reached the bottom of the silo, it will be turned off and the top of the polyethylene sleeve will be taped to the core barrel above the manhole. As the Vibra Corer is withdrawn from the silo, the polyethylene sleeve will be extended over the core barrel. After withdrawal of the entire core barrel, the sleeve will be taped shut at the bottom. The Vibra Corer containing the core sample will then be raised from the silo using a crane. Procedure K6507 provides details of the sampling method and equipment.

A remote-reading dynamometer or load cell will be placed between the Vibra Corer and the crane to be observed by the Vibra Corer operator during the sample extraction process. The purpose of the dynamometer is to detect any buildup of force between the Vibra Corer and crane if any binding occurs during extraction of the core. If excessive forces are detected, the Vibra Corer will be turned on and operated momentarily to relieve the binding forces. The dynamometer will be monitored and operated in accordance with Procedure K6507.

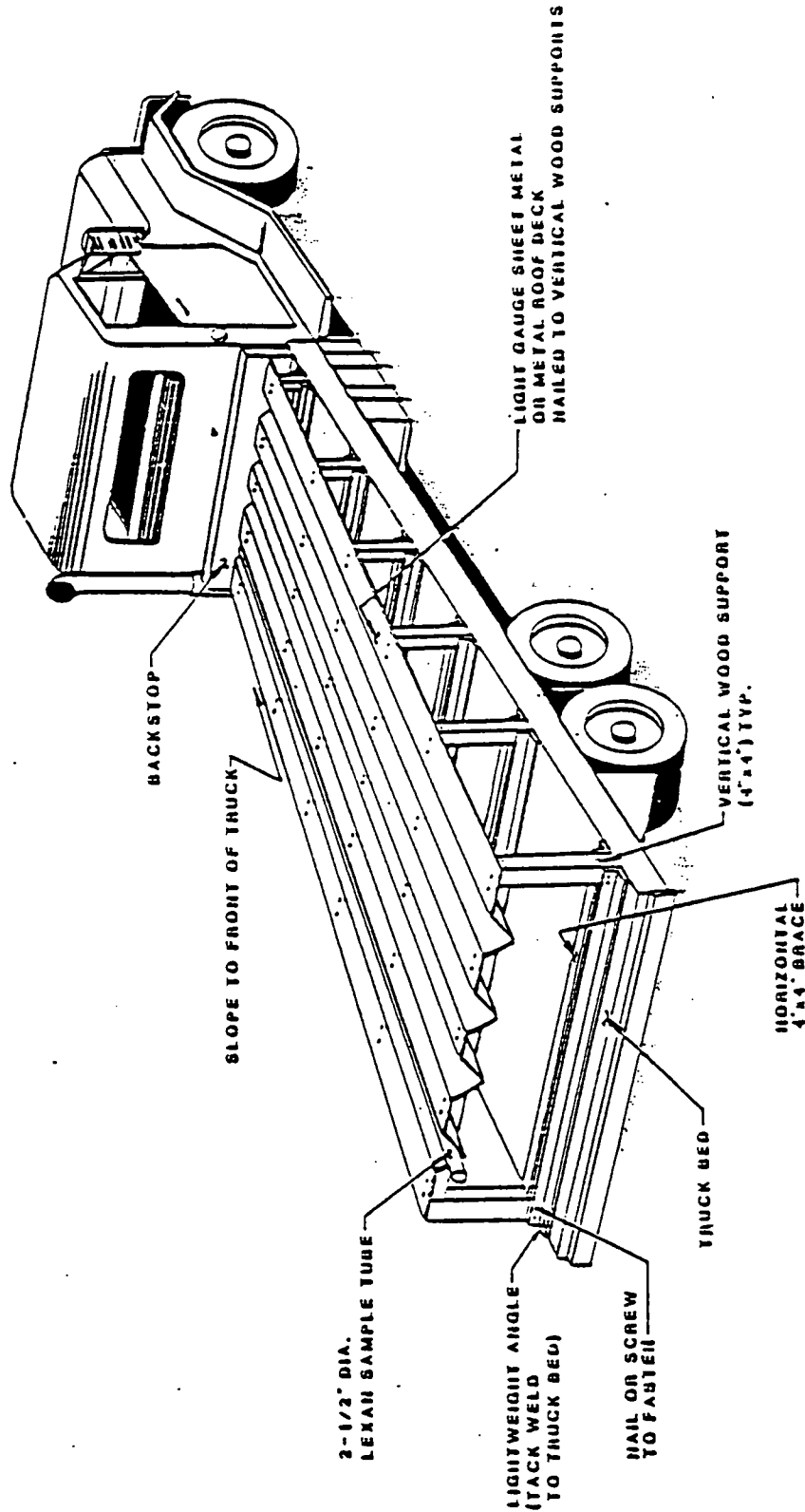
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As the crane lowers the core to the pickup area, the core will be directly placed on a specially designed truck bed as shown in Figure 4-3. Technicians will transport the sleeved core to the laydown area by the Examination Trailer.

4.2.2 Mock Sampling Run on Silo 4

A full-scale mock sampling run is planned as the first activity in the sampling project to test the Vibra Corer sampling device, the crane, and the overall implementability of the detailed sampling procedures. Particular attention will be given to the execution time of each activity, and ways that procedure execution can be streamlined to minimize the time spent on the silos. Improved equipment or procedures to minimize the chance of malfunctions will also be considered. The mock sampling run will be accomplished following Procedure K6506. Deficiencies identified in the detailed sampling procedures will be immediately communicated to the Sampling Task Manager. An alternative course of action will be identified by the Sampling Task Manager along with other task coordinators. The K-65 Sampling Task Manager and K-65 Sampling Leader will approve initially all changes before implementing any change. If safety-related, Operations Safety and Health (OSH) approval must be obtained. If quality-related, QA approval must be obtained. All changes must be documented and transmitted within 48 hours to the K-65 Team as outlined in Figure 9-2 (located in Subsection 9). If required, multiple mock sampling runs will be performed until the K-65 Sampling Task Manager is satisfied that all sampling personnel are adequately trained. All training will be documented.

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TRUCK MOUNTED CORE HOLDER

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All health and safety protective clothing required for sampling Silos 1 and 2 will be worn during the mock sampling run. This will be done to simulate actual conditions that will be encountered during the sampling of Silos 1 and 2.

4.2.3 Silo 3 Sampling

The sampling of Silo 3 will proceed after successful completion of the mock sampling run on Silo 4. Sampling will be done in accordance with Procedure K6507 except that the radon removal system will not be used to "pump down" the silo before sampling because the metal oxide residues in Silo 3 do not generate significant quantities of radon gas. Access to manhole S3-SW on Silo 3 is currently obstructed by a steel structure. This manhole may not be sampled if WMCO is unable to remove the structure. Silo 3 will be sampled using a smaller, more mobile crane and information from this sampling on the resulting suction force will be used to finalize crane required for sampling Silos 1 & 2.

4.2.4 Silos 1 and 2 Sampling

The sampling of Silos 1 and 2 will proceed after completion of sampling Silo 3. Sampling will be done in accordance with Procedure K6507. All manhole flanges will be replaced and resealed as per Procedure K6508 after completion of the sampling program. Because sampling of Silos 1 and 2 represent an increased health concern, extreme care will be exercised by all field personnel during sampling operations. The sample team members will be well-trained through the mock run and, as a result of Silo 3 sampling, will be ready to carry out the remaining sampling. Personnel dosimetry will be read daily to ensure personnel exposures are minimized.

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4.3 SAMPLE HANDLING

When the approximate 40-foot long cores are removed from the silos, the following activities will be performed:

- o Transportation of the cores to the laydown area by the Examination;
- o Trailer in a specially prepared flatbed truck, in accordance with Procedures K6507 and K6509;
- o Removal of polyethylene sleeve surrounding the corer barrel;
- o Decontamination and removal of the Vibra Corer lower cutting unit and outer steel barrel, in accordance with Procedure K6516;
- o Capping, decontamination, and labeling of the Lexan core barrels (Procedure K6516);
- o Visual inspection, video recording, and radiological scanning of cores, in accordance with Procedures K6512, K6513, and K6514, respectively;
- o Analysis of radiological scanning data and reevaluation of number samples required from each core;
- o Sectioning the Lexan core, and packaging and shipping individual samples, in accordance with Procedures K6515 and K6518;
- o Labeling of the core and core sections with unique five-digit identification numbers in accordance with Procedure K6515; after completion of sectioning, all core sections will be accounted for;
- o Capping, decontamination, and packaging the remaining core sections for long-term archiving, in accordance with Procedure K6517; and
- o All waste generated will be handled in accordance with Procedure K6524.

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4.4 DECONTAMINATION REQUIREMENTS

During sampling of Silos 1, 2, and 3, the sampling devices and some measurement equipment may become contaminated. All equipment used during sampling must be screened for external radiological contamination before leaving the regulated sampling site. The maximum radiological surface contamination limits for the equipment are shown in Table 4-1. Procedure K6516 will be followed for decontamination of these items.

Equipment to be used for more than one sample extraction must be decontaminated to prevent personnel exposure and cross-contamination of samples. All samplers must be decontaminated before use. New samplers fabricated for this project must be cleaned before use to remove fabrication oil and dirt. The new samplers will be cleaned with mild detergent and deionized water, and rinsed with methanol and/or acetone. The sampling equipment that must be routinely decontaminated includes, but is not necessarily limited to:

- o Vibra Corer lower cutting unit
- o Vibra Corer outer steel barrel
- o Lexan inner sample barrel (external surface only)
- o Sample container exteriors

The sampling personnel will be responsible for decontaminating the equipment. Clean rubber gloves will be used for the decontamination activities. The ERMT will survey the equipment before and after cleaning to determine if the radiological contaminants have been removed. The procedures will be repeated a maximum of three times if necessary. If, after the third attempt, the equipment is not

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Table 4-1. Recommended Maximum^a Contamination Limits for
Items Given Radiation Clearance

Parameter	Recommended Limit	
	(dpm/100 cm ²)	(mrad/hr)
Alpha	20	N/A
Beta/gamma	200	0.05

^aNo 100 cm² area to average greater than this value.

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clean below the levels defined in Table 4-1, another piece of equipment will be used.

The decontamination solutions to be used are mild detergent and deionized water for aqueous wastes and methanol, and acetone for organic materials. The equipment will be wiped with clean cloth towels after being moistened with the decontamination solutions. A clean long-handled swab may be required for cleaning the inside of the tubular equipment. A catch basin will be used to collect the excess decontamination solution. The catch basin will be emptied by pouring the collected liquids into a 55-gallon drum. The used towels, gloves, shoecovers, wash solutions, and equipment that cannot be decontaminated will be disposed as described in Section 1, Subsection 8.0.

4.5 CHAIN-OF-CUSTODY AND REQUEST FOR ANALYSIS

A formal Chain-of-Custody procedure will be implemented for the silo sampling program. A sample is defined as being "in custody" when:

- o It is in the physical possession of the designated responsible party.
- o It is in the view of the designated responsible party.
- o It is placed in a secure area by the designated responsible party.
- o It is in a secure area restricted to access by authorized personnel only.

The full-length core samples collected from the silos will be labeled and numbered, and a Chain-of-Custody Form will be completed. After the cores have been sectioned, each section will be labeled and numbered. A separate IT

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Chain-of-Custody Form will be completed for all sections, including those to be archived by WMC0, and a Request for Analysis Form will be completed for those sections to be sent to the laboratory.

IT sample Chain-of-Custody and Request for Analysis Forms are shown in Figures 4-4 and 4-5, respectively.

4.6 SAMPLE PACKAGING AND SHIPPING

Shipment of samples off site will be done in accordance with Procedure K6518. Samples for shipment will be packaged using package type 37A or 39, depending on hazard class determined by the preliminary screening. Overpacks will be used as much as possible to consolidate packages for shipment of samples with compatible hazard classifications.

Department of Transportation (DOT) labeling for packages will comply with the requirements of 49 CFR. The labeling class requirements will be determined by the hazard class assigned to the samples during screening. All samples will be transported by a licensed, sole-usage contractor to ensure prompt delivery of samples and to provide a tracking mechanism for undelivered sample shipments. All paperwork to accompany each sample will be inserted into a Ziploc plastic bag to be enclosed with the sample.

4.7 SAMPLE ANALYSIS

The K-65 and metal oxide samples will be analyzed for physical, chemical, and radiological parameters as described in the following subsections. The proposed number of samples to be selected for each type of analysis was presented in Section 1, Subsection 3.0.

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4.7.1 Radiological and Chemical Analyses

Selected K-65 and metal oxide samples will be analyzed for radiological and chemical constituents to characterize the materials for the evaluation of disposal options. The required radiological analyses are listed below:

- o Isotopic uranium
- o Isotopic thorium
- o Isotopic radium
- o Pb-210
- o Po-210 qualitative alpha and gamma spectroscopy

Selected samples will also be analyzed for the following chemical parameters:

- o HSL inorganics
- o HSL volatiles
- o HSL semivolatiles
- o HSL pesticides and PCBs
- o EP toxic metals.

The off-site preparation of samples for laboratory analysis will be performed in accordance with Procedures K6519 through K6523. Chemical analyses will be conducted using EPA Contract Laboratory Program (CLP) protocols when possible. CLP protocols will be modified only when conflicts arise between procedures established for handling radioactive materials and nonradioactive CLP procedures. These modifications are detailed in Procedures K6520 and K6521, and in Section 1, Subsection 7.0.

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4.7.2 Physical Analyses

Physical properties of the K-65 and metal oxide residues will be determined to predict the expected behavior of the wastes during treatment and/or disposal operations. The proposed physical analyses and ASTM Standard Procedures are provided in Table 4-2.

Table 4-2. Engineering Properties Parameters

Physical Analysis	ASTM Standard
Particle size distribution	D 422-63
Atterberg limits	D 4318-84
Moisture content	D 2216-80
Specific gravity	D 854-83

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5.0 FACILITY AND EQUIPMENT REQUIREMENTS

5.1 WMCO FACILITIES

WMCO will provide electric utilities to the trailer for use during preparation and examination of the sample cores. The location of the trailer is described in Section 1, Subsection 4.1. The electrical requirements are 110 VAC and 220 VAC.

WMCO will provide personnel clearances and escorts as necessary. WMCO will provide training for contract personnel in FMPC safety and emergency procedures. They will also provide clothing in the form of coveralls and shoes, laundry services, locker facilities, and showers.

5.2 EQUIPMENT

Procedure K6503 provides a detailed listing of the minimum equipment requirements for the sampling program. This listing does not include, however, either the equipment listed in Section 1, Subsection 5.1 above or the health and safety equipment. The required health and safety equipment is listed in Section 1, Subsection 6.7.

5.2.1 Respiratory Equipment

Personnel Certification

All subcontractor personnel using any form of respiratory protection equipment at the FMPC must be properly medically certified, trained, and fit-tested before they may use such equipment.

Documentation of the above must be submitted by the subcontractor and approved before the use of such

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respiratory equipment. The subcontractor shall make all arrangements and pay all costs to have personnel evaluated, trained, certified, and fit-tested at an off-FMPC facility. Personnel must be certified for and fit-tested with the same equipment they will be using at the FMPC.

Respiratory Equipment Certification

All respiratory equipment used on the project must be approved by the National Institute for Occupational Safety and Health (NIOSH) and properly maintained. An adequate supply of the equipment and all necessary spare parts must be kept at the FMPC site.

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6.0 OPERATIONS HEALTH AND SAFETY PROTECTION PLAN

The health and safety of workers and the protection of the environment will be ensured by The Operations Health and Safety Protection Plan. The Operations Health and Safety Protection Plan describes applicable policies, requirements, and procedures for the recognition and elimination of hazards to ensure the health and safety of workers and the general public.

All activities will be conducted with the lowest reasonable risk of personal injury, and radiation exposures will be kept as low as reasonably achievable (ALARA). An ALARA review has been conducted for this project and is presented as Section 3.0 of the Implementation Plan.

6.1 ORGANIZATION AND RESPONSIBILITIES

The silo sampling project will take place under Task 3.7 of the Fernald RI/FS. Table 6-1 is a listing of key personnel and emergency numbers for notification if required at the site.

6.2 MEDICAL PROGRAM REQUIREMENTS

All personnel who perform chemical or radiological waste sampling or other work in the production area and waste storage area (except nonworking supervisory personnel and visitors who are typically observing work from a distance) will participate in an annual medical monitoring program and a respirator fit-test. The objective of the medical monitoring program is to determine the medical competency of employees who work while wearing respiratory protection and those who work under the heat and physical stress that may be

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Table 6-1. Key Personnel and Emergency Numbers Subsection: 6

WMCO EMERGENCY.....	513-738-6511
HAMILTON COUNTY EMERGENCY.....	513-825-2260
BUTLER COUNTY EMERGENCY.....	513-867-5700
Project Coordinator Jerry Krieger, WMCO.....	513-738-8659
Manager of Health Physics Bob Rogers, WMCO	513-738-6837
Contractor Health & Safety Coordinator Larry Hubschmann, WMCO.....	513-738-6897
Manager, Special Projects Mike Townsend, WMCO.....	513-738-8413

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encountered in the workplace. Only those employees determined to be physically capable will be eligible for respirator fit-testing and training and/or assigned work involving physical stress.

Before initiating work, a work-related radiation exposure history will be acquired and maintained for each employee working in a controlled area. Results of termination bioassays will be obtained from the last employer where internal exposure to radiation may have occurred. If not available, a baseline bioassay measurement will be acquired before permitting the employee to perform radiation-related work.

6.3 PERMISSIBLE EXPOSURE LIMITS/GUIDELINES

6.3.1 Chemical Exposure Guidelines

The prescribed standards for chemical exposures at DOE facilities are the current threshold limit values (TLVs) adopted by the American Conference of Governmental Industrial Hygienists (ACGIH), although OSHA values will be used if they are more stringent. The current TLVs are found in the 1987-1988 ACGIH TLV Handbook. The most limiting chemical constituents by hazard and abundance are listed below with their TLVs:

	Concentration in Air
Lead	50)g/m3
Silicates	100)g/m3 (respirable dust)

6.3.2 Radiological Exposure Limits

Radiation exposures will be maintained as low as reasonably achievable within the standards prescribed in DOE Order

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5480.1, Chapter XI, Requirements for Radiation Protection. The concentration guides given in Attachment 1, Table 1, Column 1 of the order will be used in evaluating the adequacy of health protection measures against airborne radioactivity in regulated areas.

Radiation protection standards for occupationally exposed persons and for members of the public are given in Tables 6-2 and 6-3, respectively.

Exposure to ionizing radiation and chemical hazards will be controlled by the proper use of a Radiation Work Permit as outlined in Section 6.10 and WMCO-FMPC-ESH-P-30-002 Procedure.

Where WMCO administrative limits are more restrictive, they will be observed during the conduct of this project. These limits have currently been stated as 240 mrem/week and 1.0 rem/quarter (S. Walker, Personal Communication, April 1988).

6.4 EMPLOYEE TRAINING

Mock-run training will be conducted on Silo 4 to familiarize personnel with the procedures to be used on Silos 1, 2, and 3.

6.4.1 Worker Training

A formal site-specific training program will be provided by the Corporate Health and Safety Manager or the Site Health and Safety Officer to workers before they begin on-site work. The training will be commensurate with the work hazard and will include discussions of the FMPC RI project, industrial and radiological safety procedures, emergency and contingency

Table 6-2. Occupational Radiation Exposure Standards^a

Type of Exposure	Exposure Period	Dose Equivalent (Dose or Dose Commitment ^b in rem)
Whole body, head and trunk, gonads, lens of the eye ^c , red bone marrow, active blood-forming organs	Year Calendar quarter	5 3
Unlimited areas of the skin (except hands and forearms); other organs, tissues, and organ systems (except bone)	Year Calendar quarter	15 5
Bone	Year Calendar quarter	30 10
Forearms	Year Calendar quarter	30 10
Hands	Year Calendar quarter	75 25

^aFrom DOE Order 5480.1A.

^bTo meet the above dose commitment standards, operations must be conducted in such a manner that it would be unlikely that an individual would assimilate in a critical organ by inhalation, ingestion, or absorption, a quantity or radionuclide or mixture of radionuclides that would commit the individual to an organ dose that exceeds the limits specified in the above table. Dose commitment is defined as the dose equivalent (rem) received by specific organs during a period of one calendar year that was the result of radionuclide uptakes by a person occupationally exposed.

^cA beta exposure below a maximum energy of 700 KeV will not penetrate to the lens of the eye; therefore, the applicable limit for these energies would be that for the skin (15 rem/yr).

Table 6-3. Exposure of Individuals and Population Groups in
Uncontrolled Areas^a

Type of Exposure	Annual Dose Equivalent or Dose Commitment ^b	
	Based on Dose to Individuals at Point of Maximum Probable Exposure (rem)	Based on Average Dose to a Suitable Sample of the Exposed Population (rem)
Whole body, gonads, or bone marrow	0.5	0.17
Other organs	1.5	0.5

^aFrom DOE Order 5480.1A.^bIn keeping with DOE policy on lowest practicable exposures, exposure to the public shall be limited to as small a fraction of the respective annual dose limits as is reasonably achievable. Dose commitment is defined as the dose equivalent (rem) received by specific organs during a period of one calendar year that was the result of radionuclide uptakes by a person.

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procedures, the signs and symptoms of heat stress, the potential for encountering hazardous materials on the site, and emergency telephone numbers, first aid, and location of first aid stations and hospitals. The training will also include the highlights of this health and safety plan, WMCO's emergency plan, a detailed description of decontamination procedures, and respirator use and fit-testing.

Practical demonstrations shall be given when appropriate (e.g., in self-monitoring for contamination on workers). Fit-testing for respirator users will, at a minimum, include qualitative testing. Quantitative testing will be provided. Adequate information regarding known hazardous materials that may be encountered on site, including radioactive materials, chemical constituents, and asbestos, will be provided to ensure compliance with the Hazard Communication Standard (29 CFR 1910.1200). Workers will be informed of the physical hazards at the site. Refresher training will be provided by the Corporate Health and Safety Manager or the Site Health and Safety Officer, as deemed appropriate for the time span of the project. Visitors will receive training on the specific hazards they may encounter.

Personnel working in jobs involving possible radiation exposure will be advised of National Council on Radiation Protection (NCRP) Report 39, which recommends that exposures to embryos and fetuses be minimized. Workers will be advised of the biological risks to embryos and fetuses exposed to ionizing radiation. Workers will also be made aware that specific efforts and attention should be taken to keep the exposure of an embryo or fetus to radiation or hazardous

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materials at the very lowest practicable level during the gestation period.

Training will be provided to workers on the potential health impacts that result from chemical exposure. Following the initial site survey, an assessment will be made of these impacts and the health and safety requirements needed for individual areas on site. For example, if PCBs or PCB-containing materials are to be sampled, training specific to the safe handling and disposal of PCBs will be provided. 40 CFR 761 lists PCB prohibitions that must be followed (EPA 1986). When and if asbestos is encountered at the FMPC, worker training specific to the occupational exposure to asbestos will be provided [29 CFR 1926.58(k)(3)]. Each worker will pass a written or oral examination with results documented. The instructor will discuss and provide workers with literature on the biological effects of radiation, such as the U.S. Nuclear Regulatory Commission Regulatory Guide 8.12, "Instructions Concerning Potential Radiation Exposure."

Before beginning work at a new work location or under different working conditions, the Site Health and Safety Officer will provide a briefing to workers stating the nature and extent of contamination to be encountered that day and an explanation of safety equipment to be used.

6.4.2 Records and Reporting Requirements

The Task Leader will notify the WMCO Environmental Safety and Health (ES&H) Department, the FMPC Project Director, and the responsible installation safety officer of a fatality or serious accident, as required in DOE Order 5484.1A. Fatal accidents will be investigated by the state, federal, or

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local office having environmental, safety, and health jurisdiction.

WMC0 will be responsible for the recording and reporting of reportable illnesses and injuries in accordance with DOE requirements. Copies of these reports will be forwarded to the appropriate WMC0 personnel, including the FMPC Project Director and the responsible installation safety officer. Recordable occupational accidents and illnesses are those defined in DOE Order 5484.1A, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements."

WMC0 will submit a DOE Form 5484.X, "Individual Accident/Incident Report," for each occurrence for which reporting is required under DOE 5484.1A. Forms will be submitted to the responsible WMC0 installation safety officer and the cognizant DOE Operations Office. WMC0 will maintain records of employees' exposures to radioactive or toxic materials or other harmful physical agents for a period of 30 years. DOE Form 5484.8, "Termination Occupational Exposure Report," will be forwarded to the FMPC Project Office and responsible WMC0 installation safety officer within 30 days of termination of employment or within 30 days of the determination of exposure in accordance with Annex A of DOE Order 5484.1.

6.5 ENGINEERING CONTROLS

One of the primary means of reducing personnel exposure to radiation is to use good, sound engineering practices in designing, shielding, and containment and material handling practices for the material to be removed from the silos

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during the sampling project. Containments may be used to control the spread of contamination or release of contaminants to the environment or a combination of these factors. Shielding against exposure to ionizing radiation can be an effective tool for the ALARA concept without hindering the workers' ability to conduct their tasks in an expeditious manner. Sound engineering can reduce the requirements of personnel protective clothing to a minimum and thus, increase the productivity of the work force. Methods considered for reducing radiation exposure are:

- o Shielding during the core sectioning
- o Utilizing a bandsaw for Lexan tube cuts
- o Shielding for sample/core storage
- o Minimizing workers' time at the source
- o Maximizing workers' distance from source
- o Utilizing the Radon Removal System.

6.6 REGULATED ZONES/AREAS

A site control program has been developed at the FMPC to control worker exposure to radioactive and hazardous materials and to prevent the spread of contamination. The FMPC site has been divided into three general work zones as shown in Figure 6-1. These work zones have been established based on worker exposure potential, established site control zones, and contamination control considerations.

Zone 1 is the FMPC Process Area. This area includes both the production area and the waste storage area. Personnel access to the Process Area will be through the change rooms in the Service Building. Personnel entering the Process Area are required to change into WMC0-issued undergarments, coveralls, and boots. Showers, clothing changes, and contamination monitoring are required when leaving the Process Area.

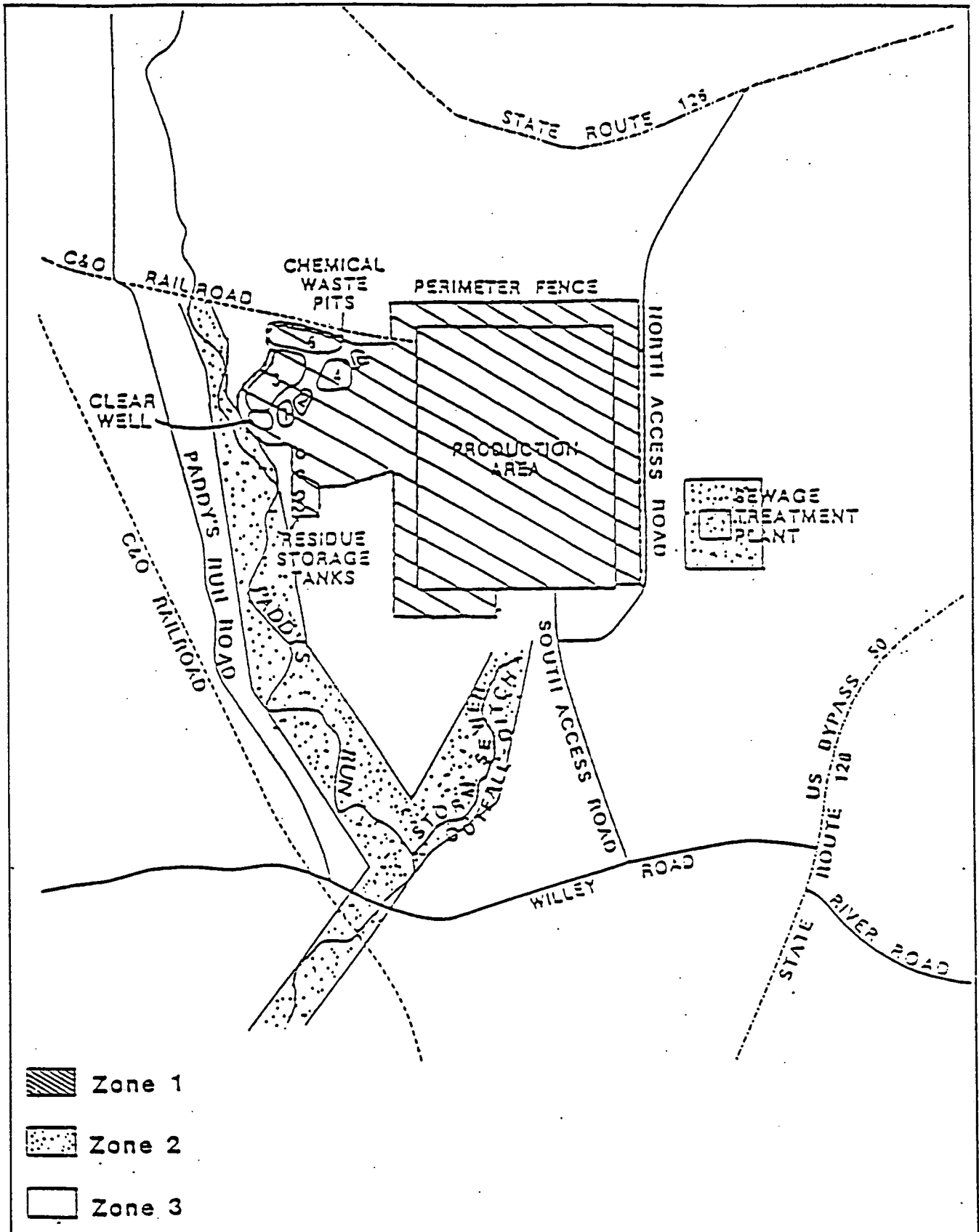


Figure 6-1. Site Control Zones

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Vehicle access to the Process Area will be through the South Gate. Vehicles leaving this zone will be monitored for contamination. Eating, drinking, and smoking are permitted only in designated areas within this zone.

Within Zone 1, an exclusion zone will be established around the three silos. This exclusion area will have its own control point for contamination control and to limit the number of personnel in the area.

6.7 PERSONNEL PROTECTIVE EQUIPMENT

Based on current information, the following personnel protective equipment is prescribed for the sampling of the silos:

Enter Zone 1:

- Safety glasses
- Safety shoes (supplied by WMCO)
- Overalls (supplied by WMCO).

Enter Exclusion Area at Silo Sampling Work Site:

- Glove liners (cotton)
- Shoe covers (PVC)
- Tyvek coveralls (hooded)
- Glove (outer) rubber/leather
- Shoe covers (outer) disposable (latex)
- Full-face respirator with organic filter and HEPA filter No. GMA-H
- Hard hats.

Any additional personnel protective equipment requirements will be stated in the WMCO Radiation Work Permit (Section 1, Subsection 6.10).

6.8 MONITORING EQUIPMENT

The components of the Health Physics and Industrial Hygiene monitoring program are contained in the Fernald RI/FS Health

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and Safety Plan (Revision 3). The specific personnel monitoring to be followed for monitoring and controlling the health and safety of this project will be, at a minimum, as follows:

- o One pocket dosimeter (self-reading)
- o One thermoluminescence detector
- o Bioassay program for sampling personnel.

Monitoring for exposures to chemicals, such as lead or silicates, will not be necessary because of the very low expected exposures. The on-site health and safety officer will determine if chemical monitoring is necessary once operations begin.

6.9 ALARA CONSIDERATIONS

Protection of workers in the United States is controlled by federal regulations that establish exposure limits. However, regardless of quantitative limits incorporated into standards, pertinent regulations require that no radiation dose be permitted that can be practically and reasonably avoided. This principle, called the ALARA concept, is the keystone of current radiation exposure reduction efforts.

ALARA involves both a philosophical approach to radiation protection and a defined set of technologies that will minimize exposure at an acceptable cost. ALARA is a moving target because the emergence of improved methods or the development of radiation protection practices may reduce radiation exposures further.

The policy established for this project will be to maintain exposures to radiation at levels that are as low as reasonably achievable. ALARA will be achieved through proper training of employees, adequate work procedures, good housekeeping practices, and, when required, use of protective

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equipment. Each individual working in radiologically controlled areas will be required to strictly adhere to established radiation protection and ALARA rules, regulations, and concepts. For example:

- o Minimizing radiation exposures where practical by the use of time, distance, shielding, and administrative controls (the methods are included in Section 3.0 of this plan)
- o Engineering the exposure to ionizing radiation out of the work to be accomplished (ALARA review document addresses the use of shielding for exposure to radiation control)
- o Mock-run training of selected work crew.

6.10 RADIATION WORK PERMIT

It is the policy of WMCO that Radiation Work Permits be issued for the performance of any task that involves radioactive material or for which there is no approved work procedure. Radiation Work Permits are also issued for tasks performed under approved work procedures if these tasks involve work in high-radiation fields or in areas where radiation fields are variable or unknown. WMCO will maintain personnel radiation dose ALARA at the FMPC. Radiation Work Permits shall be obtained as outlined in WMCO-FMPC ESH-P-30-002 Procedure.

The primary purpose of the Radiation Work Permit is to control nonroutine or periodic-routine tasks that involve the potential for significant radiation exposures. The Radiation Work Permit identifies the work activity, the associated radiological conditions, and the protective measures required to accomplish the work.

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6.11 MEDICAL/SITE EMERGENCY

In case of accident or injury, the supervisor must fill out a "Supervisor's Employee Injury Report" and give it to the Site Health and Safety Officer.

6.12 GENERAL SAFETY REQUIREMENTS

The following general safety requirements will be followed to minimize the occurrence of and potential adverse effects of unsafe or hazardous conditions at the site:

- o Contaminated protective equipment, such as respirators, hoses, boots, etc., will not be removed from the regulated area unless they are properly packaged and labeled. Waste will be handled per Procedure K6524 for this task.
- o Legible and understandable precautionary labels will be affixed prominently to containers of contaminated scrap, waste, debris, and clothing.
- o Contaminated materials will be stored in tightly closed containers in well-ventilated areas.

6.13 HEAT STRESS

Guidelines have been developed by NIOSH for monitoring heat stress and other physiological factors and are published in the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1986). These guidelines are presented in the Fernald RI/FS Health and Safety Plan (Revision 3).

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7.0 QUALITY ASSURANCE

The quality of the work to be performed in this sampling and analysis program will be insured by following the WMCO Quality Assurance Plan, FMPC-2159 (Topical Manual), Revision 0, dated May 31, 1988 and approved work procedures. The WMCO Quality Assurance Plan implements DOE Order 5700.6 and NQA-1. The procedures are contained in Section 2.0 of this plan. All personnel will be trained prior to the start of work. All training will be documented.

Additional controls for the K-65 Sampling Project are as follows and are detailed in Attachments 1 through 11.

1. Definition of the QA objectives for the collected data in terms of precision, accuracy, completeness, and representativeness as defined in Attachment 1.
2. Internal quality control (QC) checks and frequency as defined in Section 11.0 of the QA Project Plan.
3. Preventative maintenance procedures and schedules as defined in Attachment 3.
4. Equipment calibration and maintenance as defined in Attachment 4.
5. Sampling procedure distribution and control as defined in Attachment 5.
6. Chain-of-custody procedures as defined in Attachment 6
7. Procedures for controlling the evaluation and reporting of data as defined in Attachment 7 of the QA Project Plan.
8. Procedures for sample collection.
9. Laboratory testing program initiation.

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10. Procedures for controlling sampling as defined by the K-65 sampling Procedure K6507.
11. The samples will be received and will have the initial CLP preparation performed at IT's Bear Creek laboratory facility, which is not a CLP-approved laboratory. Although the sample preparation will be done at a non-CLP facility, the personnel performing this work will be experienced in the CLP procedures to be used and will have been qualified under the CLP. Experience and qualification of personnel will be documented.
12. Holding times for organic analyses may not be met because of existing procedures that must be followed for shipping and handling of radioactive materials. Because of the activity of the materials, all samples must be transferred from DOE's Radioactive Material License to IT Corporation's License. To accomplish this, WMCO must initiate shipping procedures and IT Corporation's Bear Creek facility must be the receipt point. Shipment of samples will be delayed because this step does not exist in a normal CLP sample transfer, and the Bear Creek facility is not the laboratory to perform the organic analyses. Another reason for delays in the analysis process will be the extensive on-site sample preparation and examination processes. All of the samples will be collected from the silos in approximately a two-week period. To meet the holding time, all samples (projected to be twelve) would have to be examined, screened on site, transported, screened at the laboratory, transferred to IT's Mixed Waste Laboratory, and analyzed within this short time period.
13. A listing of project personnel to ensure QC is shown in Section 9.0, Management Plan.

Specific references to the pertinent additional controls are provided in the individual, detailed procedures that have been prepared for the sampling program (Section 2 of the Implementation Plan).

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8.0 WASTE MANAGEMENT

Waste management, handling, and packaging requirements for the K-65 sampling program are provided in Procedure K6521. The generated wastes may contain both radioactive and hazardous waste materials, and will be handled as mixed waste until determined otherwise. These wastes will be packaged in appropriately labeled containers and transferred to WMCO for further handling and/or disposal. No liquid wastes, other than decontamination fluids, are expected to be generated during the sampling program. However, if any liquid waste is generated, it will be handled in accordance with WMCO provisions and transferred to WMCO for disposal after appropriate containment and packaging. Liquid waste, if generated, will be drummed and held for RCRA determination. If determined to be RCRA material, it will be stored in K-C2 warehouse and entered into hazardous waste inventory. Solid waste materials generated will be handled according to WMCO SOP's 1-C-602 and 20-C-601 and WMCO department procedure QAP-12.09. These are Attachment 11 (for reference only).

Individuals who will be performing and/or directing activities that produce, or have the potential to produce, waste materials will have appropriate training on WMCO waste management practices. This will ensure that the waste materials are handled properly and safely, as well as help to minimize the volume of waste generated. These individuals will also have appropriate training and knowledge for performing waste characterizations.

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9.0 MANAGEMENT PLAN

Figure 9-1 presents the proposed schedule for the sampling program.

The K-65 Sampling Management Organization governs all management responsibilities and activities for the K-65 Sampling Program based on the organization chart in Figure 9-2.

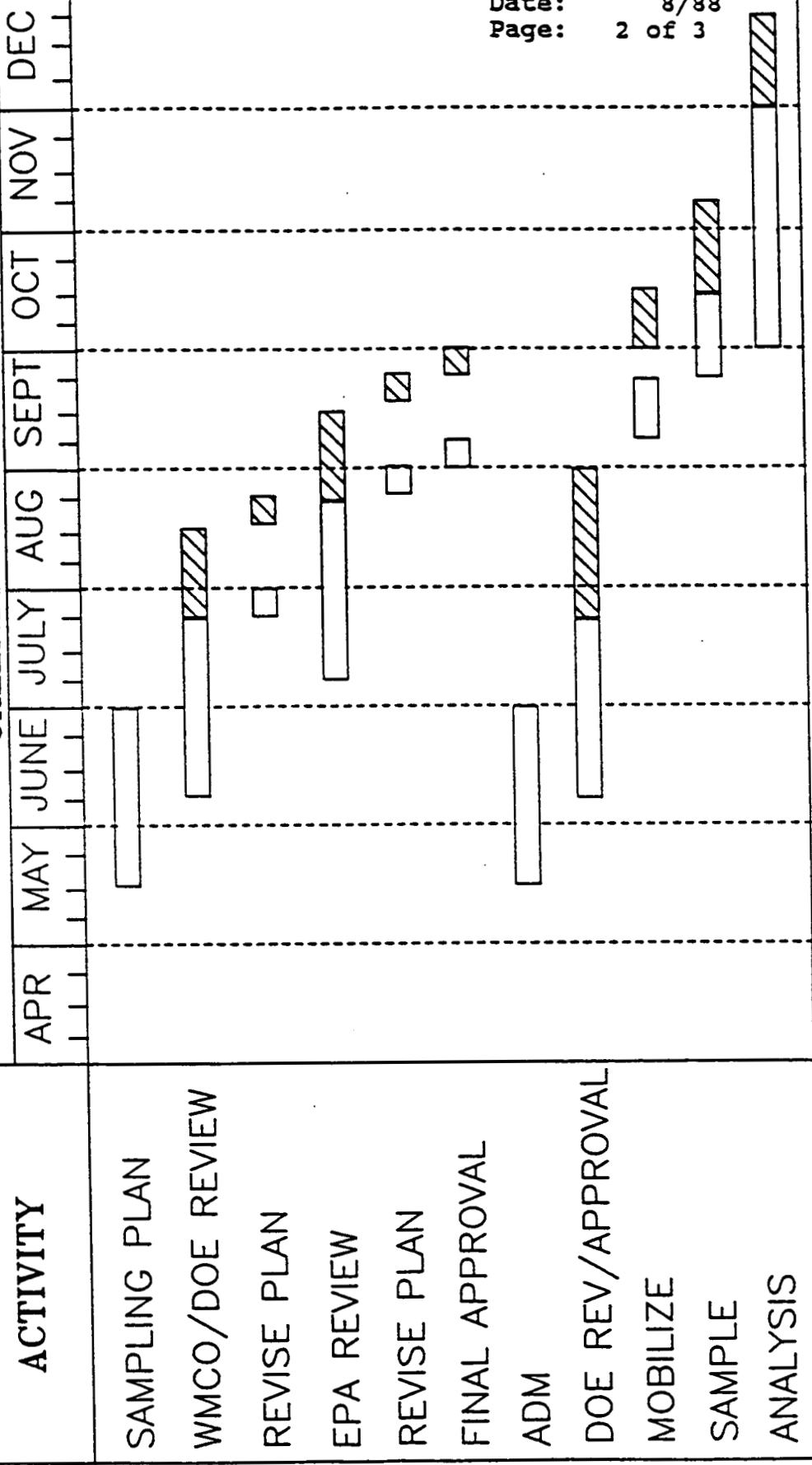
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K-65 & SILO 3 SAMPLING SCHEDULE

CALENDAR YEAR 1988



▨ - Crosshatched areas show potential schedule extension.

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REFERENCES

Health and Safety Program Plan for the Remedial Investigation of the Feed Materials Production Center, Fernald, Ohio, Revision 3.

American Conference of Governmental Industrial Hygienists Handbook, 1986-1987.

DOE Order 5480.1A, Chapter XI, Requirements for Radiation Protection.

OSHA 29 CFR 1910.132, Personal Protective Equipment.

ANSI N13.12, Surface Radioactivity Guide.

OSHA Manual for Hazardous Waste Site Activities (1986).

10 CFR 20, Standards for Protection Against Radiation.

Fernald RI/FS Environmental, Health, and Safety Plan, Addendum (September 29, 1987).

Final Safety Analysis Report for K-65 Storage Silos (October 1987).

NavSea 0989-015-9000 (Rev. 4, October 1975), Chapter 4, Paragraph 4.3.4, Radiological Fundamentals.

WMCO-FMPC ESH-P-30-002, Procedure for Filling Out Radiation Survey and Work Permit Form.

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TITLE: K-65 SAMPLING OPERATION SEQUENCE

1.0 PURPOSE

This procedure provides the overall sequence of operational events and ties together the individual procedure documents for the sampling of contents of Storage Silos 1, 2, and 3 at the FMPC, also known as the K-65 Silos and the Metal Oxide Silo. Also included is a mock sampling of the existing empty Silo 4 at the FMPC.

2.0 SCOPE

This procedure applies to all steps in the sampling, observation, handling, storage, shipping, and analysis of the contents of Silos 1, 2, and 3. The procedure serves as the master sequence for all of the above operations which hereinafter are referred to as the K-65 sampling operations.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Manager to see that this procedure is followed during the execution of the K-65 sampling program.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the use of the stated equipment and handling of the samples.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader or his designee.

4.0 REFERENCES

- 4.1 Metal Oxide and Empty Silo Study and Evaluation Report, Camargo Associates, Limited, May 1986.
- 4.2 K-65 Silos Study and Evaluation Report, Camargo Associates, Limited, February 1986.

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- 4.3 Final Safety Analysis Report for K-65 Silos Radon Mitigation and Dome Reinforcement, ASI, October 30, 1987.
- 4.4 FMPC Environmental Monitoring Annual Report for 1986, WMCO, April 30, 1987.
- 4.5 Engineering Study of the K-65 Storage Silo Radon Mitigation and Dome Reinforcement Project at the Feed Materials Production Center; IT Corporation, August 20, 1987.
- 4.6 Conceptual Design Report, K-65 Storage Silo Radon Mitigation and Dome Reinforcement Study, WMCO, May, 1987.
- 4.7 Statement of Work, K-65 Sampling; WMCO.
- 4.8 Occupational Safety and Health Standards for the Construction Industry, 29 CFR Part 1926.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Good field safety rules are to be observed at all times while equipment is handled and samples are taken in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.2 Protective clothing and dosimetry must be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.3 The entire sampling operation will be governed by a Radiation Work Permit, full-time ERMT coverage, and the approved ALARA Plan for the project.

6.0 PREREQUISITES

- 6.1 Safety and radiation training for all workers in accordance with procedures of WMCO and Contractor.
- 6.2 Craft labor available for removal of flanges and other project support.
- 6.3 Crane scheduled for sample equipment lifting.

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- 6.4 Truck with core transport racks at hand.
- 6.5 Two areas, a laydown area and an Examination Trailer, set aside and prepared for the field operations.
- 6.6 Area for archived core samples designated and prepared by WMC0.
- 6.7 For Silos 1 and 2, radon removal system operable and connected to the silo to be sampled.

7.0 PROCEDURE

Diagram representation of the K-65 Sampling Operation Sequence for Procedure K6501 is attached as Figure 1.

- 7.1 Mark location of points to be sampled, using Procedure K6502. This step may be accomplished anytime up to the start of flange removal (Procedure K6505).
- 7.2 Prepare sampling equipment and procure supplies in accordance with Procedure K6503. Place these in a controlled area under lock and key, or with a designated person to guard against tampering or contamination. Ensure that the equipment cannot be accessible to unauthorized parties. This step may be accomplished any time up to the start of flange removal (Procedure K6505).
- 7.3 Position crane for sample taking at each silo, in accordance with Procedure K6504. The crane may be positioned for the first sample anytime up to the removal of the first flange from that particular silo (Procedure K6505).
- 7.4 For Silos 1 and 2, operate the radon removal system in accordance with Procedure K6510 for sufficient time to achieve a prescribed radon level in the silo air space.
- 7.5 Once steps 7.1 Through 7.4 Are completed for the particular location to be sampled, remove the flange from the designated sample location manhole as given in Procedure K6505.

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- 7.6 Sample as per Procedures K6506 or K6507, and replace flanges after each sample as per Procedure K6508.
- 7.7 After each sample core is withdrawn from the sample location, it must be placed in a temporary carrier and transported to the laydown area under Procedure K6509. The sample core will be transferred manually to the examination trailer, where activities are controlled by Procedures K6510, K6511, K6512, K6513, K6514, and K6515.
- 7.8 Sample cores that remain after examination and sectioning are to be placed in archive storage according to Procedure K6517.
- 7.9 Shipping of samples for analysis in off-site laboratories and in other parts of the FMPC facilities is to be done in accordance with attached Procedure K6518 and Attachment 6. The designation of analyses to be performed on the samples in these shipments and the associated analytical methods are found in Procedures K6519, K6520, K6521, K6522, and K6523.
- 7.10 Waste materials and supplies from the entire sampling operation are to be accumulated in appropriately labeled containers. As indicated by storage considerations and as mandated at the end of the sample handling operations, these wastes will be handled and removed from the work area in accordance with Procedure K6524.
- 7.11 If any emergencies, spills, or other abnormal situations arise during the carrying out of these sampling operations, the responsible parties should refer to Abnormal Occurrences Procedure (Procedure K6525).
- 7.12 Samples analyzed by off-site laboratories and excess residues will be returned to WMCO to perform confirmatory analytical testing as per Procedures K6525 through K6529.

K-65 SAMPLING OPERATION SEQUENCE

BLOCK DIAGRAM

(for Procedure K6501)

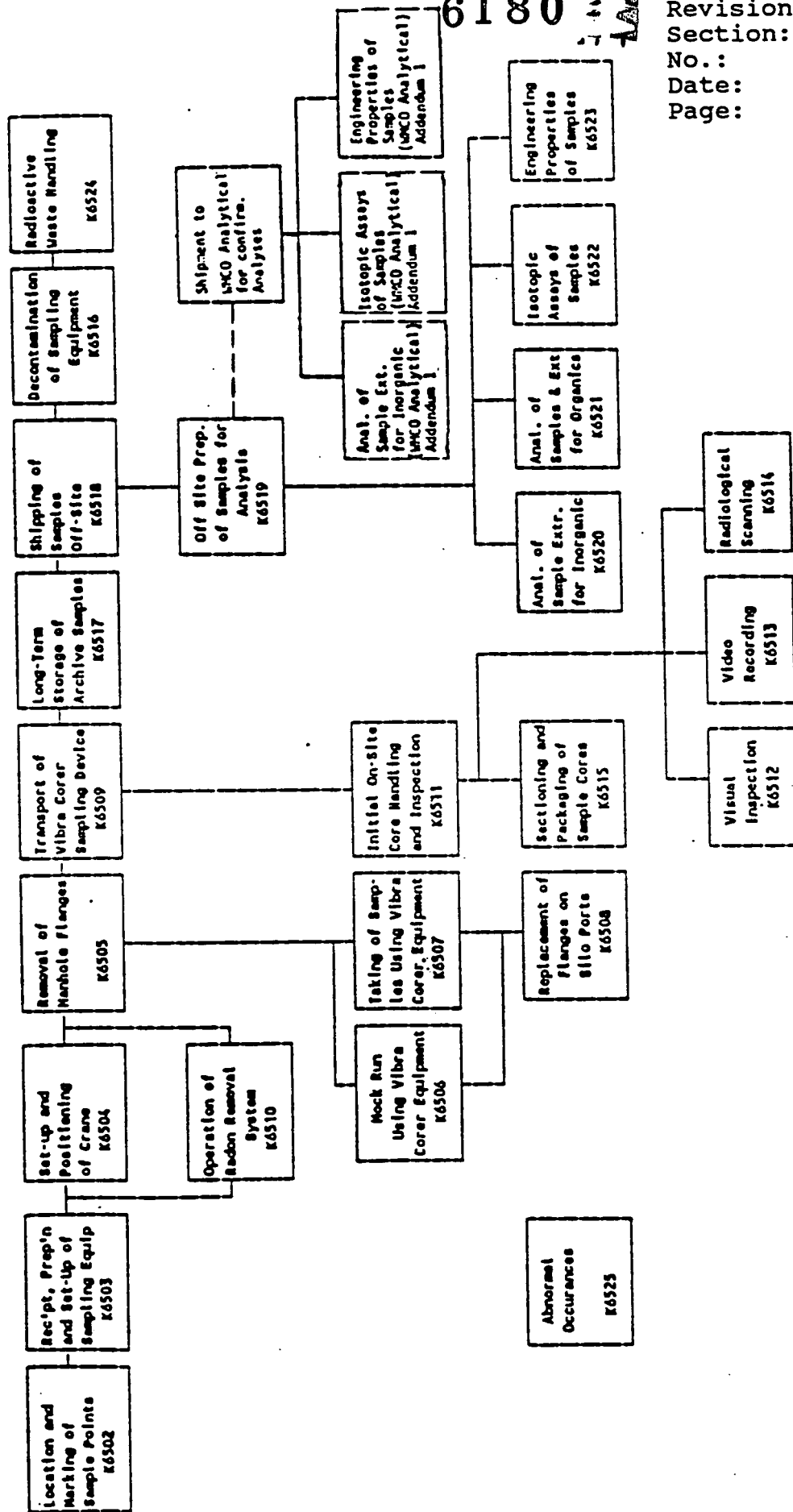


Figure 1

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TITLE: LOCATION AND MARKING OF SAMPLING POINTS

1.0 PURPOSE

This procedure provides the methodology to locate and mark sample points to aid in identification and characterization of samples taken from the silos.

2.0 SCOPE

This procedure applies to Storage Silos 1, 2, and 3. Each of these silos is equipped with five manways (manholes). Sampling will be conducted through four of these manholes. The fifth manhole, located at the center of each domed roof, will be excluded. A total of twelve sampling points will be located and marked with metal tags. Two samples will be taken from one point on Silo 1; thus, thirteen total samples will be taken. One additional location has been identified on Silo 4 for the mock sampling run.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the location, identification, and marking phase.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced with this procedure and the use of the identification and fastening equipment.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report unusual occurrences to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 Statement of Work, K-65 Sampling; WMCO.
- 4.2 K-65 Sampling Operation Sequence, Procedure K6501.

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5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing and dosimetry must be worn in accordance with Section 6.0 of the OSH Plan.
- 5.2 To minimize man-rem exposure, work on the K-65 silos must be well planned and performed so that no more time than necessary is spent on the domes.
- 5.3 Silo domes are sloped, resulting in poor footing. Proper footwear should be worn and care exercised when maneuvering on top of the silos.

NOTE: At no time should personnel walk on or equipment be placed on the center cap of the silos.

- 5.4 Review of safety and operational procedures has taken place with personnel involved.

6.0 PREREQUISITES

- 6.1 Safety and radiation training for all workers in accordance with procedures of WMCO and the contractor.
- 6.2 Project Logbook
- 6.3 Metal tags (12). The tags are to be prepunched with the manhole location identification numbers shown on Drawing No. 303317-A-C01.
- 6.4 Epoxy cement
- 6.5 Backpacks (2)
- 6.6 Wooden or plastic spatulas (12)
- 6.7 Polyethylene bags (12)
- 6.8 Wire brush (1)
- 6.9 Field logbook (1)
- 6.10 Protective clothing per Addendum No. 2 (Revision 2) to the Fernald RI/FS Health and Safety Plan (Revision 3), June 1988.
- 6.11 Duct tape

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6.12 Two-way radios (1 set)

6.13 Disposable latex gloves (2 pairs)

7.0 PROCEDURE

7.1 Preliminary Procedure

7.1.1 Prior to transit to the silos in the field, the epoxy cement components should be transferred from the 1-gallon containers to resealable 1-pint containers. The components should not be mixed at this time.

7.2 Field Activity

7.2.1 Collect required supplies and equipment including a working set of two-way radios.

7.2.2 Begin field work. Update daily the WMCO library-issued project logbook that is assigned to the K-65 Task Manager.

7.2.3 Locate the designated manhole to be marked. A metal tag will be used on each of four manholes on each silo.

7.2.4 Disposable latex gloves will be worn when affixing metal tags to the manhole.

7.2.5 Apply a small amount of epoxy on the back side of the metal tag, using the spatula to spread out the epoxy and being careful not to apply too much cement.

7.2.6 Verify the correct association of tag number to flange location per sample logbook and Drawing No. 303317-A-C01.

7.2.7 The metal tag will be affixed to a flat, clean surface of the manhole. Preferably, the tag should be in a conspicuous location on the manhole nozzle itself and not on the removable

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manhole flange (cover). If the nozzle neck is covered with foam, affix tag to the flange.

- 7.2.8 The surface where the tag is to be affixed should be clean, dry, and free of any loose paint, rust, oil, or debris. If necessary, wire brush the surface.
- 7.2.9 Carefully position the tag in place and hold for a few seconds. The cement should be tacky enough for the tag to remain in place. If necessary, the tag may be held in place with duct tape to minimize personnel exposure until the epoxy sets. (This may take a few minutes.)
- 7.2.10 Place used spatula and cement in a polyethylene bag and seal.
- 7.2.11 Proceed to the next manhole. Steps 7.2.2 through 7.2.13 should be performed for each manhole to affix the metal tags for identification purposes.

TITLE: RECEIPT, PREPARATION, AND SETUP OF SAMPLING EQUIPMENT

1.0 PURPOSE

The purpose of this procedure is to furnish the required steps for the receipt, preparation, and setup of the equipment needed for the sampling of Silos 1, 2, and 3, in addition to the mock sampling run on Silo 4.

2.0 SCOPE

This procedure will be required for the assembly, collection, and placement of all equipment necessary to perform the designated sampling tasks.

3.0 RESPONSIBILITY

3.1 It is the responsibility of the K-65 Sampling Task Team Leader to see that this procedure is followed during the field program phase.

3.2 It is the responsibility of the K-65 Sampling Task Team Leader to assign the following tasks to persons who are experienced and/or trained in the handling of the sampling equipment to be used.

3.3 It is the responsibility of each individual designated to perform the following tasks to report any unusual circumstances to the K-65 Sampling Task Team Leader. Faulty or missing equipment, or any nonconformance to the procedures should be reported.

4.0 REFERENCES

4.1 Statement of Work, K-65 Sampling; WMC0.

4.2 K-65 Sampling Operation Sequence, Procedure K6501.

5.0 SAFETY AND PRECAUTIONS

5.1 Good field safety rules will be observed at all times during the handling and assembly of the sampling equipment in accordance with Section 1, Subsection 6.0 of the OSH Plan.

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5.2 Protective clothing and dosimetry will be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.

5.3 To minimize man-rem exposure, any preparation and setup of equipment near the K-65 silos must be well planned and performed so that no more time than necessary is spent near the silos and on the domes.

6.0 PREREQUISITES

6.1 Safety and radiation training for all workers in accordance with procedures of WMCO and the Contractor.

6.2 Necessary equipment has been shipped to a designated location and addressed to the K-65 Sampling Task Manager.

6.3 Equipment received by the K-65 Sampling Task Leader will be stored in a designated, controlled area before the initiation of field activities. Flammable and combustible liquids will be stored and handled on site in accordance with DOE orders and referenced national consensus standards.

6.4 Calibration of any equipment used in the sampling procedure will have been accomplished per manufacturer's recommendations.

7.0 EQUIPMENT LIST

7.1 Vibra Corer Equipment

7.1.1 (2) 3-1/2 inch outer diameter (O.D.)
Vibra Corer Head Assemblies

7.1.2 (12) Metal catchers

7.1.3 (24) 20-foot sections of 4-inch O.D.
stainless steel outer casing

7.1.4 (12) Metal cutters

7.1.5 (12) 3-1/2 inch O.D. cutting shoes

7.1.6 (24) 20-foot sections of 3-1/2 inch O.D.
Lexan tubing

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- 7.1.7 Plastic caps for Lexan tubing
- 7.1.8 Oiler attachment for head assembly.
- 7.2 Other Equipment Required for Sampling of Silos
 - 7.2.1 Air compressor or drive unit of sufficient capacity to deliver the required vibration frequency to Vibra Corer head assembly in accordance with manufacturer's specifications
 - 7.2.2 Airline or drive cable (for above) of sufficient length to sampling requirements (see Procedure K6507)
 - 7.2.3 Correct fittings for airline or drive cable attachment to Vibra Corer head assembly in accordance with manufacturer's requirements
 - 7.2.4 Heavy duty polyethylene sleeves for core transport to the laydown area
 - 7.2.5 Duct tape for taping the polyethylene sleeve to the Vibra Corer barrel and for taping the sleeve at the bottom below the barrel after it is withdrawn from the silo
 - 7.2.6 40-foot flatbed truck for delivery of coring apparatus from equipment preparation area
 - 7.2.7 Core troughs for flatbed truck and Examination Trailer
 - 7.2.8 Dynamometer or load cell of sufficient capacity
 - 7.2.9 Connection fittings
 - 7.2.9.1 Between crane line and dynamometer
 - 7.2.9.2 Between dynamometer and Vibra Corer head

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- 7.2.10 Hand tools (including at least two large pipe wrenches)
- 7.2.11 Permanent ink markers
- 7.2.12 4-inch clear adhesive tape and 4-inch see-through red adhesive tape
- 7.2.13 3-inch adhesive surgical tape
- 7.2.14 Thread adhesive (Loctite or equal vibration proof anaerobic)
- 7.2.15 Adhesive "up" (↑) arrows
- 7.2.16 Band saw for cutting Lexan tubing
- 7.2.17 Sixty (60) rolls of electrical tape
- 7.2.18 Wooden or metal support horses for core trough support
- 7.2.19 Diesel fuel tank or tank truck

8.0 PROCEDURE

- 8.1 Finalize the complete equipment and materials list and check off each piece of equipment in the project logbook as it arrives on site or is acquired.
- 8.2 Once all of the Vibra Corer equipment has arrived on site, assemble the Vibra Corer steel outer casing by connecting the threaded head assembly to the coupler. A thread adhesive (Loctite or equivalent) will be used on the threaded portions of the sampling device.
- 8.3 Connect two 20-foot sections of outer casing by welding together cement two 20-foot sections of the Lexan pipe.
- 8.4 Attach the threaded cutting shoe to the bottom section of the casing, again using the thread adhesive.

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- 8.5 Starting at the bottom of the cutting shoe, mark each 1-foot increment on the outer casing with a permanent ink marker by drawing a complete circle around the casing. Mark the casing all the way to the top of the outer casing. This should reach 35 feet.
- 8.6 Using 3-inch surgical tape wrapped around the barrel and a permanent ink marker, indicate each foot increment up to the 35-foot mark. The numbers should be clear and 2 inches in height so as to be readable from a distance. The bottom of the white surgical tape should correspond with the exact foot marker made around the barrel in Step 8.5.
- 8.7 Wrap 4-inch clear adhesive tape over each foot marker made with the white surgical tape to protect the numbers. On every fifth foot marker (5 foot, 10 foot, 15 foot, etc.), wrap 4-inch red see-through adhesive tape around the indicated foot marker. This will help the K-65 Sampling Task Leader keep track of the depth of the rod from a distance if needed.
- 8.8 Stick adhesive "up" (↑) arrows along the length of a 36-foot section of clear Lexan tubing at an increment of 4 to 5 feet.
- 8.9 Remove the cutting shoe from the steel outer casing and insert the Lexan tubing inside the casing with the arrows pointing toward the vibratory head assembly. Push the tubing up inside the casing as far as it will go. About 1 foot of tubing should be sticking out of the casing.
- 8.10 While holding the cutting shoe beside the steel casing, cut the Lexan tubing at the point where it would meet the tapered end of the cutting shoe if the shoe was attached. (This will reduce the opportunity for materials being sampled to enter the annular space between the Lexan tubing and outer steel casing.) The Lexan tubing should fit as far down into the cutting shoe as possible.
- 8.11 Prepare a second assembly of steel outer casing and Lexan tubing as described in Steps 8.1 through 8.10. This will serve as a backup assembly in the

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event of equipment breakdown or scheduling impacts caused by sample core preparation and examination.

- 8.12 Before the assembled Vibra Corer apparatus can be loaded onto the 40-foot flatbed truck for delivery to the silo area for sampling, fabricate and securely attach core troughs to the truck bed.
- 8.13 Prepare the polyethylene containment sleeve assembly before sampling activities commence.
- 8.14 Once the crane has arrived on site, obtain and install appropriate fittings/connection devices. Attach the crane line to a dynamometer or load cell that will then be attached to the Vibra Corer sampling device.
- 8.15 Variable lengths of airline hose or Vibra Corer drive cable will be required for sampling at the different silo manholes. Before each sampling event, determine the length of cable or airline required to deliver the required vibration frequency at the head assembly based on the designated location of the crane for that specific silo sampling location. See attached map of silo sample locations (Drawing No. 303317-A-C01).
- 8.16 Check to ensure that the correct fittings which connect the Vibra Corer apparatus to the airline or drive cable are available and in place.
- 8.17 Other equipment required to be in place before sampling at each silo location includes:
 - 8.17.1 Duct tape for taping the polyethylene sleeve to the Vibra Corer apparatus and for taping the sleeve shut below the corer barrel after sampling.
 - 8.17.2 Scissors or utility knife to cut the polyethylene sleeve, if necessary, once it has been taped closed at the bottom.
- 8.18 The Examination Trailer should be secured so that expected wind conditions will not adversely affect its safety or integrity.

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DRAWING NO: 303317-A-COI
 PROJECT NO: 303317.03

INITIATOR: K SHELL
 PROJ. MGR. D HARMER

DATE LAST REV: 6-3-88
 DRAWN BY: BILL SMITH

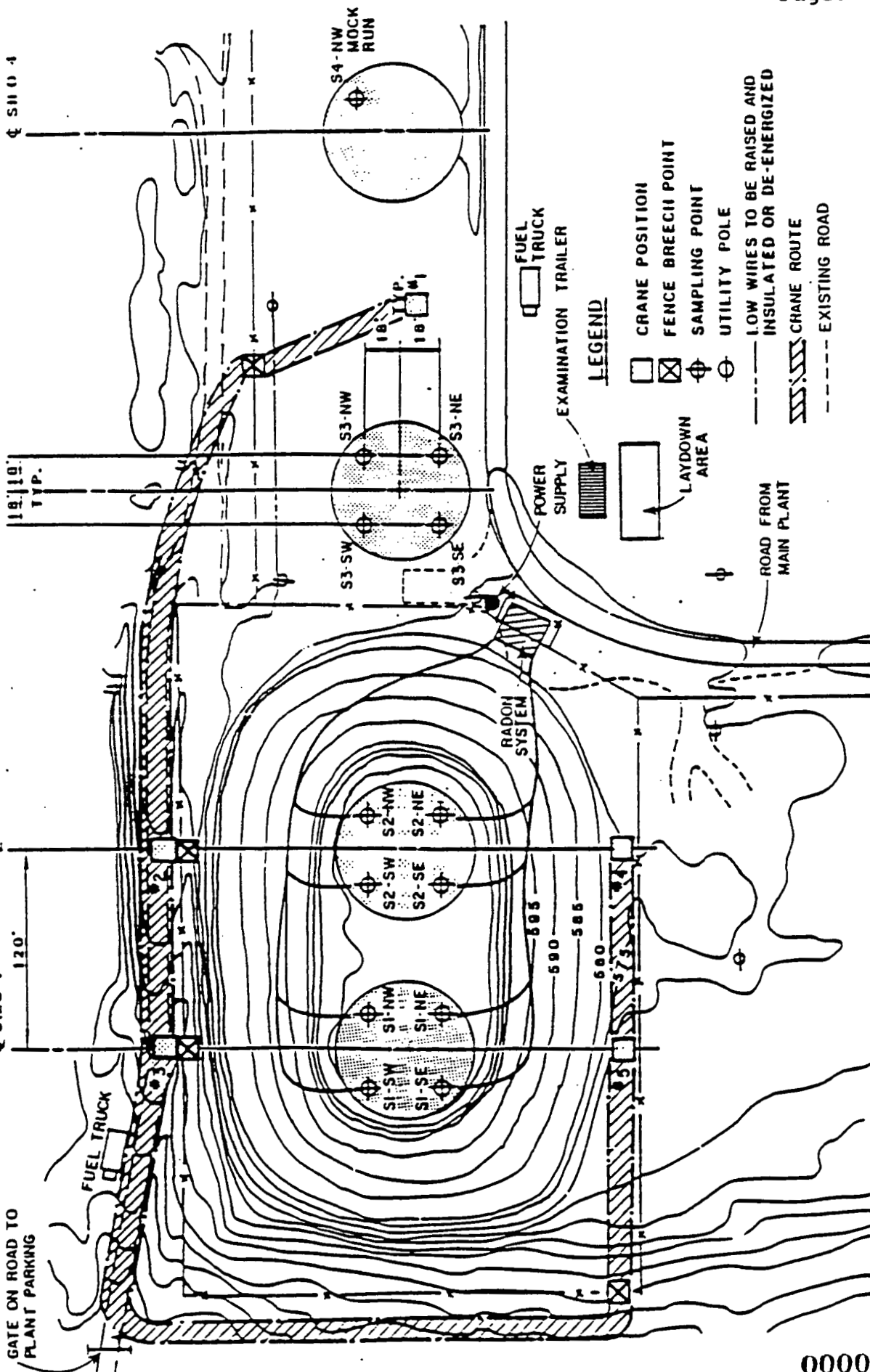
STARTING DATE: 3-20-88
 DRAWN BY: W MCGILL

Q SILO 3

Q SILO 2

Q SILO 1

N



LAYOUT OF K-65 METAL OXIDE SAMPLING AREA

NOT TO SCALE

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TITLE: SETUP AND POSITIONING OF THE CRANE

1.0 PURPOSE

This procedure defines the progression of steps to be followed during setup and positioning of the crane used to support the Vibra Corer sampler during sampling of the Waste Storage Silos 1, 2, and 3. The crane must be used to eliminate undue stress and weight on the domed roofs of the silos by the sampling equipment. The crane must be relocated four times during the sampling program.

2.0 SCOPE

This procedure applies to setup and positioning of the crane used during sampling of the FMPC Waste Storage Silos 1, 2, and 3. The mock sampling run on Silo 4 will also be performed in accordance with this procedure.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the field program phase.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced with this procedure and/or have been trained in the use of the stated equipment.
- 3.3 It is the responsibility of each individual working with the crane to be familiar with this procedure. Those directly involved with setup or positioning of the crane are responsible for following this procedure and reporting any problems or unusual occurrences immediately to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 4.1 Engineering Study of the K-65 Storage Silo Radon Mitigation and Dome Reinforcement Project at the Feed Materials Production Center; IT Corporation, August 20, 1987.
- 4.2 Statement of Work, K-65 Sampling; WMC0.

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- 4.3 Occupational Safety and Health Standards for Construction Industry; 29 CFR Part 1926.
- 4.4 K-65 Sampling Operation Sequence, Procedure K6501.
- 4.5 Mock Run Using Vibra Corer Equipment, Procedure K6506.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Setup, inspection, and operation of the crane must be per OSHA standards, Sections 1910.180, 1926.550, and all relevant national consensus standards (i.e., ANSI). Load testing must be performed and documented in accordance with WMCO Maintenance Work Instruction CRA-001, "Cranes and Hoists Inspection" and verified by the Project Engineer.
- 5.2 Protective clothing and dosimetry will be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.3 Accessible areas within the swing radius of the rotating superstructure of the crane will be barricaded to prevent an employee injury.
- 5.4 Crane clearance from any electrical distribution or transmission lines will be maintained in accordance with the following OSHA requirements and approved by WMCO Fire and Safety:
 - o Lines rated 5kV or below, minimum clearance between the lines and any part of the crane or load will be 10 feet.
 - o Lines rated over 5kV, minimum clearance will be 10 feet plus 0.4 inch for each kV over 5kV, or twice the length of the line insulator, but not less than 10 feet.
 - o In transit with no load and with the boom lowered, the equipment clearance will be a minimum of 4 feet for voltages less than 50kV; 10 feet for voltages over 50kV, up to and including 345kV; and 16 feet for voltages between 345kV and 750kV.

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5.5 The crane is being used to support the weight of the sampling equipment and to minimize stresses to the domed roofs of the silos. The limited structural integrity of the silos should be considered throughout the sampling program and particularly during the operation of the crane. At no time should the crane load rest on the surface of the dome.

5.6 Silo domes are sloped, resulting in poor footing. Appropriate footwear should be worn and care taken when walking on the silos.

NOTE: At no time should personnel walk on or equipment be placed on the center cap of the silo.

5.7 Review of safety and operational procedures has taken place with personnel involved.

6.0 PREREQUISITES

6.1 Safety and radiation training for all workers in accordance with procedures of WMCO and the contractor.

6.2 Skilled labor available for crane assembly and operation.

6.3 Fuel truck located for fueling crane at its five positions per Drawing No. 303317-A-C01.

6.4 Crane components for assembly and maintenance on site.

6.5 Adequate access and travel roads around the silos.

6.6 Tool truck, small assembly crane, and other equipment required for primary crane assembly per contractor's recommendations.

6.7 Electrical transmission lines which cross the travel route of crane de-energized or moved sufficiently out of the way per OSHA requirements during crane movement.

6.8 Security fence breached at locations per Drawing No. 303317-A-C01.

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7.0 PROCEDURES

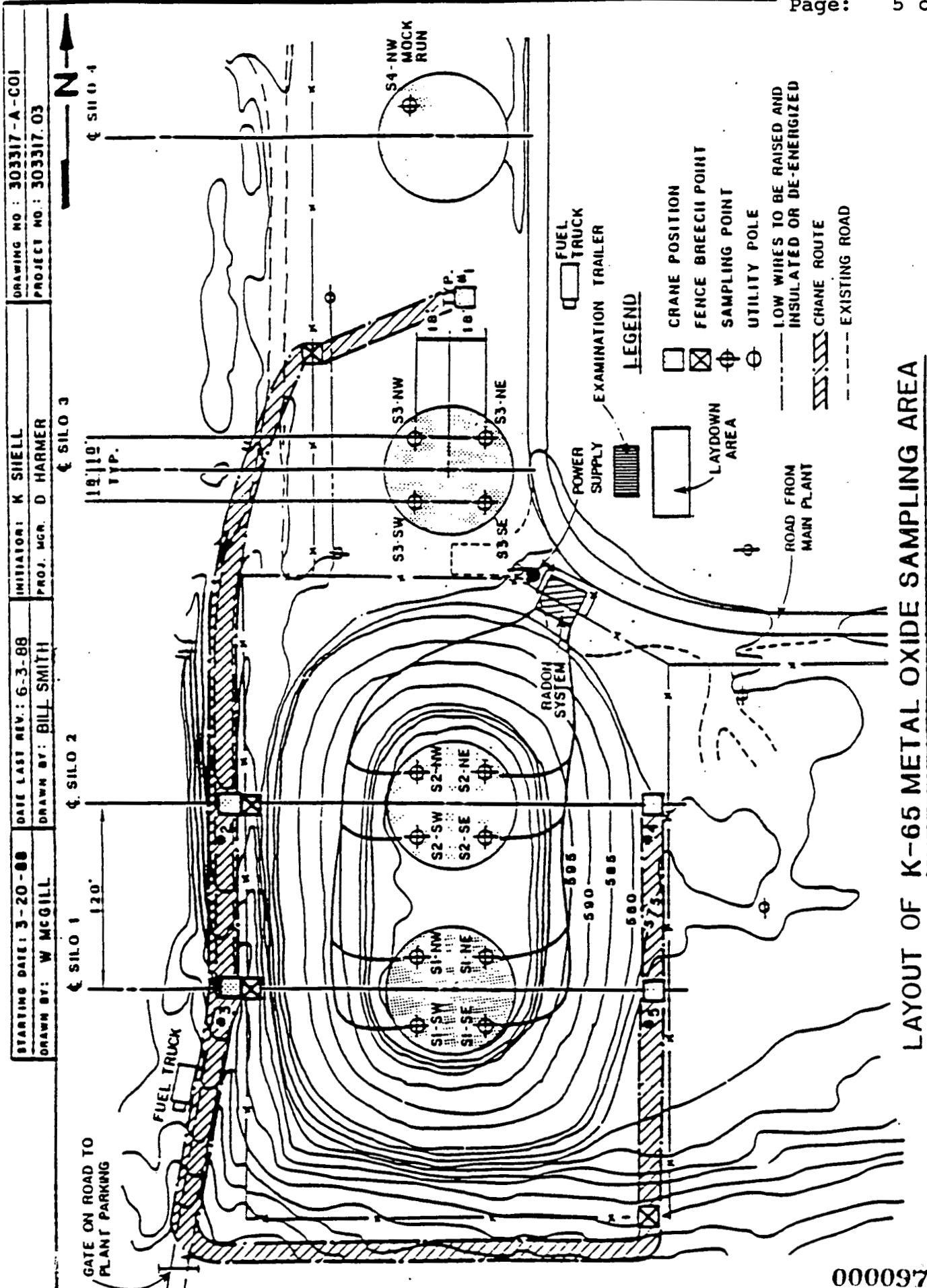
- 7.1 Locate crane components, small assembly crane, and required general tools in the assembly area.
- 7.2 Barricade accessible areas within swing radius of the rotating superstructure per contractor's recommendations.
- 7.3 Assemble crane per manufacturer's instructions.
- 7.4 Fill fuel tank with fuel oil. Be sure to ground both systems properly prior to fuel transfer.
- 7.5 Inspect equipment, machinery, and cable prior to use. Make repairs or replacements as required before proceeding. Notify K-65 Sampling Task Leader of any unusual circumstances. Perform and document load testing per WMC0 Maintenance Work Instruction, CRA-001, "Cranes and Hoists."
- 7.6 Locate crane sequentially beginning with position No. 1 per Drawing No. 303317-A-C01.

NOTE: Crane will be relocated four times throughout the sampling program. It should travel along the routes designated on Drawing No. 303317-A-C01. Travel route and access area should be barricaded when relocating the crane.

- 7.7 Set outriggers if applicable.
- 7.8 Position boom above corresponding sequential manhole per Drawing No. 303317-A-C01 to establish correct positioning.

NOTE: The K-65 Task Manager will inspect crane position and give authorization to proceed. Record authorization in the project logbook.

- 7.9 Swing boom to a location designated in Procedure K6506 for hook up to sampler. Secure crane. Do not proceed without confirmation from K-65 Sampling Task Leader.



LAYOUT OF K-65 METAL OXIDE SAMPLING AREA

NOT TO SCALE

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TITLE: REMOVAL OF MANHOLE FLANGES

1.0 PURPOSE

This procedure provides the methodology to remove the manhole flanges prior to taking core samples from the silos.

2.0 SCOPE

This procedure applies to Storage Silos 1, 2, 3, and 4. Each of these silos is equipped with five manways (manholes). Sampling will be conducted through four manholes on Silos 1, 2, 3, and a mock run will be conducted on one manhole of Silo 4. The fifth manhole, at the center of each domed roof, will be excluded from the sampling program. A total of 13 manhole covers will be removed.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of K-65 Sampling Task Leader to see that this procedure is followed during the field program phase.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced with this procedure and/or have been trained in the use of the stated equipment and removal of the flanges.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and report any unusual occurrences to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 K-65 Sampling Operation Sequence, Procedure K6501
- 4.2 Statement of Work, K-65 Sampling; WMC0
- 4.3 Radon Removal System, Procedure K6510.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing and dosimetry must be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.

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- 5.2 To minimize man-rem exposure, work on the K-65 silos must be well planned and performed so that no more time than necessary is spent on the domes.
- 5.3 Silo domes are sloped, resulting in poor footing. Proper footwear should be worn and care exercised when maneuvering on top of the silos. NOTE: At no time should personnel walk on or equipment be placed on the center cap of the dome.
- 5.4 In addition to the protective clothing referenced above, disposable latex gloves should be worn during light work around the flanges. Leather gloves should be worn when handling the flange covers.
- 5.5 Review of safety and operational procedures has taken place with personnel involved.

6.0 PREREQUISITES

- 6.1 Safety and radiation training for all workers in accordance with procedures of WMCO and the contractor.
- 6.2 Disposable latex gloves (2 pairs)
- 6.3 Wrenches (2)
- 6.4 Crowbar
- 6.5 Field logbook
- 6.6 Bolt lubricant (rust penetrant and lubricant)
- 6.7 Protective clothing per Addendum No. 2 (Revision 2) to the Fernald RI/FS Health and Safety Plan (Revision 3), June 1988.
- 6.8 Plastic squares (12) (for sitting flanges on as a holding area)

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6.9 Leather gloves (2 pairs)

6.10 Two-way radios (1 set)

6.11 Backpacks (2)

7.0 PROCEDURES

7.1 SILLO HEADSPACE "PUMP DOWN"

7.1.1 Before the manhole flanges are removed from Silo 1 and Silo 2, the Radon Removal System will be run to reduce headspace radon levels to ALARA criteria (Procedure No. K6510).

7.2 MANHOLE FLANGE REMOVAL

Note: Follow containment installation procedures outlined in K6506 and K6507 before manhole flange removal.

7.2.1 After receiving authorization from the K-65 Sampling Task Leader, collect required supplies and equipment including a working set of two-way radios.

7.2.2 Sequentially, the first flange to be removed is on Silo 4 as a mock sampling run (Drawing No. 303317-A-C01). The three flanges on Silo 3 will be removed next because radon testing and the results of sample analysis are not required prior to work on Silo 3. The radon results and confirmation to proceed by WMCO is required on Silo 1 and Silo 2. Flange removal and sampling will be performed on these two silos as the radon results and WMCO approval to proceed are secured.

7.2.3 The procedure for removing any manhole flange begins with the removal of the C-clamps (Silos 1 and 2) bolts (Silo 3) securing the flange to the manhole and

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the radon system vent pipe. An attempt should first be made to remove bolts with a wrench.

7.2.4 For rusted bolts that cannot be loosened with the wrenches, a rust penetrant and lubricant such as "Liquid Wrench" or "Kroil" may be necessary. Spray the rust penetrant and lubricant onto the rusted bolt and let it sit for 5 to 10 minutes before trying to loosen the bolt.

7.2.5 Once the C-clamps or bolts have been removed from the manhole flange, carefully pry apart the flanges using the crowbar. Also, remove the bolts from the flange connecting the radon system vent pipe.

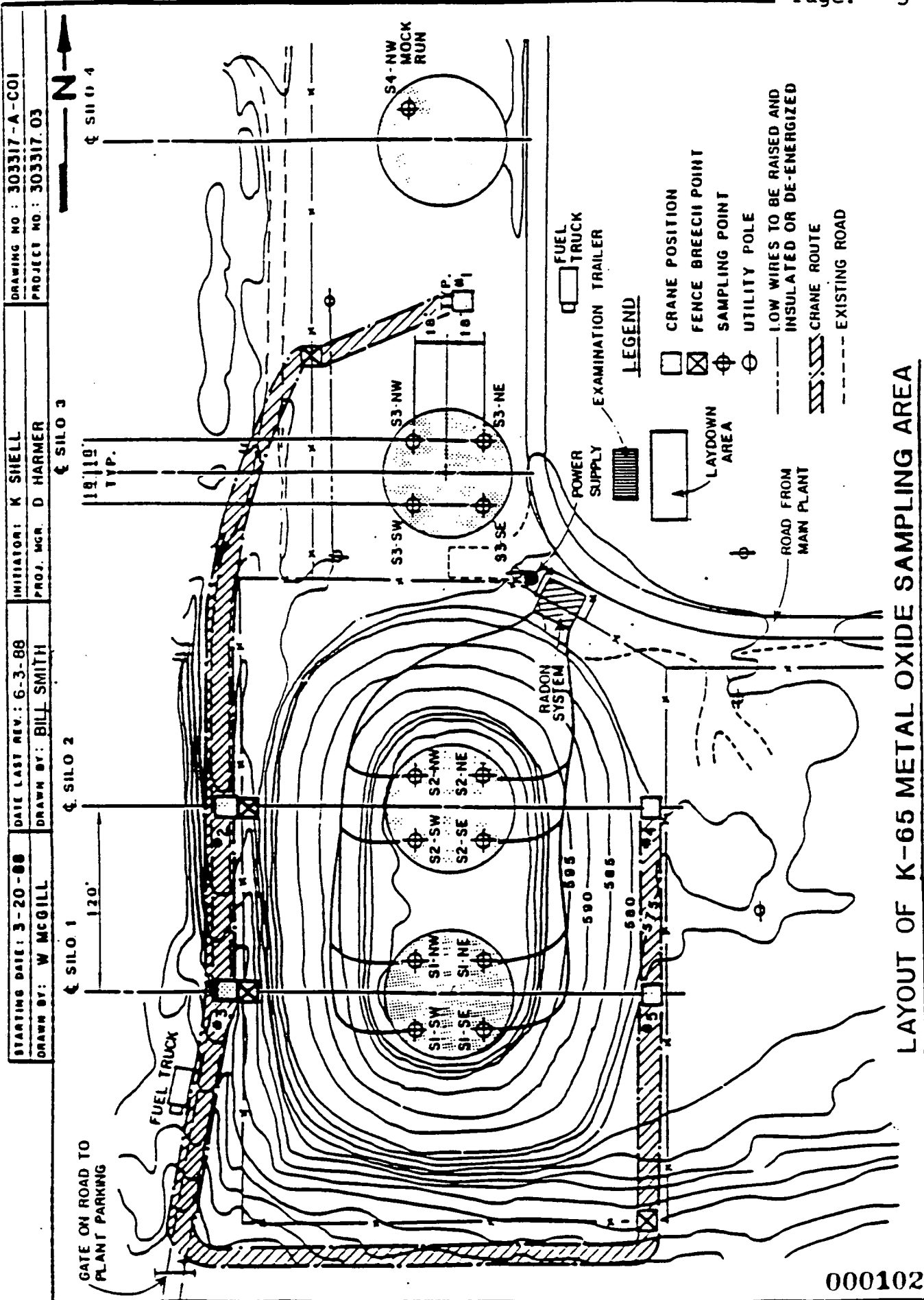
WARNING: IF, UPON OPENING THE FLANGE, EVIDENCE OF ESCAPING GAS (SOUNDS, VISIBLE VAPORS) ARE NOTICED, QUICKLY RETREAT TO A SAFE DISTANCE AND IMMEDIATELY REPORT THE INCIDENT TO THE K-65 SAMPLING TASK LEADER OR HIS DESIGNEE. DO NOT PROCEED UNTIL FURTHER AUTHORIZATION IS GIVEN.

7.2.6 Carefully slide the manhole flange over to create an edge for manually gripping and lifting the flange.

7.2.7 Using a correct lifting stance to minimize strain to the back, two people should lift the flange and relocate it to the side pocket of the containment bag.

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TITLE: SILO SAMPLING MOCK RUN USING VIBRA CORER EQUIPMENT

1.0 PURPOSE

This procedure is to provide all details and sequences of events for the mock sampling of Silo 4 using the Vibra Corer sampling device. This exercise is intended to reveal opportunities for improvement in carrying out the procedures developed for silo sampling, to define any additional or modified equipment needs, and to serve as a training mechanism for the sampling team.

2.0 SCOPE

This procedure details the steps required to collect a mock sample from Silo 4 at the northwest (NW) port opening after the crane has been correctly positioned. The mock run will continue to the point when the Vibra Corer sampling device has been properly loaded for transport to the sample laydown area.

Because this silo does not contain any material, no sample core will actually exist after the procedure is carried out. All steps required in the actual sampling of the three remaining silos will, however, be carried out in this mock run. Protective clothing designated for use in sampling the other three silos will be used in this procedure to determine if modifications are required.

3.0 RESPONSIBILITY

- 3.1 It will be the responsibility of the K-65 Sampling Task Leader to ensure that these procedures are carried out as designed. It will also be his responsibility to recognize and recommend any necessary changes to the procedures to the K-65 Sampling Task Manager prior to the sampling of Silos 1, 2, or 3. The K-65 Sampling Task Leader will report any unusual occurrences and evaluate the procedures established for the silo sampling using the Vibra Corer sampling apparatus.
- 3.2 It will be the responsibility of the K-65 Sampling Task Leader to designate appropriately trained or experienced personnel to the following tasks.

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- 3.4 It will be the responsibility of each individual assigned to the following tasks to report any unusual circumstances or modifications of the procedures as required to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 Statement of Work, K-65 Sampling; WMCO.
- 4.2 K-65 Sampling Operation Sequence, Procedure K6501.
- 4.3 Engineering Study of the K-65 Storage Silo Radon Mitigation and Dome Reinforcement Project at the Feed Materials Production Center; IT Corporation, August 20, 1987.
- 4.4 Conceptual Design Report, K-65 Storage Silo Radon Mitigation and Dome Reinforcement Study; WMCO, May 1987.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Good field safety rules will be observed at all times during the handling of the sampling equipment and the execution of the sampling exercise in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.2 Protective clothing and dosimetry will be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.3 To minimize man-rem exposure, work performed near the silo domes must be well-planned and performed such that no more time than necessary is spent in close proximity to the domes.
- 5.4 Due to the deteriorating integrity of the dome structures, strict adherence to the health and safety requirements must be maintained.
- 5.5 The K-65 Sampling Task Leader should not leave the silo area throughout the sampling operation unless a designated, qualified person is available for standby in case of an emergency.

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6.0 PREREQUISITES

- 6.1 All applicable training requirements of WMCO and the Contractor must be met by persons performing the following tasks.
- 6.2 Equipment assembly will have been completed per Procedure K6503.
- 6.3 The Vibra Corer apparatus will have been transported to the silo and properly located for crane line attachment and detachment after sample collection.

7.0 PROCEDURE

- 7.1 Tape the poly sleeve to the upper portion of the Vibra Corer casing using duct tape.
- 7.2 Position glove bag over the selected manway and position support frame to hold bag at the appropriate angle for sampling device.
- 7.3 Tape manway end of glove bag securely to the skirt of the manway frame.
- 7.4 Adjust bungee cord to position containment at the correct angle for sampling.
- 7.5 Remove silo flange per procedure K6505 and set aside in the pocket designed into the glove bag. Place manway positioning pipe on manway opening.
- 7.6 Attach the crane line to the top of the dynamometer or load cell with appropriate fittings per Procedure K6503.
- 7.7 Connect the Vibra Corer head assembly to the bottom of the dynamometer or load cell with the appropriate fittings (see Procedure K6503).
- 7.8 Connect the air line or drive cable from the compressor to the Vibra Corer head assembly.
- 7.9 The crane subcontractor or K-65 Sampling Task Leader will recheck all of the crane line connections/fittings before lifting the Vibra Corer sampling device.

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- 7.10 The K-65 Sampling Task Leader will take a position on top of Silo 4 using the ladder attached to the side of the silo. The NW port opening has been designated as the sample location for the mock run and will have been marked per Procedure K6502. (See Drawing No. 303317-A-C01.)
- 7.11 The crane signalman will then signal the crane operator to slowly raise the sampling apparatus off the flatbed truck.
- 7.12 Once the sampling device is suspended vertically in the air, the signalman will signal the crane operator to direct the device precisely over the open manhole and the containment sleeve. Note the reading on the dynamometer at this time. This is the weight of the sampling apparatus. Attach 45' containment bag to manway bag.
- 7.13 Using a utility knife, cut away the seal around the area of the transfer sleeve to allow the sampling device to be lowered into the silo.
- 7.14 The sampling device will be carefully lowered through the containment sleeve opening until it just passes inside the manhole opening, and the signalman will signal the crane operator to hold the position. Workers on the dome shall fold the transfer sleeve around the pvc pipe as the sampling device is lowered into the silo. The barrel should be lowered about approximately 20' into the silo and then the air line should be connected to compressor.
- 7.15 The signalman will then signal the operator of the drive unit to start the equipment to activate the vibrating mechanism of the Vibra Corer.
- 7.16 If the vibrating mechanism is working improperly, the signalman will signal the operator to shut off the compressor or drive unit.
- 7.17 When the vibrating mechanism is working properly, the signalman will then signal the operator to begin lowering the Vibra Corer.

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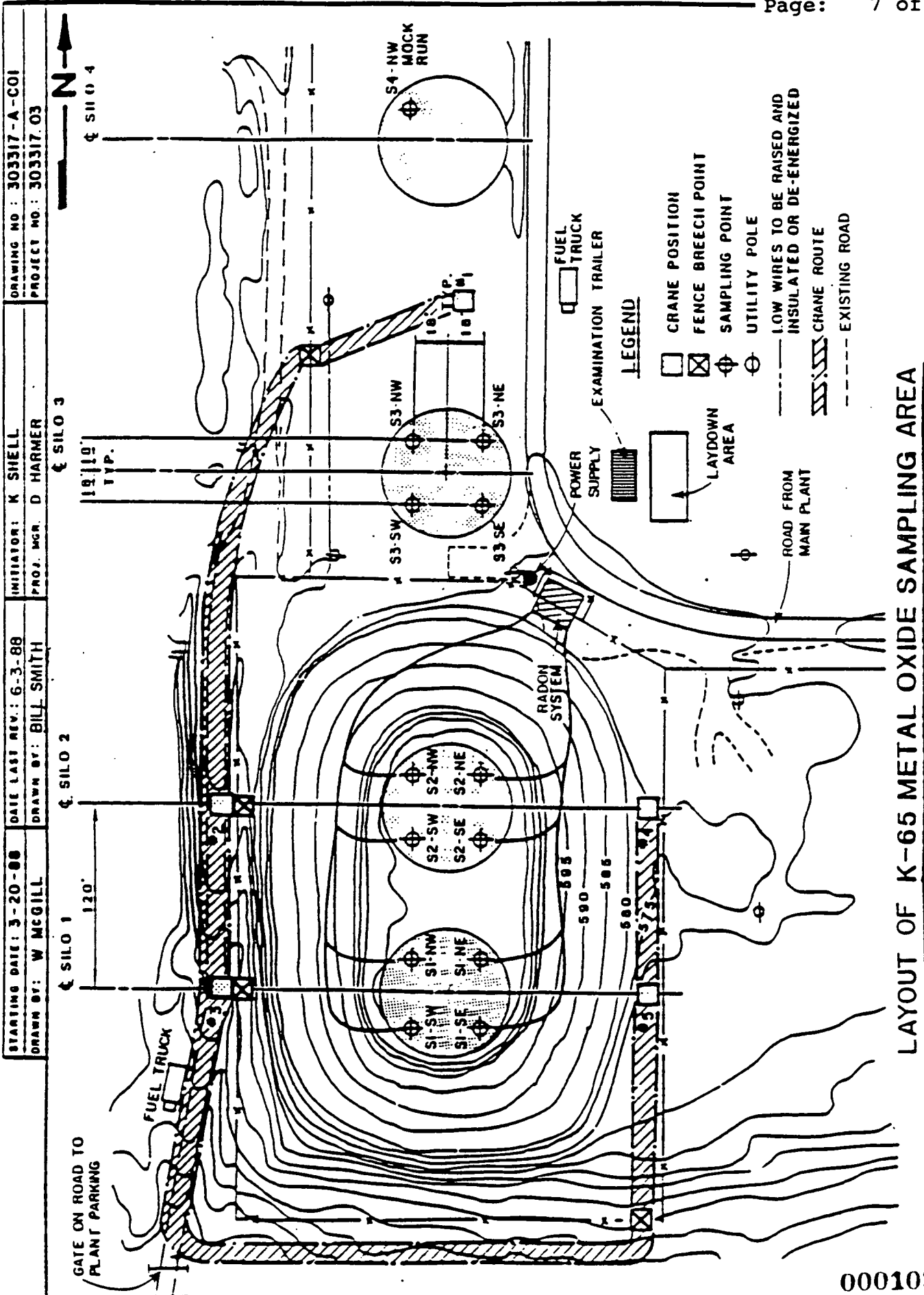
- 7.18 Continue lowering the sample device until the 33-foot mark on the outer casing is flush with the top of the manhole opening. For the next one to two feet, the lowering of the sample device should proceed in very small (1 to 2 inch) increments.
- 7.19 Continue lowering the Vibra Corer Sampling apparatus until the cutting shoe just touches the bottom of the silo, at which time the signalman will signal the operator to shut off the compressor or drive unit.
- 7.20 Note the exact depth on the outer casing that is flush with the top of the flange as the core barrel gently touches the bottom of the silo.
- 7.21 Signal the crane operator to begin slowly withdrawing the crane line. Steady the barrel of the sampling device, if needed, as it is withdrawn from the silo.
- 7.22 When the sampling device has cleared the top of the manhole opening by at least 3 feet, signal the crane operator to stop the withdrawal of the crane line.
- 7.23 Crimp and seal the polyethylene sleeve below the corer barrel using duct tape.
- 7.24 Cut the polyethylene sleeve below the taped seal.
- 7.25 Signal the crane operator to slowly begin to raise the sampling device to clear the railing on the silo roof.
- 7.26 Carefully swing the sampling device to a position above the flatbed trailer located to receive the sampling apparatus, and slowly lower the Vibra Corer to the trailer.
- 7.27 Position the end of the core barrel up against the trailer bed and inside the core trough provided.
- 7.28 Slowly lower the Vibra Corer and direct the sampling apparatus into the trough in a horizontal position.

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- 7.29 Once the entire sampling device is resting completely inside the trough, signal the crane operator to hold the position.
- 7.30 Disconnect the air line or drive cable from the head assembly.
- 7.31 Disconnect the dynamometer or load cell from the head assembly.
- 7.32 Replace manway cover per procedure K6505.
- 7.33 Remove the containment sleeve assembly from the manhole flange and remove unused polyethylene.

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LAYOUT OF K-65 METAL OXIDE SAMPLING AREA

NOT TO SCALE

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TITLE: TAKING OF SAMPLES USING VIBRA CORER EQUIPMENT

1.0 PURPOSE

The purpose of this procedure is to provide all details and sequence of events in the sampling of Silos 1, 2, and 3 using the Vibra Corer sampling device.

2.0 SCOPE

This procedure details the steps required to collect core samples from each of the three storage silos at the FMPC. The following steps become applicable at the conclusion of those described in Procedure K6505 for the removal of manhole flanges. Any procedural deficiencies, found through the performance of the mock sampling run on Silo 4 using the Vibra Corer equipment (Procedure K6506), must also be properly addressed and corrected before sampling of Silos 1, 2, and 3 proceeds.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to ensure that this procedure is carried out as designed.
- 3.2 It will be the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the use of the stated equipment and handling of the samples.
- 3.3 It is the responsibility of each individual assigned to the following tasks to report any unusual circumstances or procedural nonconformances to the K-65 Sampling Task Leader.
- 3.4 It is the responsibility of the K-65 Sampling Task Leader to inform the team members of any changes made to the procedure before implementation.

4.0 REFERENCES

- 4.1 Statement of Work, K-65 Sampling; WMC0.
- 4.2 K-65 Sampling Operation Sequence, Procedure K6501.

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- 4.3 Engineering Study of the K-65 Storage Silo Radon Mitigation and Dome Reinforcement Project at the Feed Materials Production Center; IT Corporation, August 20, 1987.
- 4.4 Conceptual Design Report, K-65 Storage Silo Radon Mitigation and Dome Reinforcement Study; WMCO, May 1987.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Field safety rules are to be observed at all times during the handling of the sampling equipment, in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.2 Protective clothing and dosimetry will be worn in strict accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.3 To minimize man-rem exposure, work performed on the silos must be well planned and performed such that no more time than necessary is spent on the domes.
- 5.4 All personnel involved in the following tasks must be thoroughly familiar with emergency procedures as described in Section 1, Subsection 6.0 of the OSH Plan.

6.0 PREREQUISITES

- 6.1 All applicable training requirements from WMCO and the Contractor must be met by persons performing the following tasks.
- 6.2 Equipment preparation and set-up must be completed per Procedure K6503. A polyethylene sheet, duct tape, and a utility knife must be available.
- 6.3 Crane assembly and positioning must be completed per Procedure K6504.
- 6.4 The Vibra Corer apparatus must be transported to the silo, and the flatbed truck must be properly located for crane line attachment and detachment after sample collection.

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7.0 PROCEDURE

- 7.1 Tape the poly sleeve to the upper portion of the Vibra Corer casing using duct tape.
- 7.2 Position glove bag over the selected manway and position support frame to hold bag at the approximate angle for sampling device.
- 7.3 Tape manway end of glove bag securely to the skirt of the manway frame.
- 7.4 Adjust bungie cord to position containment at the correct angle for sampling.
- 7.5 Remove silo flange per procedure K6505 and set aside in the pocket designed into the glove bag. Place manway positioning pipe on manway opening.
- 7.6 Attach the crane line to the top of the dynamometer or load cell with appropriate fittings per Procedure K6503.
- 7.7 Connect the Vibra Corer head assembly to the bottom of the dynamometer or load cell with the appropriate fittings (see Procedure K6503).
- 7.8 Connect the airline or drive cable from the compressor to the Vibra Corer head assembly.
- 7.9 The crane subcontractor or the K-65 Sampling task Leader will recheck all of the crane line connection/fittings before lifting the Vibra Corer sampling device.
- 7.10 The K-65 Sampling Task Leader will then signal the crane operator to slowly raise the sampling apparatus off the flatbed truck.
- 7.11 Once the sampling device is suspended vertically in the air, the signalman will signal the crane operator to direct the device precisely over the manhole and the containment sleeve. Note the reading on the dynamometer at this time. This is the weight of the sampling apparatus. The signalman will walk onto the dome next to the opened port to give the signals to the crane operator.

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Note: When sampling Silo 3 (which does not have an earthen mound around it), the signalman will have to position himself on top of the dome by climbing the ladder attached to the side of the silo. Appropriate safety measures such as lifelines or safety harnesses must be used.

- 7.12 Lower the sampling device over the selected manway until the transfer sleeve can be attached to the pvc pipe. Seal transfer sleeve to pvc pipe with duct tape at the lowest point on the pipe.
- 7.13 Using a utility knife, cut away the seal around the area of the transfer sleeve to allow the sampling device to be lowered into the silo.
- 7.14 The sampling device will be carefully lowered through the containment sleeve opening until it just passes inside the manhole opening, and the signalman will signal the crane operator to hold the position. Workers on the dome shall fold the transfer sleeve around the pvc pipe as the sampling device is lowered into the silo. The barrel should be lowered approximately 20 feet into the silo and then the airline should be connected to the compressor.
- 7.15 The signalman will then signal the operator of the drive unit to start the equipment to activate the vibrating mechanism of the Vibra Corer.
- 7.16 If the vibrating mechanism is working improperly, the signalman will signal the operator to shut off the compressor or drive unit.
- 7.17 When the vibrating mechanism is working properly, the signalman will then signal the operator to begin lowering the Vibra Corer.
- 7.18 The K-65 Sampling Task Leader or his designee will signal the operator of the compressor or drive unit to activate the vibrating mechanism of the Vibra Corer.
- 7.19 The K-65 Sampling Task Leader or his designee will signal the crane operator to begin to release line slowly to allow the sample device to lower to and penetrate the material to be sampled.

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- 7.20 Once the sample device has penetrated one to two feet of material, the signalman should move to the edge of the dome (Silo 3) or the top of the sloped mound (Silos 1 and 2). He should position himself so that eye contact with the crane operator can be maintained at all times.
- 7.21 When the 33-foot mark on the outer casing of the Vibra Corer is flush with the top of the flange opening, signal the crane operator to stop momentarily. For the next 1 foot, coring should proceed very slowly at 1- to 2-inch increments.
- 7.22 When the 34-foot mark on the outer casing of the Vibra Corer is flush with the top of the manhole opening, signal the crane operator to stop the release of the line and signal the compressor or drive unit operator to deactivate the mechanism.
- 7.23 If the coring device ceases to penetrate the waste residue at any level before the 34-foot mark, deactivate the drive unit and note in the project logbook the exact depth of the Vibra Corer barrel that is flush with the top of the flange opening.
- 7.24 Signal the crane operator to begin withdrawing the crane line slowly. Do not pull the Vibra Corer out of the silo too quickly. Refrain from engaging the vibrating mechanism of the Vibra Corer during withdrawal of the core if possible. This reduces the likelihood of losing materials from the end of the core while being pulled from the hole. Activate the compressor only if the Vibra Corer appears lodged during withdrawal, or the reading on the dynamometer approaches the load capacity of the threaded casing supplied by the manufacturer.
- 7.25 As the Vibra Corer is withdrawn, ensure that the polyethylene sleeve is unfolding and following the barrel movement.
- 7.26 As the Vibra Corer nears the top of the silo, it may be necessary to steady the barrel to prevent it from swinging excessively. Be prepared to move to the manhole opening as the last 10 feet of core is pulled from the silo to keep the barrel steady.

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- 7.27 When the entire Vibra Corer has cleared the top of the manhole opening by at least 3 feet, signal the crane operator to stop withdrawal of the crane line.
- 7.28 Crimp and seal the polyethylene sleeve below the corer barrel using duct tape.
- 7.29 Cut the polyethylene sleeve at the center of the taped seal.
- 7.30 Signal the crane operator to slowly begin to raise the sampling device to clear the railing on the silo roof. The signalman will signal the crane operator that the Vibra Corer is ready to be moved to the flatbed trailer. The end of the core barrel will be held steady as necessary by walking alongside it as it is being moved to the trailer.

NOTE: When sampling Silo 3, the K-65 Sampling Task Leader will descend the silo ladder only when a qualified stand-by person is available in case of an emergency.

- 7.31 Carefully swing the sampling device to a position above the flatbed trailer located to receive the sampling apparatus, and slowly lower the Vibra Corer to the trailer.
- 7.32 Position the end of the core barrel up against the trailer bed and inside the core trough provided.
- 7.33 Slowly lower the Vibra Corer and direct the sampling apparatus into the trough in a horizontal position. Tape and mark the outside of the barrel "Top" and "Bottom". Bottom is the section inserted first into the silo. Also mark Silo # and manway location on both sets of tape.
- 7.34 Once the entire sampling device is resting completely inside the trough, signal the crane operator to hold the position.
- 7.35 Disconnect the airline or drive cable from the head assembly.

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- 7.36 Disconnect the dynamometer or load cell from the head assembly.
- 7.37 Replace manway cover per Procedure K6508.
- 7.38 Remove the containment sleeve assembly from the manhole flange and remove unused polyethylene.

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TITLE: REPLACEMENT OF FLANGES ON SILO ACCESS PORTS

1.0 PURPOSE

The purpose of this procedure is to define the progression of steps to be followed to replace the nozzle flanges upon completion of sampling.

2.0 SCOPE

This procedure applies to replacing the nozzle flanges upon completion of the mock sampling run of Silo 4 and the sampling at each of the four locations on Silos 1, 2, and 3.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the field program phase.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel that are experienced and/or have been trained in the use of the stated equipment.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 K-65 Sampling Operation Sequence, Procedure K6501.
- 4.2 Engineering Study of the K-65 Storage Silo Radon Mitigation and Dome Reinforcement Project at the Feed Materials Production Center; IT Corporation, August 20, 1987.
- 4.3 Statement of Work, K-65 Sampling; WMCO.

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5.0 SAFETY AND PRECAUTIONS

5.1 Protective clothing and dosimetry will be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.

5.2 Silo domes are sloped, resulting in poor footing. Appropriate footwear should be worn and care taken when walking on the silos.

NOTE: Do not permit personnel or equipment on center cap areas of silo domes.

5.3 Every attempt should be made to minimize structural stresses to the domed roofs of the silos. Appropriate care should be taken when maneuvering heavy materials above the silos.

5.4 In addition to the protective clothing referenced in Step 5.1, leather gloves should be worn when lifting flanges or working with heavy equipment.

5.5 To minimize man-rem exposure, work on the K-65 silos must be well planned and performed such that no more time than necessary is spent on the dome.

5.6 Any action which results in unplanned exposure to radioactive materials will be reported immediately to the K-65 Sampling Task Leader and the Project Health Physicist.

5.7 Review of safety and operational procedures has taken place with personnel involved.

6.0 PREREQUISITES

6.1 Safety and radiation training for all workers in accordance with procedures of WMCO and the contractor.

6.2 General tools for replacement of flanges should be available, including:

6.2.1 Gasket material

6.2.2 Six sets of nuts and bolts per flange

6.2.3 Two wrenches

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6.2.4 Two pairs of leather shoes

6.2.5 "Moly Kote" thread lubricant or approved equivalent.

6.3 A working set of two-way radios.

6.4 Procedure K6506 or K6507, as appropriate, is complete for each specific manhole location.

7.0 PROCEDURE

7.1 Replace gasket material on sealing surface of flange.

7.2 Carefully lift flange and carry from holding area to nozzle. Align bolt hole pattern and lower flange into position.

7.3 Replace nuts and bolts or C-clamps prepared with thread lubricant. Tighten nuts uniformly, working back and forth across the flange.

7.4 Connect radon removal system vent pipe if directed by WMCO.

7.5 Enter work completed and any other applicable information in the project logbook.

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TITLE: TRANSPORT OF VIBRA CORER SAMPLING DEVICE

1.0 PURPOSE

The purpose of this procedure is to provide the sequence of events and equipment necessary to transport the Vibra Corer sampling device from the sampling area at each silo to the laydown area.

2.0 SCOPE

This procedure applies to the transport of the sampling device after sampling at each silo manhole.

3.0 RESPONSIBILITY

3.1 It is the responsibility of the K-65 Sampling Task Leader to ensure that the following procedures are followed during the field program phase.

3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the following tasks to persons having the appropriate training or experience to competently perform the tasks.

3.3 It is the responsibility of each designated team member to notify the K-65 Sampling Task Leader if any unusual circumstances are noted or a nonconformance to the procedure is necessary.

4.0 REFERENCES

4.1 Statement of Work, K-65 Sampling; WMC0.

5.0 SAFETY AND PRECAUTIONS

5.1 Good field safety rules will be observed at all times during the handling of the sampling equipment, in accordance with Section 1, Subsection 6.0 of the OSH Plan.

5.2 Protective clothing and dosimetry must be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.

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- 5.3 All personnel involved in the following tasks must be thoroughly familiar with the Emergency Procedures as detailed in the aforementioned Health and Safety Plan.

6.0 PREREQUISITES

- 6.1 All applicable training requirements of WMCO and the Contractor must be met by all persons performing the following tasks.
- 6.2 A 40-foot flatbed truck with a core trough secured to the bed of the truck per Procedure K6503.
- 6.3 A core receiving trough is located outside the Examination Trailer.
- 6.4 A preplanned route for the flatbed truck to deliver the Vibra Corer sampling device to the laydown area near the Examination Trailer will have been established prior to the sampling of each silo port.

7.0 PROCEDURE

- 7.1 Secure the Vibra Corer head assembly to the truck once it has been laid inside the core trough by threading rope through the closed hook or eyelet in the T-shaped head assembly. Tie the rope to the corner bar of the flatbed or other location on the truck so that the sampling device cannot slide out of the truck while in transit.
- 7.2 Carefully transport the sampling assembly to the laydown area via the preplanned route.
- 7.3 Back the flatbed truck toward the core receiving trough by the trailer, allowing at least 50 feet so that the entire sample device can be removed from the truck before placing it in the trough.
- 7.4 Untie, or otherwise disconnect the sampling apparatus from the truck bed. Remove the Vibra Corer device from the truck bed by sliding it out of the trough. (Because of its weight and length, an adequate number of sampling team members must be available.)

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- 7.5 Sampling team members should line up on the same side of the coring device as it is pulled from the truck bed. The side should be selected based on the location of the receiving trough by the Examination Trailer.
- 7.6 Care must be taken to keep the sample core as horizontal as possible and to move it with as little agitation as possible while carrying it.
- 7.7 Once the entire device is over the core receiving trough, gently lower the whole length of the device at the same time into the trough.
- 7.8 Remove the Vibra Corer head assembly by unscrewing it from the coupler.

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TITLE: OPERATION PROCEDURES FOR RADON REMOVAL SYSTEM

1.0 PURPOSE

This procedure defines the progression of steps to be followed during operation of the Radon Removal System in support of the K-65 sampling program.

2.0 SCOPE

This only applies to Silo #1 and #2. The radon removal system is a temporary processing unit designed to remove and retain radon gas present in the air space of the silos. The unit will draw the air through dehumidifiers and activated carbon beds by a fan. About 1000 cfm can be achieved. System radon concentrations will be monitored. Prior to each sampling activity, the radon removal system will be operated on the particular silo being sampled to reduce the radon to an acceptable level to meet ALARA criteria. The system will be shut down after each silo "pump down".

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the operation of the radon removal system.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who have had experience or training with this procedure and the use of the radon removal system equipment.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and report unusual occurrences to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 Statement of Work, K-65 Sampling; WMCO.
- 4.2 K-65 Sampling Operation Sequence, Procedure K6501.

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- 4.3 Engineering Study of the K-65 Storage Silo Radon Mitigation and Dome Reinforcement Project at the Feed Materials Production Center; IT Corporation, August 20, 1987.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing and dosimetry will be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.2 Radon is a radioactive gas that decays to form intermediate radioactive particulates. All work performed in and around the trailer and radon removal unit will be under the direction of Health Physics personnel, and all aspects of installation, testing, and operation will be carefully controlled by Radiation Work Permits.
- 5.3 To minimize man-rem exposure, all work on the radon removal unit must be well planned and performed so that no more time than necessary is spent completing the required tasks.
- 5.4 Any circumstance that could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption will be reported immediately to the K-65 Sampling Task Leader and the Project Health Physicists. The involved employees will report to the WMCO Medical Department at the end of their shift to submit a urine sample and again will report at the start of their next shift to submit another urine sample. The K-65 Sampling Task Leader or his designee will inform the WMCO Environmental and Radiological Monitoring Technician of the circumstance and file an Abnormal Incident Report Form before the end of the shift during which the circumstance happened.

6.0 PREREQUISITES

- 6.1 Radon removal system operable and connections available at the sampling areas.
- 6.2 Safety and radiation training for all workers in accordance with procedures of WMCO and the Contractor.

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6.3 A review of safety and operational procedures has taken place with the personnel involved.

7.0 PROCEDURE

7.1 Startup of Radon Unit (Reference Drawing No. 303317-B-P05)

- 7.1.1 Check electrical installation to the fan and verify the rotation of the fan.
- 7.1.2 Check instrument installation and calibration, or perform required calibration.
- 7.1.3 Verify all system dampers are closed.
- 7.1.4 Open Dampers D-01, D-03, D-04, and D-11.
- 7.1.5 Start fan F-001.
- 7.1.6 When fan is operating, observe and record in the logbook system static pressure, fan differential pressure, and air flow. Verify that the system is operating within the design range.

7.2 Radon Removal Operation

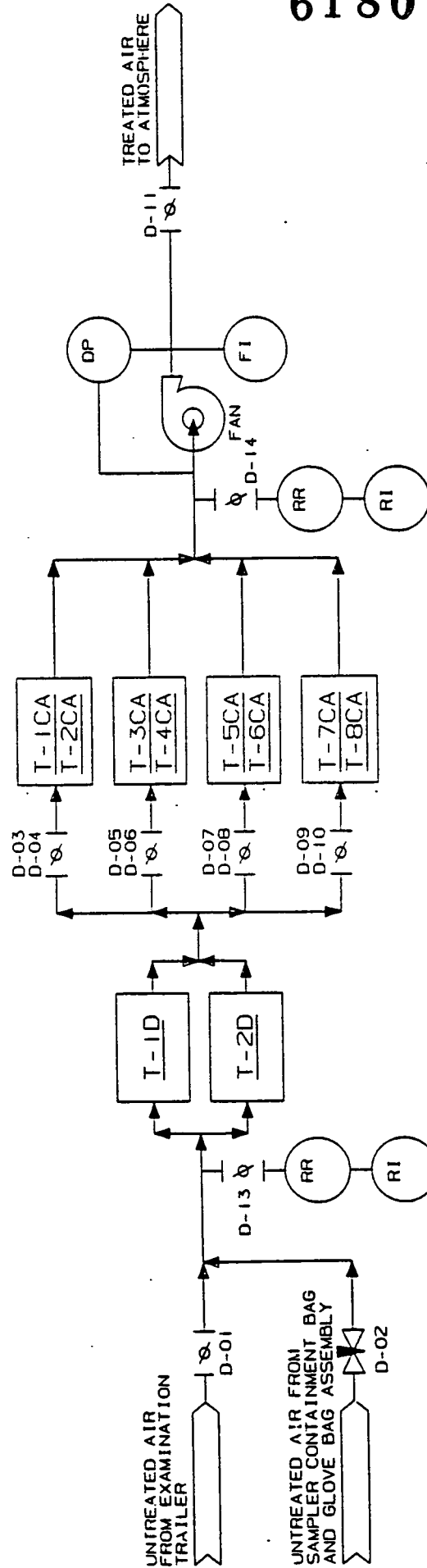
- 7.2.1 Verify that all system dampers are closed (see Step 7.1.3).
- 7.2.2 Open the following dampers (see Steps 7.1.4 and 7.1.7):
 - D-01
 - D-03
 - D-04
 - D-11
 - D-13
 - D-14.
- 7.2.3 Start fan and verify air flow through system at 1000 cfm 10 percent (see Step 7.1.5).

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- 7.2.4 Continue flow and monitor system inlet and outlet radon concentrations and dose buildup on tanks T-1CA and T-2CA.
- 7.2.5 Continue air recirculation until dose rate on top of silo manways are less than 60 mr/hr.
- 7.2.6 In the event the concentrations of radon at the inlet and outlet of tanks T-1CA and T-2CA reach equilibrium before the desired inlet radon concentration is reached, open Dampers D-05 and D-06.
- 7.2.7 Close Dampers D-03 and D-04. Note: A third and fourth set of carbon beds is provided and can be operated if necessary to achieve desired concentrations (Dampers D07 through D-11).
- 7.2.8 When the desired radon concentration is reached, the sampling equipment is assembled, and the sampling team is prepared to begin work, shut down fan F-001.
- 7.2.9 Close the following dampers:
- | | | |
|------|------|------|
| D-01 | D-06 | D-10 |
| D-03 | D-07 | D-11 |
| D-04 | D-08 | D-13 |
| D-05 | D-09 | D-14 |
- 7.2.10 Proceed with sampling activities, following Procedure K6505.
- 7.2.11 Repeat for second K-65 silo.

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T-1CA THRU T-8CA
 ACTIVATED CARBON ADSORBERS

T-1D, T-2D
 CALCIUM SULFATE
 DEHUMIDIFIER

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TITLE: INITIAL ON-SITE CORE HANDLING AND INSPECTION

1.0 PURPOSE

The purpose of this procedure is to specify those actions that are necessary between the time the sample core barrel has been placed in the receiving trough and the time of initiating the detailed on-site data gathering. This procedure should ensure that the sample core is removed from the Vibra Corer barrel, cleaned externally, and placed in position for further examination in a safe and well controlled series of steps.

2.0 SCOPE

This procedure is to be used for each sample core before formal examination and data-gathering begin.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the field operations.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps and requirements.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K- 65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 K-65 Sampling Operation Sequence, Procedure K6501.
- 4.2 Taking of Samples Using Vibra Corer Equipment, Procedure K6507.
- 4.3 Operation Procedures for Radon Removal System, Procedure K6510.

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5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing, respiratory protection, and dosimetry must be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 5.2 Any circumstance that could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption will be reported immediately to the K-65 Sampling Task Leader and the Project Health Physicists. The involved employees will report to the Medical Department at the end of their shift to submit a urine sample and again will report at the start of their next shift to submit another urine sample. The K-65 Sampling Task Leader or his designee will inform the Environmental and Radiological Monitoring Technician of the circumstance and file a Minor Event Report before the end of the shift during which the circumstance happened.
- 5.3 Review of safety and operational procedures has taken place with personnel involved.

6.0 PREREQUISITES

- 6.1 Safety and radiation training for all workers in accordance with procedures of WMCO and the Contractor.
- 6.2 Clean examination area available for receipt of the new core in the Examination Trailer. Previously examined cores either removed or placed in a shielded condition with respect to the new core.

7.0 PROCEDURE

- 7.1 Move core in Vibra Corer barrel to Examination Trailer.

Note: The core and the Vibra Corer barrel inside the containment bag will be stored outside the examination trailer for at least four hours before sectioning and sample preparation. This will allow radon to decay and will decrease radiation exposure. The ends of the barrel will be wrapped in cold packs.

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- 7.2 Cut and remove the polyethylene sleeving material from the Vibra Corer casing.
- 7.3 Discard the polyethylene sleeving material in container designated for dry radioactive waste materials.
- 7.4 Using absorbent wiping fabric (such as "Maslon" or equivalent) and dilute cleaning detergent, moisten and wipe the exterior surface of the Vibra Corer casing until all visual evidence of soil and contamination has been removed. Place the core casing on a clean work surface during the final portion of this activity, to avoid recontamination.
- 7.5 Remove the lower "cutting unit" of the Vibra Corer in accordance with manufacturer's instructions.
- 7.6 IMMEDIATELY place a prepared plug in the open end of the Lexan plastic tube.
- 7.7 Lift the Vibra Corer casing while tilting it slightly and carefully slide the Lexan core out of its steel casing. This step must be performed under complete control and may require opening of the trailer doors.
- 7.8 Cut off the Lexan core-tube 1.5 feet above the top of the waste core sample.
- 7.9 Dispose of the top section in an appropriately labeled container.
- 7.10 Cap the ends of the Lexan core-tube as required and recheck that the tube is sealed on both ends.
- 7.11 Clean the Lexan core-tube per procedure in Step 7.4 above.
- 7.12 Affix sample numbering labels to the clean core tube and accurately mark which end of the tube was the upper one.
- 7.13 Continue work, as required, on this particular core using Procedures K6512, K6513, and K6514.

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- 7.14 Clean the remaining parts of the lower Vibra Corer unit as above before returning to service.
- 7.15 If no further samples are to be taken with this part of the Vibra Corer equipment, it must be set aside for decontamination in accordance with Procedure K6516.
- 7.16 Enter work completed and any other applicable information in the project logbook.

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TITLE: ON-SITE ANALYTICAL METHODS

K6512 - VISUAL INSPECTION
K6513 - VIDEO RECORDING
K6514 - RADIOLOGICAL SCREENING

1.0 PURPOSE

The purpose of these procedures is to provide the overall sequence for the performance of the on-site analysis of the core samples from the K-65 Silos (Silos 1 and 2) and the Metal Oxide Silo (Silo 3) at the FMPC.

2.0 SCOPE

Three procedures, K6512 - Visual Inspection, K6513 - Video Recording, and K6514 - Radiological Screening, have been combined into one procedure in order to simplify the process and minimize health and safety effects by concurrently performing all three operations.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the field program phase.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel that are experienced and/or have been trained in the proper operation and use of the equipment and handling of samples required in this procedure.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and report any unusual occurrences to the K-65 Sampling Task Leader.

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4.0 REFERENCES

4.1 K-65 Sampling Procedures:

K6501 - K-65 Sampling Operation Sequence

K6511 - Initial On-site Core Handling and Inspection

K6515 - Sectioning and Packaging of Sample Cores

4.2 Statement of Work, K-65 Sampling; WMC0.

4.3 1986 Annual Book of ASTM Standards, Section 4.

5.0 SAFETY AND PRECAUTIONS

5.1 Good field safety rules will be observed at all times and in accordance with Section 1, Subsection 6.0 of the OSH Plan.

5.2 Protective clothing and dosimetry will be worn in accordance with Section 1, Subsection 6.0 of the OSH Plan.

5.3 To minimize man-rem exposure, the visual inspection, video recording, and radiation scanning will be conducted at the same time insofar as it is possible.

5.4 Any circumstance that could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption will be reported immediately to the K-65 Sampling Task Leader and the Project Health Physicists. The involved employees will report to the WMC0 Medical Department at the end of their shift to submit a urine sample and again will report at the start of their next shift to submit another urine sample. The K-65 Sampling Task Leader or his designee will inform the WMC0 Environmental and Radiological Monitoring Technician of the circumstance and file an Abnormal Incident Report Form before the end of the shift during which the circumstance happened.

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6.0 PREREQUISITES

- 6.1 Safety and radiation training for all personnel in accordance with procedures of WMC0 and the Contractor.
- 6.2 Successful completion of Procedure K6511.
- 6.3 Personnel protective clothing in accordance with Section 1, Subsection 6.0 of the OSH Plan.
- 6.4 Video camera with audio capability mounted on tracks, wheels, or cart to allow movement along core sample and positional indicator (scale). A 35 mm camera will also be used in conjunction with the video camera to make color prints for archival purposes. Cameras should have a pan/tilt function, and sufficient lighting should be provided.
- 6.5 Spare video tapes.
- 6.6 Collimated Geiger counter with meter readout mounted within readable view of the video camera to allow visual indication of the counts relative to the location along the core. Shielding to be aligned such that the counter is exposed only to the sample.
- 6.7 Core trough with a scale mounted such that a single view of the camera will include the positional scale, core, and geiger reading.
- 6.8 Ice packs in plastic bags.
- 6.9 HEPA Filtration System connected to the Examination Trailer and operational.

7.0 PROCEDURE

7.1 PRELIMINARY PROCEDURES

- 7.1.1 Prior to receipt of the core sample, the video camera should be checked and loaded with a new, labeled tape. Video tapes should be labeled with the date, time, and core sample number.

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- 7.1.2 The radiation monitor should be checked and calibrated in accordance with Attachment A. The date, time of calibration, and the instrument numbers should be recorded in the logbook.
- 7.1.3 The camera and audio recording system should be charged. The camera cart should be checked for free movement.
- 7.1.4 The core trough should be prepared for receipt of the sample and the positional scale checked for proper placement. Ice packs should be placed in the trough prior to receipt of the sample.
- 7.1.5 Notebooks and logbooks should be ready and labeled.
- 7.1.6 Proper personnel protective clothing should be donned.
- 7.1.7 Portable HEPA Filtration Vacuum Cleaner checked and ready.

7.2 ON-SITE INSPECTIONS AND ANALYSIS

- 7.2.1 Position the cleaned core sample from Procedure K6511 onto the ice-packed core trough in the Examination Trailer. The core should still be inside the plastic (Lexan) tube. DO NOT REMOVE THE PLASTIC(LEXAN) TUBE FROM THE CORE!
- 7.2.2 Align the core tube with the scale at the index mark.
- 7.2.3 Make sure the video camera, 35 mm camera, radiation meter, and audio system are turned on and the cameras are also aligned with the index mark.
- 7.2.4 Begin verbal description of the sample. Maintain camera visual field to correspond to that section of the core being described. The "Description and Identification of Soils" method of description (ASTM D2488-84) should be

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used. Physical handling of the sample will not be possible, so the method will have to omit the related portion of the procedure. Do not move radiation detector faster than six feet per minute.

- 7.2.5 Enter work completed and any other applicable information in the project logbook in addition to verbal descriptions on the audio/visual tapes. Note the location on the scale marker. Annotation of the physical descriptions will be logged on the attached Visual Inspection Form in a tabular form along with the radiation readings in order to correlate the radiation readings with the physical descriptions.
- 7.2.6 At the completion of the observations, turn the video camera system off. Remove and ensure that the tape is properly labeled. Ensure that the tabular data and the video tapes and 35 mm film are properly labeled and cross referenced to the complete core sample number per the Sampling and Analysis Plan.
- 7.2.7 Move the camera system aside and prepare for Procedure K6515, Sectioning and Packaging of Sample Cores.

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PAGE

CHK'D BY _____

VISUAL INSPECTION FORM

PROJECT NO.	TASK NO.
DATE	TIME
CORE SAMPLE NO.	LENGTH OF CORE FT IN
TEAM MEMBERS	
INSTRUMENT NO.	

LOCATION		RADIATION READING	PHYSICAL DESCRIPTION
FT	IN		

1 BOTTOM OF CORE IS LOCATION 0 FT. 0 INCHES

SIGNATURE _____

DATE/TIME _____

000137

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TITLE: SECTIONING AND PACKAGING OF SAMPLE CORES

1.0 PURPOSE

The purpose of this procedure is to specify the progression of steps to be followed for sectioning and packaging the sample cores. These instructions pertain to the packaging of both archive and analytical samples.

2.0 SCOPE

This procedure is to be used for each sample core once it has been visually inspected, video taped, and radiologically screened. Sectioning for each core may vary based on these prior inspections.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the field program phase.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the use of the stated equipment.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and report any unusual occurrences to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 K-65 Sampling Operation Sequence, Procedure K6501.
- 4.2 Visual Inspection, Procedure K6513.
- 4.3 Video Recording, Procedure K6514.
- 4.4 Radiological Scanning, Procedure K6515.
- 4.5 Abnormal Occurrences, Procedure K6525.
- 4.6 Statement of Work, K-65 Sampling; WMCO.

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4.7 K-65 Sampling Plan, Section 1, Subsection 6.0.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing, respiratory protection, and dosimetry must be worn in accordance with Section 6.0 of the OSH plan.
- 5.2 Disposable gloves will be worn at all times when handling the core samples.
- 5.3 With sectioning and packaging taking place in the Examination Trailer, care should be exercised at all times to prevent spread of contamination. Decontamination efforts should be thorough.
- 5.4 HEPA Filtered Portable Vacuum Units will be used to vent the sectioning of the Lexan tube.
- 5.5 All temporary and permanent storage areas for cores, samples, or sample residues will be shielded to satisfy ALARA requirements for radiation exposure.
- 5.6 All high radiation areas will be posted and locked or guarded at all times.
- 5.7 Any action that results in unplanned exposure to radioactive materials must be reported immediately to the K-65 Sampling Task Leader and the Project Health Physicists (see Procedure K6525).

6.0 PREREQUISITES

- 6.1 Safety and radiation training for all workers in accordance with procedures of WMC0 and the Contractor
- 6.2 Sample labels
- 6.3 Sample Collection Log Form
- 6.4 Disposable gloves
- 6.5 Permanent ink markers
- 6.6 Scaled sectioning trough

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- 6.7 Cutting tool (hack saw)
- 6.8 Plastic caps for Lexan liner
- 6.9 Electrical tape (multiple rolls)
- 6.10 Portable HEPA Filtered Vacuum Cleaner Operating
- 6.11 Trash barrel labeled "Contaminated"
- 6.12 Decontamination wipes
- 6.13 Detergent rinse and rinse bottles
- 6.14 Roll of plastic sleeve for encasing core sections
- 6.15 Heat sealers for plastic sleeves (2)
- 6.16 Paper towels
- 6.17 Sample bottles, amber glass, EPA-certified clean
- 6.18 Sample bottle lids, teflon-lined closure
- 6.19 Sample custody tape
- 6.20 Core sample storage racks (2)
- 6.21 Ice chests
- 6.22 Writing pens
- 6.23 Supply of cold packs
- 6.24 Disposable paper (multiple rolls).

7.0 PROCEDURES

7.1 SECTIONING, LABELING, AND PACKAGING OF CORE SECTIONS

- 7.1.1 Upon completion of Procedures K6512 (Visual Inspection), K6513 (Video Recording), and K6514 (Radiological Scanning), the Lexan-encased core will be in the cold inspection trough of the Examination Trailer.

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- 7.1.2 Based on the results of Procedures K6512, K6513, and K6514, the K-65 Sampling Task Leader or his designee should complete a Sectioning Plan Form and give copies of it to the task manager and the laboratory supervisor. The Sectioning Plan Form is attached.
- 7.1.3 Carefully transfer the Lexan-encased core to the sectioning trough in the Examination Trailer.
- 7.1.4 The sectioning trough is scaled off in 1-inch increments. Position the bottom of the core at the index mark on the scale.
- 7.1.5 Mark the top and bottom of the core sample with a permanent marker.
- 7.1.6 In accordance with the Sectioning Plan Form and using the trough scale, mark the sample core sections with permanent marker directly on the Lexan liner; include an arrow at each mark indicating the top of each section.
- Note: Make sure to verify the association between the Sectioning Plan Form and the core to be sectioned by checking the manhole identification tag number on the core against the tag number on the form.
- 7.1.7 Prepare sample labels assigned to this core per Attachment 6. Record the unique core sample number and core manhole tag number on the sample label and complete the appropriate line on the Sample Collection Log and the Chain-of-Custody Form.
- 7.1.8 Cut through the Lexan liner along the line marking the top of the core.
- 7.1.9 Recap the top end of the Lexan liner with a plastic cap and seal securely with electrical tape.

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7.1.10 Cut through the Lexan liner at the next section marker working from top to bottom.

7.1.11 Securely cap and tape adjoining ends of the liner exposed by each cut.

Note: Attempt to minimize loss of sample when cutting and capping by holding entire liner securely and making a clean cut. Do not attempt to collect lost sample in any core section as cross contamination of layers could result.

7.1.12 Rotate each core section removed into an upright position.

7.1.13 Decontaminate the outside of the Lexan liner and capped ends of the core section removed with a detergent wipe.

7.1.14 Dry each removed section with paper towels and affix a sample label near the top of the core section. Protect the label with a layer of clear tape. Complete the appropriate line on the Sample Collection Log (see Attachment 6).

7.1.15 Cut a section of polyethylene sleeve several inches longer than the core section. Heat seal at one end to form a bag.

7.1.16 Place the core section in the custom fabricated polyethylene bag and prepare and affix a sample label to the bag and complete the Sample Collection Log. Mark the label with an arrow indicating the top of the core section. Heat seal the sample bag as designated on the Sectioning Plan Form.

7.1.17 Store the section upright in either the temporary archive storage rack or temporary analytical sample rack. At completion of this task, storage rack

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will be closed and sealed with custody tape. Record specific rack location of each core section in project logbook.

- 7.1.18 Repeat steps 7.1.10 to 7.1.17 for each core section.

7.2 REPACKAGING OF ANALYTICAL SAMPLES

As the other core sections are being decontaminated, labeled, and bagged, the core sections in the temporary analytical sample rack should be repackaged for laboratory analysis.

Note: A person should work with one core section at a time when repackaging!

- 7.2.1 Record the label numbers of the specific core section to be repackaged in the project logbook.
- 7.2.2 Place a sheet of disposable paper on the work area.
- 7.2.3 Obtain sample bottles and remove lids.
- 7.2.4 Remove the core section to be repackaged from the temporary analytical storage rack and place it on the disposable paper.
- 7.2.5 Remove the core section from the outer bag, placing the clean bag in an adjoining clean work area for reuse after sample transfer.
- 7.2.6 Remove the tape-sealed end cap on the top of the core section.
- 7.2.7 Using a pipe sampler, carefully transfer the core sample into the bottle. Use a disposable spatula or spoon to break up the sample material if it will not flow. Fill the bottle completely to minimize the vapor space. Care must be taken not to spill sample material!

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- 7.2.8 Place cap on the bottle. Seal with custody tape.
- 7.2.9 Fill out a sample label, as detailed in Attachment 6, to be placed on the sample bottle duplicating the unique core sample label number. If all of the sample was not removed from the core, a new unique sample number will be assigned to the sample bottle. Record this number in the Sample Collection Log.
- 7.2.10 If all of the sample was not removed from the core, reseal the Lexan core section with an end cap and custody tape.
- 7.2.11 Decontaminate the outside of the Lexan core section with a detergent rinse. Dry with paper towels.
- 7.2.12 Place the Lexan-encased core section back in original bag and heat seal.
- 7.2.13 Place bagged core section in temporary archive storage rack. Indicate these sections by number on the Sectioning Plan Form and in the project logbook.
- 7.2.14 Decontaminate the outside of the sample bottle with a detergent rinse. Dry with paper towels.
- 7.2.15 Place bottle in ice chest with cold packs for storage until transported to the analytical laboratory.
- 7.2.16 Dispose of spatula or spoon after each sample (if used).
- 7.2.17 Carefully roll up disposable paper on repackaging work area and dispose in appropriate trash container. Dispose of work gloves worn when repackaging and decontaminating.

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7.2.18 Prepare shipping container(s) chests for shipment to the analytical laboratory per Procedure K6518, and transfer the temporary archive storage rack to long-term archive storage per Procedure K6517.

1.

SECTIONING PLAN FORM

PROJECT NO.	TASK NO.
DATE STARTED	DATE COMPLETED
TIME STARTED	TIME COMPLETED
CORE SAMPLE NO.	LENGTH OF CORE FT IN
TEAM MEMBERS	

[illegible]

BOTTOM OF CORE IS LOCATION 0 FT 0 INCHES

² NOT TO EXCEED 30 INCHES (2 FT 6 INCHES)

SIGNATURE _____

DATE/TIME _____

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TITLE: DECONTAMINATION OF SAMPLING EQUIPMENT

1.0 PURPOSE

The purpose of this procedure is to provide guidance for decontaminating equipment used in sampling the K-65 and Metal Oxide Silos at the Fernald Feed Materials Production Center (FMPC).

2.0 SCOPE

This procedure is applicable to the equipment used in collecting samples from the K-65 and Metal Oxide Silos.

3.0 RESPONSIBILITY

3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed throughout the sampling program.

3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the use of the stated equipment and procedures.

3.3 It is the responsibility of each individual performing this procedure to follow it and to report any necessary deviations to the K-65 Sampling Task Leader for approval.

4.0 REFERENCES

4.1 Procedures K6501 through K6524.

4.2 Statement of Work, K-65 Sampling; WMCO.

5.0 SAFETY AND PRECAUTIONS

5.1 All personnel operating any decontamination equipment will be adequately trained to use the equipment.

5.2 Protective clothing and dosimetry will be worn in accordance with Section 1, Subsection 6.0 of the OSH plan.

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6.0 PREREQUISITES

- 6.1 Safety and training for all personnel in accordance with the procedures of WMC0 and the Contractor.
- 6.2 The radiation monitor should be checked and calibrated in accordance with Attachment 4. The date, time of calibration, and the instrument numbers should be recorded in the logbook.
- 6.3 Controlled decontamination area will have been established.

7.0 PROCEDURE

NOTE: The Vibra Corer barrels will be used only once per manway to minimize cross contamination.

7.1 Before reuse of equipment:

- 7.1.1 Bring equipment to be cleaned to the designated decontamination area.
- 7.1.2 Remove plastic coverings, if present.
- 7.1.3 Wipe down surfaces of sample equipment with towels and a mild detergent solution.
- 7.1.4 Perform radiological survey of the sampling equipment. Survey for releasable surface contamination first by using a wipe test. If contaminants are present, repeat Step 7.1.3. Allow surfaces to dry completely before performing another wipe test. Once the wipe test indicates no releasable contamination, resurvey the item for detection of fixed contamination.

Note: If the survey results indicate contamination, equipment can be transported for reuse in a controlled manner if the contamination will not affect data quality.

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- 7.2 After final use of equipment, perform Steps 7.1.1 through 7.1.4 and repeat decontamination efforts until release criteria in accordance with WMCO standard practices are met.

Note: If contamination persists, and wiping efforts obtain no further reduction in these levels, other more aggressive decontamination methods may be employed or the material may be disposed as radioactive. The K-65 Sampling Task Leader will direct the disposition of equipment in conjunction with WMCO.

- 7.3 All vehicles and equipment leaving the K-65 Silo area will be monitored for radioactive contamination by the ERMT. If contamination is present, the vehicle/equipment will be directed to one of the decontamination facilities within the FMPC Production Area. After monitoring or decontamination, the vehicle/equipment will be transferred to the main plant access gate to be monitored by a WMCO ERMT to obtain authorization to leave the Production Area. An exception is the final monitoring of the crane assembly, which will take place at the fenceline prior to its release through a breach in the fence. Monitoring for both releasable and fixed contamination will be per Step 7.1.4. Decontamination of the crane will be per Step 7.2.

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TITLE: LONG-TERM STORAGE OF ARCHIVE SAMPLES

1.0 PURPOSE

This procedure provides the methodology to prepare core samples for long-term storage for archival purposes. This procedure will specify those actions that are necessary after the samples have been examined, sectioned, and packaged for archive storage.

2.0 SCOPE

This procedure is to be used for each K-65 or metal oxide sample core to be archived as soon as it has been examined, sectioned, and packaged.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the field operations.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps and requirements.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and report any unusual occurrences to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 K-65 Sampling Operation Sequence, Procedure K6501.
- 4.2 Statement of Work, K-65 Sampling; WMCO.
- 4.3 Sectioning and Packaging of Sample Cores, Procedure K6515.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing and dosimetry will be worn in accordance with Section 1, Subsection 6.0 of the OSH plan.

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5.2 Minimum exposure is dependent on maintaining a seal with the caps attached to the Lexan tube and the outer bag intact. If the caps are missing, the Lexan tube is broken, or the outer bag is torn, contact the K-65 Sampling Task Leader immediately.

5.3 Any action that results in unplanned exposure to radioactive materials must be reported immediately to the K-65 Sampling Task Leader and the Project Health Physicists.

6.0 PREREQUISITES

6.1 Safety and radiation training for all workers in accordance with procedures of WMCO and the Contractor.

6.2 A review of safety and operational procedures has taken place with the personnel involved.

6.3 Core storage racks consisting of 55-gallon drums and specially designed inserts are available to store core sections safely in an upright position.

6.4 Core samples have been sectioned into lengths not greater than the height of the storage rack. Core sections must be prepackaged in accordance with Procedure K6515.

6.5 Sectioning Plan Form.

6.6 Core Sample Storage Location Form (attached).

6.7 Procedure K6515 has been completed.

6.8 Storage building for 55-gallon drums is available.

7.0 PROCEDURE

7.1 Upon completion of Procedure K6515, store the core sections to be archived in an upright position inside a drum.

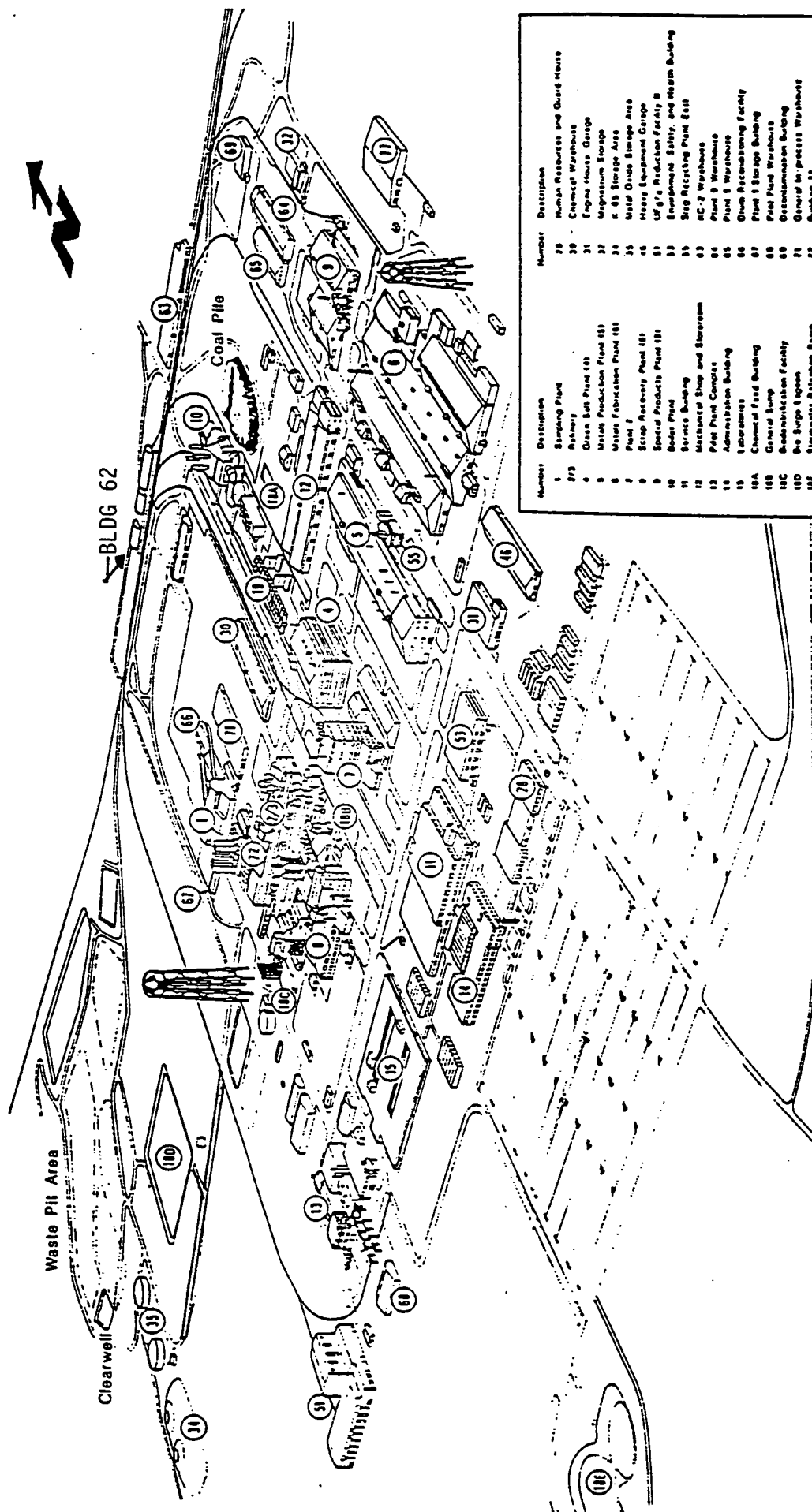
7.2 Move the drums upon completion of sampling. The Task Leader, development engineer, and QA will inspect each core section sample. Note any tears or punctures in the outer plastic bag containing

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the core section sample. If there are any rips or tears in the outer plastic bag, repackage in a new bag, label appropriately, and document in the project logbook.

- 7.3 Note the label number on the sectioned core sample and compare it with the number on the Sectioning Plan Form acquired from Impact Assessment files to see if it belongs in archive storage. Note also the "Up" arrow on the core sample section. Notify the K-65 Sampling Task Leader and Plant Quality Engineering if these labels are missing or if the sample number does not correspond to that on the Sectioning Plan Form. Occurrences of this kind will be documented by QA on a Deviation and Corrective Action Report (DCAR).
- 7.4 The packaged core sample sections will be stored in groups, silo # in drums to facilitate possible later retrieval.
- 7.5 Note the positions of the core section samples just placed in the core storage rack. Peel off a label from the Sectioning Plan Form that corresponds to each sample stored, and place these labels in the proper positions on the Core Sample Storage Location Form. This form will act as a guide in locating individual core sample sections for possible later retrieval.
- 7.6 Label the storage drums with the silo # and date.
- 7.7 Repeat steps 7.1 through 7.5 for the other two silos.
- 7.8 Transfer the drums to Building #62, which is located along the north boundary of the Process Area, for long-term storage.
- 7.9 A copy of the Sectioning Plan Form will be kept in the impact assessment files, one will be given to the WMCO task manager and laboratory supervisor, and one will be kept in the archive building.

K-65 SAMPLE ARCHIVE LOCATION



Number	Description	Number	Description
1	Sampling Plant	26	Human Resources and Guard House
2/3	Refinery	29	Chemical Warehouse
4	Green Salt Plant 100	30	Engine House Garage
5	Waste Production Plant 101	31	Magnesium Storage
6	Waste Fabrication Plant 102	32	K 65 Storage Area
7	Plant 7	33	Water Oxide Storage Area
8	Sludge Recovery Plant 103	34	Heavy Equipment Garage
9	Special Products Plant 104	35	UP's Reduction Facility B
10	Solids Plant	36	Environmental Safety and Health Building
11	Solids Building	37	Brig Rectifying Plant East
12	Mechanical Shop and Storehouse	38	PC-2 Warehouse
13	Plant Plant Complex	39	Plant 3 Warehouse
14	Administration Building	40	Plant 4 Warehouse
15	Laboratory	41	Chemical Recombining Facility
16A	Chemical Feed Building	42	Plant 5 Storage Building
16B	General Pump	43	Plant 6 Warehouse
16C	Brickmasonry Facility	44	Distillation Building
16D	Boiler Engine	45	General In-process Warehouse
16E	Steamwater Retention Basin	46	Building 22
16F	Metal Tank Farm	47	Finished Products Warehouse

FMPC Site Map

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CHK'D BY_____

PROJECT NO.	TASK NO.
DATE	TIME
CORE SAMPLE NO.	LENGTH OF CORE FT IN
TEAM MEMBERS	
INSTRUMENT NO.	

[illegible]

1 BOTTOM OF CORE IS LOCATION 0 FT 0 INCHES

SIGNATURE _____

DATE/TIME _____

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TITLE: SHIPMENT TO OFF-SITE LABORATORIES

1.0 PURPOSE

The purpose of this procedure is to provide guidance for shipping samples to an off-site laboratory.

2.0 SCOPE

This procedure is applicable to all samples taken from the K-65 and Metal Oxide Silos that are to be shipped from the Feed Materials Production Center (FMPC). The intent of this procedure is to ensure that all shipments are conducted properly.

3.0 RESPONSIBILITY

3.1 It is the responsibility of the K-65 Sampling Task Manager or the K-65 Sampling Task Leader to see that this procedure is followed.

3.2 It is the responsibility of the K-65 Sampling Task Leader or his designee to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the use of the stated equipment and handling of the samples.

3.3 It is the responsibility of each individual performing this procedure to follow it and to report any necessary deviations to the K-65 Sampling Task Leader or his designee. Deviations from the procedure can be approved only by the K-65 Sampling Task Leader, the K-65 Sampling Task Manager, or their designee.

4.0 REFERENCES

4.1 10 CFR 71, Packaging and Transportation of Radioactive Material.

4.2 49 CFR 173, U.S. Department of Transportation Rules and Regulations for Packaging and Shipment of Radioactive Materials.

4.3 Procedures K6501 through K6524.

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4.4 WMC0 Radioactive Material Shipping Procedures, as applicable.

5.0 SAFETY AND PRECAUTIONS

5.1 Protective clothing and dosimetry will be in accordance with Section 1, Subsection 6.0 of the OSH plan.

6.0 PREREQUISITES

6.1 The K-65 Sampling Task Leader will provide a list of samples to be shipped by the person conducting this procedure.

6.2 The K-65 Sampling Task Leader or his designee will ensure that the consignee's license authorizes receipt of the type, form, and quantity of radioactive materials to be transferred.

6.3 Type A packages will be prepared to contain the samples prepared by performing Procedure K6515 (Sectioning and Packaging of Sample Cores).

6.4 Bills of lading and other necessary transportation documents will be completed in accordance with References 4.1, 4.2, and 4.4.

7.0 PROCEDURE

When the sole use transport vehicle has arrived at the FMPC and a pre-shipment inspection of the vehicle has been completed:

7.1 Place fresh cold packs in each sample container to be shipped.

7.2 Fill void spaces of sample container(s) with vermiculite-type material. See Attachment 8.

7.3 Place each sample container in its designated shipping container.

7.4 Fill void spaces of the shipping container(s) with vermiculite-type material.

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- 7.5 Enclose completed Chain-of-Custody and Request-for-Analysis Forms (see Attachment 6). Close and seal the shipping container.
- 7.6 Survey the shipping containers and document results on shipping papers. Ensure radiation contamination levels do not exceed limits detailed in Attachment 8.
- 7.7 Label each shipping container in accordance with Attachment 8.
- 7.8 Placard transport vehicles in accordance with Attachment 8.
- 7.9 Load containers in transport vehicle and brace the containers to preclude shifting of load under conditions incident to normal transport.
- 7.10 Survey the transport vehicle and document on shipping papers. Ensure that radiation and contamination levels do not exceed the limits specified in Attachment 8.
- 7.11 Have transportation department complete shipping papers.
- 7.12 Have transportation department brief driver on shipment, and transfer copies of shipping papers to driver.
- 7.13 When shipment leaves the FMPC site, the laboratory supervisor will call IT's Bear Creek Laboratory personnel who are to receive samples and brief these personnel on sample content, dose rates, and scheduled arrival time.

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TITLE: OFF-SITE PREPARATION OF SAMPLES FOR ANALYSIS

1.0 PURPOSE

The purpose of this procedure is to specify actions to be taken after arrival of samples from the K-65 sampling program for off-site analysis. These procedures ensure that subsamples of the required size are prepared under the applicable protocols for the analytical methods to be carried out at the IT Radiological Sciences and Mixed Waste Laboratories.

2.0 SCOPE

All samples from the K-65 and Metal Oxide Silos being received under this sampling program will be subject to the steps of this procedure before final analytical methods are applied.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader, and the Managers of the IT Radiological Sciences and Mixed Waste Laboratories to see that this procedure is followed during the receipt and processing of the samples from the K-65 silos.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader and the Managers of the IT Radiological Sciences and Mixed Waste Laboratories to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps and requirements.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader and the IT Laboratory Manager involved.

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4.0 REFERENCES

- 4.1 U.S. EPA Contract Laboratory Program (CLP), Statement of Work for Inorganics Analysis, Multi-Media and Multi-Concentration, 1987 (Revised Protocol).
- 4.2 U.S. EPA Contract Laboratory Program (CLP), Statement of Work for Organics Analysis, Multi-Media and Multi-Concentration, 1987 (Revised Protocol).
- 4.3 IT Mixed Waste Laboratory, Laboratory-Specific Attachment.
- 4.4 IT Radiological Sciences Laboratory, Laboratory-Specific Attachment.
- 4.5 IT Analytical Services, Quality Assurance Manual.
- 4.6 IT Radiological Sciences Laboratory, Radiation Safety Manual.
- 4.7 IT Bear Creek Facility, Radiation Safety Manual.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing, respiratory protection, and dosimetry must be worn in accordance with the Radiation Safety Manuals for the IT Radiological Sciences Laboratory and Bear Creek Facility.
- 5.2 Operating procedures and precautions for these facilities, as stated in the above manuals, must be observed.
- 5.3 Work must be performed in the presence of the Health Physicist for the host facility, or his approved designee, who will approve personnel assigned to various tasks.
- 5.4 Chain-of-Custody protocols must be observed at all times for these samples and subsamples.

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- 5.5 All samples must be measured for radiation levels and approved for transfer by the IT Radiological Sciences Laboratory Health Physicist or his designee before transfer from the Bear Creek Facility to the IT Radiological Sciences Laboratory.

6.0 PREREQUISITES

- 6.1 Completion of Procedures K6507, K6515, and K6517.
- 6.2 A refrigerated or ice-packed receiving area for incoming samples.
- 6.3 Gamma survey instruments to determine the condition of incoming samples.
- 6.4 Health Physics or supervisory personnel on hand, as required by the Bear Creek Facility Radioactive License.
- 6.5 Personnel performing this work will be experienced in the procedures and qualified under the U.S. EPA's Contract Laboratory Program.

7.0 PROCEDURE

- 7.1 When a sample group is received at 1570 Bear Creek Road, Oak Ridge, Tennessee, the external surface of the package will be inspected and monitored with a gamma-detecting instrument. Any damage or contamination must be treated in accordance with Bear Creek Facility Procedures (see Attachment 8).
- 7.2 Shipping and Chain-of-Custody papers will be checked for completeness.
- 7.3 Samples will be removed from the shipping container, examined as above, and placed in refrigerated or ice-packed storage. All data and observations will be logged.
- 7.4 Each sample will be opened in the laboratory hood and sufficient sample removed for

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moisture analysis. The remaining portion will be dried and blended to produce homogeneous sample.

- 7.5 A portion of the sample will be extracted for HSL inorganics (metals and cyanides) as directed by Reference 4.1.
- 7.6 The procedure for EP toxicity metals will be carried out on another portion of the subdivided sample.
- 7.7 A portion of the subdivided samples from a single core from each silo will be subjected to the extraction procedure for HSL Volatiles in accordance with the procedures of Reference 4.2.
- 7.8 In a likewise manner, portions of the samples will be subjected to the extraction and preparation procedures for HSL Semivolatiles and HSL Pesticides and PCBs by the procedures of Reference 4.2.
- 7.9 Portions of each of the extracts and samples prepared above will be subdivided for the continuation of the analytical procedures. The size of each aliquot will be determined by the specific procedure and the sensitivity requirements of the analysis.
- 7.10 Each sample and extract will be screened for radioactivity. If the amount of radioactivity carried through into the aliquot is too high for receipt under the procedures of the Radiological Sciences Laboratory, the size will again be proportionately reduced or diluted. This will reduce the sensitivity of the analysis, and the detection limits specified in CLP may not be obtained.
- 7.11 Samples and extracts so prepared will be transferred to the IT Mixed Waste Laboratory for the remaining steps in the chemical analyses, under Procedures K6520 and K6521.

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- 7.12 A portion of selected samples will also be repackaged in the approved sample bottles and sent to the IT Radiological Sciences Laboratory for isotopic analysis. Sample size and materials for which analyses are required are controlled by Procedure K6522.
- 7.13 Horizontal composite samples from each silo will be prepared from the designated samples from each of the four cores from that silo. Equal volume portions of the designated samples will be mixed and shipped back to the Fernald Analytical Laboratory for the determination of physical and engineering properties.
- 7.14 Composite samples for each core will be obtained by removing a small diameter core sample from the total length of all sections of the cores which have been sectioned on the basis of visually determined physical properties and radiological screening. The same process, removing a small diameter core sample from the total length of all sections, shall be followed for the core which is sectioned in 30-inch lengths.

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TITLE: ANALYSIS OF SAMPLE EXTRACT FOR INORGANIC CONSTITUENTS

1.0 PURPOSE

The purpose of this procedure is to specify the procedure for analysis of the TCLP and leachate extracts for HSL inorganics of the K-65 and metal oxide core samples. This procedure ensures that the extracts are analyzed for the specified inorganic constituents using the appropriate analytical methods.

2.0 SCOPE

All samples received from the K-65 sampling program at the IT Mixed Waste Laboratory for inorganic assays (cyanide and metals) are covered by this procedure.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader and the Manager of the IT Mixed Waste Laboratory to see that this procedure is followed during the receipt and analysis of the sample extracts from the Bear Creek Laboratory.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader and the Manager of the IT Mixed Waste Laboratory to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps and requirements.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader and the IT Laboratory Manager involved.

4.0 REFERENCES

- 4.1 U.S. EPA Contract Laboratory Program (CLP), Statement of Work for Inorganics Analysis, Multi-Media and Multi-Concentration, 1987 (Revised Protocol).
- 4.2 Test Methods for Evaluating Solid Waste, USEPA, SW-846, 3rd edition, 1986 (or most current edition).

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- 4.3 IT Mixed Waste Laboratory, Laboratory Specific Attachment.
- 4.4 IT Analytical Services, Quality Assurance Manual.
- 4.5 IT Radiological Sciences Laboratory, Radiation Safety Manual.
- 4.6 Fernald RI/FS Quality Assurance Project Plan (Revision 3), March 1988.

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing, respiratory protection, and dosimetry must be worn in accordance with the Radiation Safety Manual for the IT Radiological Sciences Laboratory.
- 5.2 Operating procedures and precautions for these facilities, as stated in the above manuals, must be observed.
- 5.3 Work must be performed in the presence of the Health Physicist for the host facility, or his authorized designee.
- 5.4 Chain-of-Custody protocols must be observed at all times for these samples and extracts.

6.0 PREREQUISITES

- 6.1 Completion of Procedures K6507, K6515, K6518, and K6519.
- 6.2 A refrigerated or ice-packed receiving area for incoming samples.
- 6.3 Gamma survey instruments to determine condition of incoming samples.
- 6.4 Health Physics or supervisory personnel at hand, as required by the Radiological Sciences Laboratory Radioactive License.
- 6.5 Personnel performing this work will be experienced in the procedures and qualified under the U.S. EPA Contract Laboratory Program.

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7.0 PROCEDURE

- 7.1 When the sample extracts from the Bear Creek Laboratory have been received, they will be inspected for damage or contamination using a gamma detecting instrument (see Attachment 9).
- 7.2 Request-for-Analysis and Chain-of-Custody Forms will be checked against samples received and for completeness.
- 7.3 Samples will be held in refrigerated storage.
- 7.4 The extracts from the procedure for cyanides will be analyzed by the protocols specified by the CLP (Reference 4.1).
- 7.5 The leachate from the EP toxicity will be analyzed for metals by the protocols specified in SW-846. The leachate will be analyzed for all EP toxicity metals.
- 7.6 The digestate from the acid extractions of the core samples will be analyzed for HSL metals by CLP protocols (Reference 4.1).
- 7.7 All wastes from the analysis will be disposed of in accordance with IT Mixed Waste Laboratory Procedures. Any remaining K-65 or metal oxide samples will be transferred to the Bear Creek Laboratory for return to the FMPC.

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TITLE: ANALYSIS OF SAMPLES AND EXTRACTS FOR ORGANIC CONSTITUENTS

1.0 PURPOSE

The purpose of this procedure is to specify the methodology for analysis of the extracts from the K-65 and Metal Oxide core samples for volatile and semi-volatile HSL constituents.

2.0 SCOPE

All samples received from the K-65 sampling program at the IT Mixed Waste Laboratory for organic assays are covered by this procedure.

3.0 RESPONSIBILITY

3.1 It is the responsibility of the K-65 Sampling Task Leader and the Manager of the IT Mixed Waste Laboratory to see that this procedure is followed during the receipt and analysis of the sample extracts received from the Bear Creek facility.

3.2 It is the responsibility of the K-65 Sampling Task Leader and the Manager of the IT Mixed Waste Laboratory to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps and requirements.

3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader and the IT Laboratory Manager involved.

4.0 REFERENCES

4.1 U.S. EPA Contract Laboratory Program (CLP), Statement of Work for Organics Analysis, Multi-Media and Multi-Concentration, 1987 (Revised Protocol).

4.2 IT Mixed Waste Laboratory, Laboratory-Specific Attachment.

4.3 IT Analytical Services, Quality Assurance Manual.

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4.4 Radiation Safety Manual, IT Radiological Sciences Laboratory.

4.5 Fernald RI/FS Quality Assurance Project Plan (Revision 3), March 1988.

5.0 SAFETY AND PRECAUTIONS

5.1 Protective clothing, respiratory protection, and dosimetry must be worn in accordance with the Radiation Safety Manual for the IT Radiological Sciences Laboratory.

5.2 Operating procedures and precautions for these facilities, as stated in the above manual, must be observed.

5.3 Work must be performed with the approval of the Health Physicist for the host facility, or his authorized designee.

5.4 Chain-of-Custody protocols must be observed at all times for these samples and subsamples (see Attachment 6).

6.0 PREREQUISITES

6.1 Completion of Procedures K6507, K6515, K6518, and K6519.

6.2 A refrigerated or ice-packed receiving area for incoming samples.

6.3 Gamma survey instruments to determine condition of incoming samples.

6.4 Health Physics or supervisory personnel on hand, as required by the Radiological Sciences Laboratory Radioactive License.

6.5 Personnel performing this work will be experienced in the procedures, and qualified under the U.S. EPA's Contract Laboratory Program.

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7.0 PROCEDURES

- 7.1 When the sample extracts have been received from the Bear Creek Laboratory, they will be inspected for damage or contamination using a gamma detecting instrument (see Attachment 9).
- 7.2 Request for Analysis and Chain-of-Custody forms will be checked against sample receipts and for completeness (see Attachment 6).
- 7.3 Samples will be held in refrigerated storage.
- 7.4 The methanol extract from the volatiles procedure will be analyzed for HSL volatiles by the methods specified by CLP (Reference 4.1).
- 7.5 The extract from the HSL semi-volatiles procedures will be analyzed by the methods specified by CLP (Reference 4.1).
- 7.6 All wastes and residues from the analysis will be disposed of in accordance with IT Mixed Waste Laboratory Procedures. Any remaining K- 65 or metal oxide sample will be transferred to the Bear Creek Laboratory for return to the FMPC.

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TITLE: ISOTOPIC ASSAYS OF SAMPLES

1.0 PURPOSE

The purpose of this procedure is to specify the methodology for isotopic analysis of core samples.

2.0 SCOPE

All samples received at the IT Radiological Sciences Laboratory for isotopic analysis are covered by this procedure.

3.0 RESPONSIBILITY

3.1 It is the responsibility of the K-65 Sampling Task Leader and the Managers of the IT Mixed Waste and Radiological Sciences Laboratories to see that this procedure is followed during the receipt and analysis of the sample extracts from the Bear Creek Laboratory (1570 Bear Creek Road).

3.2 It is the responsibility of the K-65 Sampling Task Leader and the Managers of the involved laboratories to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps and requirements.

3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader and the IT Laboratory Manager involved.

4.0 REFERENCES

4.1 IT Radiological Sciences Laboratory, Laboratory-Specific Attachment.

4.2 Sample Preparation, IT-RSL Procedure No. 201.

4.3 Gamma Spectroscopy, IT-RSL Procedure No. 112.

4.4 Determination of Selected Alpha Emitters, IT-RSL Procedure No. 304.

4.5 IT Analytical Services Quality Assurance Manual.

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4.6 IT Radiological Sciences Laboratory, Radiation Safety Manual.

4.7 Fernald RI/FS Quality Assurance Project Plan (Revision 3), March 1988.

5.0 SAFETY AND PRECAUTIONS

5.1 Protective clothing, respiratory protection, and dosimetry must be worn in accordance with the Radiation Safety Manual for the IT Radiological Sciences Laboratory.

5.2 Operating procedures and precautions for these facilities, as stated in the above manuals, must be observed.

5.3 Work must be performed with the approval of the Health Physicist for the host facility, or his authorized designee.

5.4 Chain-of-Custody protocols must be observed at all times for these samples and subsamples (see Attachment 6).

6.0 PREREQUISITES

6.1 Completion of Procedures K6507, K6515, K6518, and K6519.

6.2 Gamma survey instruments to determine condition of incoming samples.

6.3 Health Physics or supervisory personnel on hand, as required by the Radiological Sciences Laboratory.

6.4 Personnel performing this work will be experienced in the procedures and qualified under the U.S. EPA's Contract Laboratory Program.

7.0 PROCEDURES

7.1 When the samples have been received from the Bear Creek Laboratory (1570 Bear Creek Road), they will be inspected for damage or contamination using a gamma detecting instrument (see Attachment 9).

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7.2 Request-for-Analysis and Chain-of-Custody forms will be checked against actual samples received and for completeness (see Attachment 6).

7.3 The samples will be analyzed for the following isotopes:

Pb-210	Th-232
Ra-226	U-234
Ra-228	U-235
Th-228	U-238
Th-230	Qualitative Alpha and Gamma Spec.

7.4 Analysis will be by the RSL procedures for sample preparation, gamma spectroscopy, and alpha emitters described in References 4.2, 4.3, and 4.4 of this procedure.

7.5 All wastes and residues from the analysis will be disposed of in accordance with IT Radiological Sciences Laboratory Procedures. Any remaining K-65 or metal oxide samples will be transferred to the Bear Creek Laboratory for return to the FMPC.

TITLE: RADIOACTIVE WASTE HANDLING

1.0 PURPOSE

This procedure is to provide the necessary controls and guidelines for the packaging of radioactive waste generated during the K-65 sampling tasks for disposal and dispositioning.

2.0 SCOPE

This procedure is applicable to all radioactive waste generated by sampling operations conducted on the K-65 and metal oxide silos at the Fernald Feed Materials Production Center (FMPC).

3.0 RESPONSIBILITY

3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the field program phase.

3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced with the performance of this procedure and/or have been trained in the use of the stated equipment.

3.3 It is the responsibility of each individual working with radioactive material to be familiar with this procedure. Those directly involved with packaging radioactive waste are responsible for following this procedure and immediately reporting any problems to the K-65 Sampling Task Leader.

4.0 REFERENCES

4.1 Statement of Work, K-65 Sampling; WMCO.

4.2 K-65 Sampling Operation Sequence, Procedure K6501.

4.3 49 CFR 178, Department of Transportation Regulations for Shipping Containers Specifications.

4.4 WMCO Waste Shipment SOP's 1-C-602 and 20-C-601.

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4.5 WMCO QA Department Procedure WMCO-QAP-12.09.

5.0 SAFETY AND PRECAUTIONS

5.1 Protective clothing and dosimetry will be worn as specified in Section 1, Subsection 6.0 of the OSH plan.

6.0 PREREQUISITIES/REQUIREMENTS

6.1 Only radioactive material will be disposed of as radioactive waste.

6.2 Radioactive waste volumes will be minimized to the extent practicable.

6.3 No packages will contain free liquid.

6.4 All packages will be free of materials that are explosive, have explosive off-gases, or ignite spontaneously. All combustibles will be packaged to prevent spontaneous combustion.

6.5 All personnel handling containers will be trained to utilize proper drum handling equipment and procedures.

7.0 PROCEDURES

7.1 Empty Container Inspection

Before moving a container into an area for packaging radioactive waste, visually inspect each container for adequacy per SOP 20-C-601.

7.1.1 Drums

7.1.1.1 Ensure that the drum is a new DOT specification 17H container. Each 55-gallon drum must be embossed in accordance with the specifications outlined in 49 CFR 178.

7.1.1.2 Ensure that the drum is assembled with all parts, gaskets, and fittings in their proper places.

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- 7.1.1.3 Ensure that closures are adequate to prevent leakage of contents.

7.1.2 Boxes

- 7.1.2.1 Ensure that the box is a new box constructed for containing radioactive waste.
- 7.1.2.2 Ensure that the box is of the correct specification for the types of waste being packaged (e.g., limited quantity, LSA, Type A).
- 7.1.2.3 Ensure that the box is assembled with all parts, gaskets, and fittings in their proper places.
- 7.1.2.4 Ensure that closures are adequate to prevent leakage of contents.

7.2 Segregation

Waste will be segregated as necessary to facilitate final packaging and dispositioning. Waste will be packaged to the requirements of SOP 20-C-601.

7.3 Loading

- 7.3.1 All waste will be surveyed by a health physics technician before packaging to ensure that only radioactive waste is packaged for disposal. Documentation of surveys for release of clean material will be maintained.
- 7.3.2 All waste will be visually inspected per SOP 20-C-601 and WMCO-QAP-12.09.
- 7.3.3 Baleable waste will be placed in plastic bags and then taken to a dumpster.
- 7.3.4 Rags, mopheads, etc. used for cleaning contaminated items will be allowed to dry, if possible, then packaged as baleable waste.

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- 7.3.5 Contaminated items such as plastic liners for the trough will be carefully rolled up to contain the contamination and then handled per SOP 20-C-601.

7.4 Sealing Containers

- 7.4.1 All packages will be inspected per SOP 1-C-602, SOP 20-C-601, for free-standing liquid prior to sealing. If any free-standing liquid is detected, containers will be reprocessed.
- 7.4.2 Containers will be sealed and inspected to ensure that the following criteria are met per SOP 1-C-602, SOP 20-C-601, and WMCO-QAP-12.09:
 - 7.4.2.1 Drum lid fits properly and gasket is not damaged.
 - 7.4.2.2 Bolt ring fits securely.
 - 7.4.2.3 Bolt lug fits tightly.
 - 7.4.2.4 Boxes will be sealed and inspected for containment adequacy.

7.5 Marking and Labeling

- 7.5.1 Assign an identification number to each container. The numbers will be visible from 10 feet and durable enough for shipment and emplacement in a burial trench.
- 7.5.2 Label and record each package identification number per SOP 1-C-602, SOP 20-C-601 and WMCO-QAP-12.09

7.6 Curie Content and Survey

- 7.6.1 Estimate the number of curies contained in each package and record per WMCO-QAP-12.09 and SOP 20-C-601.

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7.6.2 Perform a final radiation and surface contamination survey for each package.

7.6.3 Enter survey data on OS&H Radiation Survey Form.

7.7 Records

7.7.1 Documentation will be generated and maintained per SOP 1-C-602, SOP 20-C-601, and WMCO-QAP-12.09.

7.8 Storage

7.8.1 After a health physics technician clears a package from the waste packaging area, the package will be taken to a designated temporary storage area per SOP 1-C-602, SOP 20-C-601, and WMCO-QAP-12.09.

7.8.2 The radioactive waste storage area will meet all posting requirements for a radioactive materials storage area, and access to the area will be controlled.

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TITLE: ABNORMAL OCCURRENCES

1.0 PURPOSE

The purpose of this procedure is to provide guidance for mitigating events that are not within the normal procedures for sampling the K-65 and Metal Oxide Silos. These procedures include potential accidents, injuries, and events not a part of the normal procedures for the sampling event.

2.0 SCOPE

This procedure covers all of the steps in the sampling, observation, handling, shipping, and analysis of the silo contents. It serves as the master sequence for all abnormal events and a single source for procedures to mitigate such occurrences.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the sampling event.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel that are experienced and/or have been trained in the use of the stated equipment and handling of the sample cores.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any necessary deviations to the K-65 Sampling Task Leader (see Attachment 10).
- 3.4 Deviations from the procedure must be approved by the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 Procedures K6501 through K6524.
- 4.2 WMC0 Emergency Procedures, as applicable.

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5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing and dosimetry will be in accordance with Section 1, Subsection 6.0 of the OSH plan.
- 5.2 Additional health and safety requirements may be necessitated by the particular sampling event being performed at the time of the abnormal occurrence and the associated health risks developed as a result.

6.0 PREREQUISITES

- 6.1 Safety and radiation training of all involved personnel in accordance with the procedures of WMCO.
- 6.2 Appropriate Emergency Response Training and other training as required by the type of event.
- 6.3 Abnormal Incident Report Form.

7.0 PROCEDURES

- 7.1 Sampling Event Abnormal Occurrences Cross-Reference List to Sampling Procedures.
 - 7.1.1 K6502 - Marking and Locating Sample Points
 - 7.1.1.1 Personal Injury, see Section 7.2
 - 7.1.1.2 Silo Roof Failure, see Section 7.3
 - 7.1.2 K6503 - Setup of Sampling Equipment
 - 7.1.2.1 Personal Injuries, see Section 7.2
 - 7.1.3 K6504 - Setup and Positioning of Crane
 - 7.1.3.1 Personal Injuries, see Section 7.2
 - 7.1.3.2 Crane Failure, see Section 7.4
 - 7.1.4 K6505 - Mock Run
 - 7.1.4.1 Personal Injury, see Section 7.2

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- 7.1.4.2 Crane Failure, see Section 7.4
- 7.1.4.3 Loss of Sampling Equipment in Silo, see Section 7.5
- 7.1.4.4 Silo Damage, see Section 7.3
- 7.1.5 K6506 - Removal of Flanges on Access Ports
 - 7.1.5.1 Personal Injuries, see Section 7.2
 - 7.1.5.2 Silo Roof Failure, see Section 7.3
 - 7.1.5.3 Dropped Equipment into Silo, see Section 7.5
 - 7.1.5.4 Radon Removal System Failure, see Section 7.8
- 7.1.6 K6507 - Taking Samples Using Vibra Corer Equipment
 - 7.1.6.1 Personal Injury, see Section 7.2
 - 7.1.6.2 Vibra Corer System Failure, see Section 7.6
 - 7.1.6.2.1 Vibra Corer Break Inside Silo
 - 7.1.6.2.2 Jammed Vibra Corer
 - 7.1.6.2.3 Sample Loss, No Recovery
 - 7.1.6.3 Crane Failure, see Section 7.4
 - 7.1.6.3.1 Before Sampling
 - 7.1.6.3.2 During Sampling
 - 7.1.6.3.3 After Sampling
 - 7.1.6.4 Silo Roof Failure, see Section 7.3

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7.1.7 K6508 - Replacement of Flange on Silo (See Section 7.1.5: K6506 - Removal of Flanges)

7.1.8 K6509 - Transportation and Storage at On-site Laydown Area

7.1.8.1 Dropped or Loss of Sample from Trailer or Crane, see Section 7.7

7.1.8.2 Failure of Plastic Casing/Seal Prior to Decontamination, see Section 7.7

7.1.8.3 Truck Accidents, see Section 7.9

7.1.9 K6510 - Radon Removal System, see Section 7.8

7.1.10 K6511 - Initial On-Site Core Handling and Inspection

7.1.10.1 Dropped or Loss of Sample, see Section 7.7

7.1.10.2 Failure of Plastic Casing/Seal Prior to Decontamination, see Section 7.7

7.1.11 K6512, K6513, K6514 - On-site Examination of Sample Cores

7.1.11.1 Personal Injury, see Section 7.2

7.1.11.2 Transport Accident, see Section 7.9

7.1.11.3 Trailer Fires, see Section 7.10

7.1.11.4 Failure of Examination Equipment, see Section 7.15

7.1.12 K6515 - Sectioning and Packaging of Sample Cores

7.1.12.1 Personal Injuries, see Section 7.2

7.1.13 K6516 - Decontamination of Sampling Equipment

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7.1.13.1 Spilled or Leaking Decontamination
Material, see Section 7.7

7.1.14 K6517 - Long-Term Storage of Samples

7.1.14.1 Site Integrity

7.1.14.1.1 Security Breaches, see Section
7.14

7.1.14.1.2 Fire, see Section 7.10

7.1.14.1.3 Flood, see Section 7.13

7.1.14.1.4 Windstorm, see Section 7.11

7.1.14.1.5 Seismic, see Section 7.12

7.1.14.2 Sample Integrity

7.1.14.2.1 Plastic or Lexan Tube
Failure, see Section 7.7

7.1.14.2.2 Cap or Ends Fall Off, Sample
Leaks, see Section 7.7

7.1.14.2.3 Improper Documentation
Misabeled, etc. see Section
7.16

7.1.15 K6518 - Shipping of Wastes to Off-site
Laboratories

7.1.15.1 Transportation Accidents, see Section
7.9

7.1.15.2 Leaks or Sample Container Failure
During Transport (not a result of an
accident), see Section 7.7

7.1.15.3 Documentation Errors, see Section
7.16

7.1.16 K6524 - Handling Wastes from Sampling
Operation

7.1.16.1 Spillage and Leaks, see Section 7.7

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7.1.16.2 Personal Injury, see Section 7.2

7.1.16.3 Accidents During Transport to
Disposal Area, see Section 7.9

7.2 Personal Injuries

The following procedures are intended to provide guidance and state minimum requirements in the event of injury or illness to personnel. WMCO Safety Policies and Procedures provided to contractor will be followed. Actions outlined in Section 1, Subsection 6.0 of the OSH plan will also be followed.

All injuries must be reported to the WMCO medical section as outlined in subcontractor safety requirements. Form 5484.X will be completed for any injury/illness covered under DOE Document SSDC-7B, "DOE Guide to the Classification of Recordable Accidents," January 1987.

- 7.2.1 Any injury, no matter how minor, is to be reported to the K-65 Sampling Task Leader or the K-65 Sampling Task Manager as soon as possible after occurrence.
- 7.2.2 The K-65 Sampling Task Leader or his designee is responsible to report to Health and Safety personnel all injuries and accidents occurring during his or her shift.
- 7.2.3 Summon help if required using other uninjured personnel, alarm, radio, or voice. Phone numbers for emergency personnel will be posted prominently at site telephone locations.
- 7.2.4 Site personnel qualified to render first aid and/or cardiopulmonary resuscitation will provide aid to the victim as appropriate to the limit of their abilities without compromising safety.
- 7.2.5 Any person rendering aid must decide, based on severity of injury and potential or impending damages, whether to treat

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victims in place or move them. As a general rule, do not move victim in any way if the person cannot perform this movement under his or her own control.

- 7.2.6 When trained emergency personnel arrive, if summoned, transfer victim to their care and provide as much information as possible.
- 7.2.7 If any injury/illness is the result of a chemical exposure, a supervisor will promptly initiate the steps necessary to identify the chemical(s) being used.
- 7.2.8 Any injury/illness not limited to a first aid case will require that the task leader immediately notify the Health and Safety representative. This will allow the coordination of internal resources to assist the treating physician in rendering appropriate care.
- 7.2.9 The event must be recorded in the project log book and reported per site procedure FMPC 704 (minor event reporting system).

7.3 Damage or Failure of the Silo or Silo Roof

This procedure is designed to provide guidance to emergency and operating personnel in the event of a silo or silo roof failure.

- 7.3.1 Upon failure of the silo or roof, immediately cease all operations and evacuate the immediate work area.
- 7.3.2 Notify the K-65 Sampling Task Manager or his designee of the event and its estimated magnitude.
- 7.3.3 If any personnel are injured, refer to Section 7.2, Personal Injuries.
- 7.3.4 The K-65 Sampling Task Leader or his designee should notify the appropriate WMCO personnel of the event so that their

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plant wide emergency response system can be activated, if needed.

7.3.5 WMCO emergency evacuation procedures may be instituted if the magnitude of the event is sufficient. In that event, follow instructions or training given by WMCO personnel.

7.3.6 If sampling cannot continue on the failed/damaged silo, remove equipment as soon as possible after safety and radiological clearances are given by WMCO health physics or appropriate personnel. DO NOT ENTER AREA WITHOUT CLEARANCE. Otherwise, the equipment may have to be left in place. Mitigation of the event will be determined at the time.

7.3.7 If the safety evaluation determines that sampling can continue, proceed with due caution. If the event damaged any sampling equipment, refer to the appropriate abnormal occurrence procedure.

7.3.8 The event must be recorded in the project logbook and reported per site procedure FMPC 704 (minor event reporting system).

7.4 Crane Failures

The following is a series of steps to be followed upon failure of the crane during sampling operations:

7.4.1 Tipping

Tipping can be minor, moderate, or major (overturning) depending on the causes and circumstances. The causes for this mode of failure are as follows:

7.4.1.1 Improper bearing conditions are the most common cause of a crane tipping. Improper calculations on the soil bearing capacity and improper outrigging on the crane

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allows the crane's counterbalance system, the outriggers, to sink into soft ground thus changing the crane's center of gravity. During this occurrence the crane will lift off the ground a few inches. This can be rectified by changing the center of gravity of the crane by moving the boom. Once the crane has settled back down, inspect the outriggers and place pads or mats under the outriggers, or mechanically lock the outriggers into place if they are unlocked.

- 7.4.1.2 Miscalculation of payload weight is another factor to induce crane tipping. This factor will be minor in this application as a dynamometer will be used to monitor abnormal forces during crane operation.
- 7.4.1.3 Excessive forces during extraction of the sample can also cause the crane to tip. Again, this factor will be minor because of monitoring abnormal extractive forces using the dynamometer during sample retrieval.
- 7.4.1.4 Excessive wind loads can also cause a crane to tip. A good practice is to park the crane with the boom lowered after daily operations have ceased. Do not operate the crane during high winds, thunderstorms, or lightning conditions.
- 7.4.1.5 Tipping can be sensed by an experienced crane operator and tipping is generally lifting the back end of the crane a few inches off the ground. This can be compensated by backing off on hoisting the load or shifting the boom and changing the center of gravity of the crane.

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- 7.4.1.6 In the event the crane tips over, another crane must be used to upright the overturned crane.

NOTE: During an abnormal occurrence such as this, immediately attempt to rectify the situation to prevent damage, then stop and report the incident to the K-65 Sampling Task Leader. Do not proceed any further with any procedure until direction from the K- 65 Sampling Task Leader has been given, and an authorization to proceed has been received.

7.4.2 Mechanical Failures

- 7.4.2.1 The crane uses a series of winches, cables, and other mechanical components that must be properly lubricated for efficient operation. Two winches are used for the boom lift, and one winch is used for the hoist (load) lift. An internal combustion engine drives the winches and must be properly maintained. Should the crane experience a mechanical failure during sampling, stop operations and report the situation to the K-65 Sampling Task Leader.
- 7.4.2.2 The winches use a mechanical friction brake that must be properly maintained. If the brake gets wet due to precipitation, the load will start to slip. This will be felt by an experienced operator. In this instance, an operator would dry the brake drum by carefully lowering the load while applying the brake, similar to tapping the brake pedal in an automobile after running through a deep puddle.
- 7.4.2.3 Cable failure during operation is a remote possibility if proper

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maintenance and inspection prior to operation is performed. Should a failure occur, stop current procedure and immediately report incident to the K-65 Sampling Task Leader. If damage to the silo occurs, refer to Section 7.3. If loss of equipment in the silo occurs, refer to Section 7.5.

7.4.2.4 Should cable failure occur and result in loss of load, replace damaged cable and attempt to recover lost load after authorization from WMCO has been given. Once load has been recovered and inspection reveals no damage to the sampler, resume sampling. The K-65 Sampling Task Leader will then note the incident on the Abnormal Incident Report Form and in the project logbook.

7.4.2.5 Should cable failure occur with no loss of load due to a cable jam in the boom head pulley (due to improper operation), stop current procedure and immediately report incident to the K-65 Sampling Task Leader. If sampler is in manhole and sampling operations have begun, it may be necessary to use another crane to complete the procedure if the cable cannot be freed while the sampler is still attached. If sampling operations have not been started or have been completed, it may be possible to lower the load by lowering the boom. Set the load on plastic sheeting as designated by the K-65 Sampling Task Leader.

7.5 Loss of Equipment into Silo

The following is a series of steps to be followed upon loss of equipment into a silo:

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- 7.5.1 Upon loss of equipment (Vibra Corer, tools, etc.) into the silo through the open manhole, stop current activity, and immediately report incident to the K-65 Sampling Task Leader. Describe the item dropped into the silo and obtain the decision from the K-65 Sampling Task Leader on whether to leave the object in the silo or to recover it.

NOTE: Do not proceed any further with any procedure until direction from the K-65 Sampling Task Leader has been given and an authorization to proceed has been received.

- 7.5.2 If authorized to leave the object in the silo, continue with the then note the incident on the Abnormal Incident Report Form and in the project logbook.
- 7.5.3 If directed to recover object in the silo and the object can be safely and easily recovered by manually picking it out or by otherwise removing it without physically entering the silo, then recover object.
- 7.5.4 If directed to recover object in the silo and object cannot be easily recovered, stop and report recovery attempts to the K-65 Sampling Task Leader. A different recovery plan must be formulated to recover the lost object.
- 7.5.5 Once object has been recovered and/or authorization to proceed has been given, continue with current procedure. The K-65 Sampling Task Leader will then note the incident in the Abnormal Incident Report Form and in the project logbook.

7.6 Vibra Corer Failure

The following is a series of steps to be followed upon failure of the Vibra Corer and ancillary equipment:

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- 7.6.1 Upon failure of Vibra Corer equipment, stop current procedure and immediately report incident to the K-65 Sampling Task Leader. Describe current operations prior to failure of equipment to aid in determining cause of failure.

NOTE: Do not proceed any further with any procedure until direction from the K-65 Sampling Task Leader has been given and an authorization to proceed has been received.

- 7.6.2 Determine if the compressed air supply from the compressor is of sufficient capacity and pressure. If insufficient, repair or replace compressor.
- 7.6.3 If compressed air supply is of sufficient capacity and pressure at compressor, the problem may be in the hose. Visually check the hose for kinks, holes, loose fittings, or other problems.
- 7.6.4 If the hose appears to be in satisfactory condition, then the problem may be in the Vibra Corer head or at the fittings. The Vibra Corer must be carefully retracted using the crane. The polyethylene sleeve must then be taped closed in accordance with Procedure K6507.
- 7.6.5 Carefully set the Vibra Corer on the plastic sheeting as designated by the K-65 Sampling Task Leader. Carefully disconnect the crane hook from the sampler head assembly. Check the fittings where they connect to the Vibra Corer head to determine if they are loose or improperly connected. A leak detectant such as "Snoop" can be used to determine if there are any leaks in the fittings.
- 7.6.6 Carefully disconnect the air compressor hose from the sampler head. Inspect the

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fittings to make sure air is flowing through the hose. If no air is flowing through the hose and Step 7.6.2 has confirmed that the compressor is producing air at sufficient capacity and pressure, the problem is in the hose. Replace or repair hose and check for any obstructions in the hose. Verify air is flowing through the new or repaired hose.

- 7.6.7 If air is flowing through the hose, then the problem may be in the Vibra Corer sampler head. Check the sampler head lubricator to ensure that it is filled with proper lubricant to the proper level. Refill reservoir with proper lubricant to the proper level as described in the manufacturer's operating manual.
- 7.6.8 If the lubricant reservoir is filled to the proper level, reconnect fitting to the sampler head and reopen air supply valve. If Vibra Corer head does not operate, then the sampler head may be defective. Check the manufacturer's operating manual for additional directions.
- 7.6.9 If the procedures and suggestions in the manufacturer's operating manual have been followed and the unit still fails to operate, the head is defective and must be repaired or replaced. Transport the entire Vibra Corer to the laydown area in accordance with Procedure K6509. Remove and save any sample collected and label according to Procedure K6511. Remove the defective head in accordance with the steps outlined in Procedure K6509 and decontaminate sampler head and casing conforming with Procedure K6516. Replace the head with an operating unit.
- 7.6.10 Connect the air compressor hose to the replaced sampler head and verify that the head operates properly. Reassemble Vibra Corer and replace with a new sample tube

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and an uncontaminated casing. Transport assembly to the silo.

7.6.11 Carefully reattach crane hook to the sampler head and hoist above manhole. Resample per Procedure K6507.

7.6.12 The K-65 Sampling Task Leader will then note the incident in the project logbook and report it per site procedure FMPC 704 (minor event reporting system).

7.7 Spills

7.7.1 Isolate and contain the spill; do not allow the spill to migrate. If the spill is on a hard surface, such as concrete or tile, and relatively small, wipe it up or pick up the spilled material and place it in an approved waste container.

7.7.2 Notify the K-65 Sampling Task Leader or his designee of the spill and warn nearby personnel of the possible danger.

7.7.3 If the spill is on open ground, contain the spill. Because the material to be handled from the silo is a solid or thick sludge, the material may be scooped up with a shovel and placed in waste containers. Some soil may have to be picked up.

7.7.4 Health and Safety personnel will be required to monitor the area to determine exposure levels and subsequent decontamination procedures.

7.7.5 If the spill occurs inside a building or trailer, follow the above procedures. In addition, initiate HEPA filtered ventilation if available. Do not allow the spill to spread outside the building or trailer; close the doors unless ventilation requirements dictate otherwise.

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- 7.7.6 Disallow unnecessary entry of personnel into the area and minimize personal exposure by leaving the area after the initial containment is complete.
- 7.7.7 If personnel are contaminated, follow procedures outlined in the Health and Safety Plan for personnel decontamination.
- 7.7.8 If the spill is major (e.g., if the silo has a major rupture), attend to any injured, evacuate the area, and immediately notify the K-65 Sampling Task Leader.
- 7.7.9 Do not reenter any spill zone without approval of the K-65 Sampling Task Leader.
- 7.7.10 Record the spill in the project logbook and report it per site procedure FMPC 704 (minor event reporting system).
- 7.8 Radon Removal System Failure
 - 7.8.1 Shut down all work that relies on the operation of the Radon Removal System.
 - 7.8.2 Duct work Failure
 - 7.8.2.1 Shut down Radon Removal System fan.
 - 7.8.2.2 Close Dampers D-01, D-11, D-13, D-14 and all carbon bed inlet dampers that are open.
 - 7.8.2.3 After system is repaired refer to Procedure K6510 for startup.
 - 7.8.3 Power or Instrument Failure
 - 7.8.3.1 Isolate the unit by closing the open dampers.
 - 7.8.3.3 Refer to Procedure K6510 for startup.

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7.9 Transportation Accidents

7.9.1 On-site Transportation Accidents

- 7.9.1.1 Accidents that involve personal injury, see Section 7.2.
- 7.9.1.2 Accidents which result in a spill of core material, see Section 7.8.
- 7.9.1.3 Accidents which involve a fire, see Section 7.10.
- 7.9.1.4 For accidents in which none of the above apply, actions required will be determined by the nature of the problem. The K-65 Sampling Task Leader must be notified and an appropriate response determined. If the truck cannot be moved and the trailer is not damaged, then another truck could be used to move the trailer to its destination. If the trailer is damaged and cannot be easily moved, then the core will have to be transferred to another trailer for transport to its final destination.
- 7.9.1.5 After the core has been secured, appropriate measures to repair the damaged equipment can be initiated. These measures will have to be developed at the site and approved by team management.
- 7.9.1.6 An entry will be made in the logbook and reported per site procedure FMPC 704 (minor event reporting system).

7.9.2 Off-site Accidents

- 7.9.2.1 For off-site accidents, the primary concern should be personal safety and health and safety of the public. Local authorities and the K-65 Sampling Task Leader should be notified immediately. The nature

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of the incident and integrity of the cargo should be determined.

- 7.9.2.2 If the core sample is damaged and is exposed, notification and isolation of the area are essential. If possible, the material should be contained.
- 7.9.2.3 An appropriate emergency response person must be made available to assist the local authorities in the mitigation of the incident.
- 7.9.2.4 If the core sample is not damaged, the accident investigation will follow standard contractor and local procedures.
- 7.9.2.5 An entry will be made in the project logbook and reported per site-procedure FMPC 704 (minor event reporting system).

7.10 Fires

- 7.10.1 The primary concerns in the event of a fire are personal injuries, contamination, and extinguishing or controlling the fire.
- 7.10.2 If anyone is injured, refer to Section 7.2 for instruction.
- 7.10.3 Notify the Fire Brigade, then notify the K-65 Sampling Task Leader or his designee.
- 7.10.4 If the fire is small enough and does not present a radiological contamination problem, fire extinguishers may be used to suppress the fire until the Fire Brigade arrives.
- 7.10.5 If the fire is severe enough that fire extinguishers are insufficient, remove any injured personnel, secure any

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equipment in danger, evacuate to a safe distance, and wait for the Fire Brigade.

- 7.10.6 Should a radiological hazard exist, evacuate according to WMCO procedures and await clearance from WMCO and the K-65 Sampling Task Leader for reentry.
- 7.10.7 After the fire, cleanup and decontamination should follow WMCO- and contractor-developed procedures prior to resumption of sampling or repair of storage structures.
- 7.10.8 The K-65 Sampling Task Leader or his designee should note the event in the project logbook and report it per site procedure FMPC 704 (minor event reporting system).

7.11 Windstorm, Lightning, Tornado

- 7.11.1 Sampling operations should cease during severe weather conditions, especially operations with the crane and on top of the silos in high winds and lightning. Severe thunderstorms, lightning, and tornados do occur in Ohio. Under no circumstances should anyone be on top of the silo or in the crane during a lightning storm. Personnel should go to a safe location inside a designated building or trailer until the storm has passed.
- 7.11.2 Personnel will institute a general housekeeping practice that all loose material is kept to a minimum and/or safely tied down.
- 7.11.3 The trailer should be secured so that the expected wind conditions will not adversely affect its safety or integrity.
- 7.11.4 Sampling should continue only after the danger of severe according to the procedure appropriate for that equipment

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or event.

- 7.11.5 An entry will be made in the project logbook and reported per site procedure FMPC 704 (minor event reporting system).

7.12 Seismic Event

- 7.12.1 If a seismic event occurs during the sampling process, all work should cease and an assessment of damage completed.
- 7.12.2 If any injuries occur, refer to Section 7.2 for instructions.
- 7.12.3 If there is neither significant damage nor any consequential impact, resume sampling after concurrence with the K-65 Sampling Task Leader.
- 7.12.4 If significant damage does occur, refer to the appropriate procedure for that equipment or event and proceed with mitigation. Do not resume sampling until clearance is given by the K-65 Sampling Task Leader.
- 7.12.5 Check the sample storage building for damage. If the samples have been damaged, refer to Section 7.8 for cleanup procedures.
- 7.12.6 The event should be recorded in the project logbook and reported per site procedure FMPC 704 (minor event reporting system).

7.13 Flood

- 7.13.1 Flooding of the area during the sampling event by rising backwater is not likely. Flash flooding from a heavy rainstorm could occur, however.
- 7.13.2 Work should not be in progress during a rainstorm heavy enough to cause flash flooding as per Section 7.11.

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- 7.13.3 Safe areas on high ground should be provided and personnel should assemble there. The trailer and storage and archive building should be in an area not subject to flash flooding.
- 7.13.4 If the buildings cannot be placed on high ground and a flash flood occurs, do not enter the area until the water subsides. Examine the buildings and their supports for stability and make necessary repairs. If the crane has been undermined, refer to Section 7.4 for instructions.
- 7.13.5 Samples should be stored so that they cannot be washed away. If they are washed away, every attempt should be made to safely retrieve them.
- 7.13.6 An entry will be made in the project logbook and reported per site procedure FMPC 704 (minor event reporting system).

7.14 Security Breaches

- 7.14.1 The sampling and storage areas will be inside the security fence at the FMPC. The area is continuously patrolled and an intruder is unlikely; however, if an intruder is spotted, immediately notify the K-65 Sampling Task Leader who should then notify WMC0 security personnel.
- 7.14.2 Report to the K-65 Sampling Task Leader any unusual occurrences that may indicate intrusion into the area when operating and sampling personnel were away.
- 7.14.3 An entry will be made in the project logbook for each case or perceived case of intrusion.

7.15 Failure of On-site Examination Equipment

- 7.15.1 Failure of the Audio/Video Recorder, 35 mm camera, or Geiger counter would not constitute a serious personnel hazard. Delay the completion of the on-site

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examination process until the equipment can be repaired. Consult manufacturer's information to troubleshoot any failures of the equipment.

7.15.2 Extra tapes, battery packs, film, etc. should be kept on site.

7.15.3 An entry will be made in the project logbook for each case or perceived case of intrusion.

7.16 Documentation Errors

7.16.1 Every effort should be made to ensure that all samples are properly and securely labeled, referenced, and accompanied by the completed chain-of-custody forms.

7.16.2 Should a sample be discovered with missing sample identification or duplicate sample identification the team management should be notified immediately.

7.16.3 An investigation into the sample history should include personnel handling the sample, sample number sequences, and missing sample numbers. The sample identification should be evident by finding a "missing" sample sequence number. If the number is a duplicate, the sample may have to be discarded.

7.16.4 If the investigation does not reveal the identity of the sample, it cannot be utilized in the program.

7.16.5 Missing or incorrectly documented chain-of-custody forms should be reported to the K-65 Sampling task Leader.

**TITLE: SHIPMENT OF IT EXCESS RESIDUE AND SAMPLES ANALYZED BACK
TO WMCO**

1.0 PURPOSE

The purpose of this procedure is to provide guidance for shipping excess K-65 residue and samples to WMCO for further disposition.

2.0 SCOPE

This procedure is applicable to all samples actually analyzed by IT and any excess residue remaining from the subsampling as described in procedure K6519 of this manual. The intent of this procedure is to ensure that all materials shipped back to WMCO are properly identified and that the shipment is conducted properly.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the Manager of the IT Mixed Waste Laboratory to see that this procedure is followed during all operations up to the time that the material is received back at WMCO site.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during all operations after the material arrives back at the WMCO site.
- 3.3 It is the responsibility of the Manager of the IT Mixed Waste Laboratory and K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps and requirements of this procedure.

4.0 REFERENCES

- 4.1 10 CFR 71, Packaging and Transportation of Radioactive Material.
- 4.2 49 CFR 173, U.S. Department of Transportation Rules and Regulations for Packaging and Shipment of Radioactive Materials.
- 4.3 Procedures K6501 through K6524
- 4.4 WMCO Radioactive Material Shipping Procedures, as applicable

5.0 SAFETY AND PRECAUTIONS

5.1 Protective clothing and dosimetry will be in accordance with Subsection 6.0 of the OSH plan.

6.0 PREREQUISITES

- 6.1 The Manager of the IT Mixed Waste Laboratory will provide a list of samples and excess residues to be shipped by the person conducting this procedure.
- 6.2 The Manager of the IT Mixed Waste Laboratory will notify K-65 Sampling Task Leader before this shipment takes place of exactly what will be shipped back and how it will be labeled.
- 6.3 Bills of lading, chain of Custody Forms, and other necessary transportation documents will be completed in accordance with References 4.1, 4.2, and 4.4.

7.0 PROCEDURE

When the sole use transport vehicle has arrived at the IT Laboratory Facility and a preshipment inspection of the vehicle has been completed:

- 7.1 Place fresh cold packs in each sample container to be shipped.
- 7.2 Fill void spaces of sample container(s) with vermiculite-type material. See Attachment 8.
- 7.3 Place each sample container in its designated shipping container.
- 7.4 Fill void spaces of the shipping container(s) with vermiculite type material.
- 7.5 Enclose completed Chain-of-Custody forms. Close and seal the shipping container.
- 7.6 Survey the shipping containers and document results on shipping papers. Ensure radiation contamination levels do not exceed limits detailed in Attachment 8.
- 7.7 Label each shipping container in accordance with Attachment 8.
- 7.8 Placard transport vehicles in accordance with Attachment 8.

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- 7.9 Load containers in transport vehicle and brace the containers to preclude shifting of load under conditions incident to normal transport.
- 7.10 Survey the transport vehicle and document on shipping papers. Ensure that radiation and contamination levels do not exceed the limits specified in Attachment 8.
- 7.11 Have transportation department complete shipping papers.
- 7.12 Have transportation department brief driver on shipment, and transfer copies of shipping papers to driver.
- 7.13 When shipment leaves IT Bear Creek Laboratory the appropriate IT personnel will contact K-65 Task Leader with information concerning: sample content, dose rates, and scheduled arrival time.

000201

**TITLE: PROCEDURE TO BE FOLLOWED BY WMCO PERSONNEL FOR RECEIVING
EXCESS RESIDUE AND SAMPLES FROM K-65 SILOS SENT BY IT BEAR
CREEK LABORATORY**

1.0 PURPOSE

The purpose of this procedure is to specify actions to be taken after arrival at WMCO of excess residue and samples from the K-65 sampling program for archiving and further WMCO confirmatory analyses. This procedure ensures that proper actions are taken to ensure the safe and proper transfer of these materials from IT to the appropriate WMCO personnel.

2.0 SCOPE

All materials received back from IT Bear Creek Laboratory which are a part of the K-65 and Metal Oxide Silo sampling project will be subject to the steps of this procedure before final WMCO confirmatory analytical methods are applied.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader to see that this procedure is followed during the receipt and processing of this material from the K-65 silos.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps of this procedure and requirements.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader.

4.0 REFERENCES

- 4.1 Analytical Laboratories Quality Assurance Plan, AnL-QAP, Rev. 0, Oct. 1, 1987--WMCO
- 4.2 Feed Materials Production Center Radiation Control Manual, FMPC-2084, Sept. 14, 1987--WMCO
- 4.3 Environmental Safety and Health Standard Operating Procedures, Revision 1, December 7, 1987--WMCO

4.4 Westinghouse Materials Company of Ohio Site Policies and Procedures Manual, Rev. 23, June 16, 1988--WMCO

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing, respiratory protection, and dosimetry must be worn in accordance with ES&H procedures and Radiation Control Procedure Manual(ref. 4.3 and 4.2 respectively).
- 5.2 Operating procedures and precautions for these facilities are found in references 4.1-4.4 and all pertinent directions must be followed.
- 5.3 Work must be performed in the presence of the Health Physicist or approved designee, who will approve personnel assigned to various tasks.
- 5.4 Chain-of-Custody protocols must be observed at all times for these materials received.
- 5.5 All materials received must be measured for radiation levels and approved for transfer by the WMCO Health Physicist for his designee before transfer of materials is made to any other group within WMCO.

6.0 PREREQUISITES

- 6.1 Completion of Procedures K-6520, K-6521, K-6522, K-6523, K-6524, and K-6525.
- 6.2 A refrigerated or ice-packed receiving areas for incoming samples.
- 6.3 Gamma survey instruments to determine the condition of incoming samples.
- 6.4. WMCO Health Physicists and associated personnel to monitor handling of materials received.
- 6.5 Personnel performing this work will be experienced and knowledgeable in all steps of this procedure.

7.0 PROCEDURE

- 7.1 When these materials are received in the Receiving Department of WMCO the external surface of the package will be inspected and monitored with a gamma-detecting instrument. Any damage or contamination must be treated in accordance with WMCO Radiation Control Manual Procedures(ref. 4.2).

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- 7.2 Shipping of Chain-of-Custody papers will be checked for completeness.
- 7.3 Samples will be removed from the shipping container, examined as in step 7.1, and placed in refrigerated or ice-packed storage. All data and observations will be logged.
- 7.4 All other received materials(non samples) will be left in shipping containers and taken to temporary designated storage area. All information describing the contents of each item, observations, and data will be logged.
- 7.5 All samples to be analyzed by the Analytical Group of WMCO will be delivered to Sample Receiving Laboratory. The manager of the Instrumental Analysis Group will be contacted so that he may prepare the proper request forms for the specific analytical tests to be performed.
- 7.6 Procedures K-6527, K-6528, and K-6529 will be followed for the specific WMCO confirmatory analytical tests designated.

TITLE: DETERMINATION OF ENGINEERING PROPERTIES OF SAMPLES

1.0 PURPOSE

The purpose of this procedure is to specify the methodology for determining the engineering properties of samples from the K-65 sampling program.

2.0 SCOPE

All samples from the K-65 sampling program received at the WMCO Analytical Laboratory for physical or engineering properties of moisture content, specific gravity, particle size, plasticity, and angle of repose will be submitted to Chemical Analysis Group of Analytical.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader and the Manager of WMCO's Analytical Laboratory to see that this procedure is followed during the receipt and testing of the core samples.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader and the Manager of WMCO's Analytical Laboratory to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps and requirements of the procedure.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and report any unusual occurrences to the K-65 Sampling Task Leader or the Manager of WMCO's Analytical Laboratory.

4.0 REFERENCES

- 4.1 Standard Method for Specific Gravity of Soils, ASTM D-854.
- 4.2 Standard Method for Particle Size Analysis of Soils, ASTM D-422.
- 4.3 Standard Method for Laboratory Determination of Water (Moisture) Content of Soils, ASTM D-2216.
- 4.4 Standard Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils, ASTM D-4318.
- 4.5 Environmental Safety and Health Standard Operating Procedures, Revision 1, December 7, 1987--WMCO.

4.6 WMCO Analytical Laboratories Quality Assurance Plan, Revision 0, Oct. 1, 1987.

4.7 FMPC Materials Production Center Radiation Control Manual, FMPC-2084, Sept. 14, 1987--WMCO.

4.8 Fernald RI/FS Quality Assurance Project Plan (Revision 3), March 1988.

5.0 SAFETY AND PRECAUTIONS

5.1 Protective clothing and dosimetry must be worn in accordance with the ES&H Procedure and Radiation Control Manuals (ref. 4.5 and 4.7 respectively).

5.2 All personnel working with this material or working in same general area where this material is being prepared will wear half face respirators with appropriate radioactive particulate filters.

5.3 Operating procedures and precautions for these facilities in references 4.1-4.8 must be observed.

5.4 Work must be performed with the approval of the Health Physicist or his authorized designee.

5.5 All work involving handling or preparing of these solid type residue samples must be done in HEPA exhausted hood which meets minimum velocity specifications.

5.6 Chain-of-Custody protocols must be observed at all times for these samples (see attachment 6).

6.0 PREREQUISITES

6.1 Completion of procedure K-6526.

6.2 Personnel performing this work will be experienced and/or trained in referenced procedures 4.1-4.4.

7.0 PROCEDURES

7.1 Using referenced procedures 4.1-4.4 analyze all submitted samples for Moisture content, Specific Gravity, Particle Size, Plasticity, and Angle of Repose.

7.2 All wastes and residues will be disposed of in accordance with WMCO's Environmental Health and Safety Procedures.

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7.3 All copies of results will be sent to Manger of Instrumental Analysis Group.

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TITLE: ISOTOPIC ASSAYS OF SAMPLES

1.0 PURPOSE

The purpose of this procedure is to specify the methodology for confirmatory isotopic analyses of K-65 silo samples.

2.0 SCOPE

All K-65 samples specified to receive confirmatory isotopic analyses will be submitted to the Radiometric Group of Analytical for the isotopes of uranium, thorium, radium, and lead. These sample will also receive alpha and gamma qualitative characterizations.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader and the Managers of Analytical at WMCO to see that this procedure is followed during the receipt and analyses of samples received from IT Laboratories.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader and the Managers of Analytical at WMCO to delegate the performance of this procedure to personnel who are experience and/or have been trained in the steps of this procedure and requirments.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader and WMCO Managers involved.

4.0 REFERENCES

- 4.1 The Radiometric Determination of Ra-226 and Ra-228 in Various Matrices, Revision 1, Sept. 18, 1986, Analytical Method No. 4002.
- 4.2 Alpha Spectrometer Operating Procedure Utilizing Silicon Surface Barrier Detectors, Revision 1, Jan. 7, 1987, Analytical Method No. 4004.
- 4.3 The Radiometric Determination of Thorium-230 in Thorium Matrices, Revision 1, Jan. 14, 1987, Analytical Method No. 4010.

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- 4.4 Uranium Isolation and Purification from Various Matrices for Subsequent Uranium Isotopic Analysis, Revision 0, Feb. 26, 1987, Analytical Method No. 4018.
- 4.5 The Radiometric Determination of Gamma Activity in Recycled Materials, Revision 1, Jan. 16, 1987, Analytical Method No. 4016.
- 4.6 The Radiometric Determination for Pb-210 In Various Matrices, procedure No. 4009, non finalized.
- 4.7 Radiometric Total Activity Determination, Revision 1, Jan. 14, 1987, Analytical Method No. 4013.
- 4.8. The Determination of the Uranium Isotopes (wt.%) by Thermal Ionization Mass Spectrometry (TMS), Revision 1, April 6, 1987, Analytical Method No. 6005.
- 4.9 SOP-Radiometric Records and Sample Handling, Revision 2, May 24, 1988, Analytical Standard Operating Procedure No. AnL-33-0028.
- 4.10 WMCO Analytical Laboratories Quality Assurance Plan, Revision 0, Oct. 1, 1987.
- 4.11 Fernald RI/FS Quality Assurance Project Plan (Revision 3), March 1988.
- 4.12 Environmental Safety and Health Standard Operating Procedure Revision 1, December 7, 1987--WMCO
- 4.13 FMPC Materials Production Center Radiation Control Manual, FMPC-2084, Sept. 14, 1987--WMCO

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing and dosimetry must be worn in accordance with the ES&H Procedure and Radiation Control Manual (ref. 4.12 and 4.13 respectively).
- 5.2 All personnel working with this material or working in same general area where this material is being prepared will wear half face respirators with appropriate radioactive particulate filters.
- 5.3 Operating procedures and precautions for these facilities referred to in references 4.1-4.13 must be observed.

5.4 Work must be performed with the approval of the Health Physicist or his authorized designee.

5.5 All work involving handling or preparing of these solid type residue samples must be done in HEPA exhausted hood which meets minimum velocity specifications.

5.6 Chain-of-Custody protocols must be observed at all times for these samples (see attachment 6).

6.0 PREREQUISITES

6.1 Completion of procedure K-6526.

6.2 Personnel performing this work will be experienced and/or trained in referenced procedures 4.1-4.9

7.0 Procedures

7.1 Using referenced procedures 4.1-4.9 analyze all submitted samples for Ra-226/228, Th-228/230/232, U-234/235/238, Pb-210, and alpha/gamma qualitative characterization.

7.2 All wastes and residues will be disposed of in accordance with WMCO's Environmental Health and Safety Procedures.

7.3 All copies of results will be sent to Manager of Instrumental Analysis Group.

TITLE: ANALYSIS OF SAMPLES FOR EP TOXICITY TESTING

1.0 PURPOSE

The purpose of this procedure is to specify the methodology for confirmatory EP Toxicity analysis of K-65 silo samples.

2.0 SCOPE

All K-65 samples specified to receive confirmatory EP Toxicity analyses will be submitted to the NMC-SS Group of Analytical for the extraction procedure for toxic analytes such as As, Pb, Hg, Se, Cr, Cd, Ba, and Ag and their subsequent quantification.

3.0 RESPONSIBILITY

- 3.1 It is the responsibility of the K-65 Sampling Task Leader and the Managers of Analytical at WMCO to see that this procedure is followed during the receipt and analyses of samples received from IT Laboratories.
- 3.2 It is the responsibility of the K-65 Sampling Task Leader and the Managers of Analytical at WMCO to delegate the performance of this procedure to personnel who are experienced and/or have been trained in the steps of this procedure and requirements.
- 3.3 It is the responsibility of each individual performing this procedure to follow it and to report any unusual occurrences to the K-65 Sampling Task Leader and WMCO Managers involved.

4.0 REFERENCES

- 4.1 Extraction Procedure Toxicity, Revision 0, May 19, 1988, Analytical Method No. 1054.
- 4.2 Graphite Furnace AAS Method for the determination of Total Chromium in NPDES Water Samples, Revision 0, Jan. 14, 1988, Analytical Method No. 1025.
- 4.3 Graphite Furnace AAS Method for the Determination of Silver, Revision 0, Aug. 31, 1987, Analytical Method No. 1055.
- 4.4 Graphite Furnace AAS Method for the Determination of Arsenic, Revision 0, Aug. 28, 1987, Analytical Method No. 1056.
- 4.5 Graphite Furnace AAS Method for the Determination of Barium, Revision 0, Aug. 31, 1987, Analytical Method No. 1057.

- 4.6 Graphite Furnace AAS Method for the Determination of Cadmium, Revision 0, Aug. 31, 1987, Analytical Method No. 1058.
- 4.7 The Determination of Mercury by AAS-Hydride Generation, Revision 0, no issue date as yet, Analytical Method No. 1059.
- 4.8. Graphite Furnace AAS Method for the Determination of Lead, Revision 0, Aug 6, 1987, Analytical Method No. 1060.
- 4.9 Graphite Furnace AAS Method for the Determination of Selenium, Revision 0, Aug. 28, 1987, Analytical Method No. 1061.
- 4.10 WMCO Analytical Laboratories Quality Assurance Plan, Revision 0, Oct. 1, 1987.
- 4.11 Fernald RI/FS Quality Assurance Project Plan (Revision 3), March 1988.
- 4.12 Environmental Safety and Health Standard Operating Procedure Revision 1, December 7, 1987--WMCO
- 4.13 FMPC Materials Production Center Radiation Control Manual, FMPC-2084, Sept. 14, 1987--WMCO

5.0 SAFETY AND PRECAUTIONS

- 5.1 Protective clothing and dosimetry must be worn in accordance with the ES&H Procedure and Radiation Control Manual (ref. 4.12 and 4.13 respectively).
- 5.2 All personnel working with this material or working in same general area where this material is being prepared will wear half face respirators with appropriate radioactive particulate filters.
- 5.3 Operating procedures and precautions for these facilities referred to in references 4.1-4.13 must be observed.
- 5.4 Work must be performed with the approval of the Health Physicist or his authorized designee.
- 5.5 All work involving handling or preparing of these solid type residue samples must be done in HEPA exhausted hood which meets minimum velocity specifications.
- 5.6 Chain-of-Custody protocols must be observed at all times for these samples (see attachment 6).

6.0 PREREQUISITES

6.1 Completion of procedure K-6526.

6.2 Personnel performing this work will be experienced and/or trained in referenced procedures 4.1-4.9

7.0 Procedures

- 7.1 Using referenced procedures 4.1-4.9 analyze all submitted samples for Extraction Procedure Toxicity test and quantitate the following analytes Ba, Ag, Se, Hg, Pb, Cr, Cd, and As using WMCO analytical methods referenced in steps 4.1-4.9 above.
- 7.2 All wastes and residues will be disposed of in accordance with WMCO's Enviromental Health and Safety Procedures.
- 7.3 All copies of results will be sent to Manager of Instrumental Analysis Group.

SECTION 3

11-11-11



ALARA REVIEW OF SAMPLING PLAN OF
K-65 RESIDUE SILOS 1 AND 2 AND
METAL OXIDE SILO 3 AT FERNALD, OHIO

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ALARA REVIEW SUMMARY

An ALARA Review of the K-65 Residue Silos 1 and 2 and the Metal Oxide Silo 3 Sampling plan was conducted in accordance with the Statement of work, using the Guidelines of DOE/EV/1830-TS Publication, "Radiation Work Practices Handbook" and good engineering practices.

The estimated radiation exposure for the K-65 and Metal Oxide Silo sampling project is a total of 2.862 rem. Supporting calculations are included as attachments. Major contributions to the estimated dose are the (1) sampling of Silos 1 and 2, (2) on-site survey/sectioning of cores from Silo 3, and (3) on-site survey/sectioning of cores from Silos 1 and 2. Using the time, distance, and shielding components of ALARA, the component that has the most input to dose reduction in this project is time. By being well prepared to perform each task in an expeditious manner and performing it correctly the first time, total exposure will be kept to ALARA. Distance will also be used by restricting the number of personnel on or near the dome. Shielding will not be an option to help reduce exposure rates during the sampling of Silos 1 and 2 due to the requirement that no additional weight be loaded on the domes because of their structural condition. Hands-on guiding of the Vibra Corer into each manhole and handling of samples are essential for proper collection of representative samples. Shielding will be useful in limiting exposure rates as indicated below for Items 2 and 3. Shielding with either lead blankets or a shield wall along the core during sectioning is recommended for operator dose reduction. The use of a bandsaw for cutting of core samples is also recommended.

Shielding Design for Sectioning Cores, Inspection of Cores, Etc.

1. Distance from source is limited due to the need of the worker to be near the core for operation of Lexan tube cutting device.
2. Time of actual contact with core is dependent on the required number of cuts (samples) determined from results of inspection and surveys. Time can be greatly reduced by being prepared to perform the task expeditiously and NOT loitering near radiation areas when the job is complete. Extremities dose may be lowered by the use of remote handling

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devices such as mechanical fingering. Whole body dose, which was used in the estimation, is computed at 2 feet from the core.

3. Shielding may be effective for whole body exposure reduction. Temporary shielding, such as lead blankets or bricks, may be useful in areas where cores accumulate, where hot spots exist on cores, and close to where the sectioning work is being performed.

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ATTACHMENT A
ALARA REVIEW SUMMARY

1. Setup phase

A. Crane positioning/setup	62.0 mrem
B. Trailer positioning/setup	3.0 mrem
C. Laydown area	1.0 mrem
D. Silo 4 mock up training	<u>5.0 mrem</u>

Total 71.0 mrem OR 0.071 rem

2. Sampling phase

A. Silo 3 (metal oxide) with 2.5 factor

(1) Whole body 12.0 mrem

Total 12.0 mrem OR 0.012 rem

B. Silos 1 and 2 (K-65 with 2.5 factor

(1) Whole body 1176.0 mrem

Total 1176.0 mrem OR 1.176 rem

3. Site survey/sectioning/decontamination

A. Silo 3 core with 2.5 factor

(1) Survey	3.0 mrem
(2) Sectioning	6.4 mrem
(3) Decon/handling	<u>29.0 mrem</u>

Total 38.4 mrem OR 0.038 rem

B. Silos 1 and 2 core with 2.5 factor

(1) Survey	225.0 mrem
(2) Sectioning	480.0 mrem
(3) Decon/Handling	650.0 mrem
(4) Packaging/Archiving	<u>150.0 mrem</u>

Total 1505.0 mrem OR 1.505 rem

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4. Site cleanup with 2.5 factor

A. Crane removal	1.0 mrem
B. Trailer removal	4.0 mrem
C. Tool removal	5.0 mrem
D. Waste cleanup	<u>50.0 mrem</u>

Total 60.0 mrem OR 0.060 rem

5. Analytical phase

A. Sample receipt	
B. Sample prep/reduction	
C. Laboratory analysis	<u> </u>

Total

6. Summary of exposure

Phase 1	0.071 rem
Phase 2	1.188 rem
Phase 3	1.543 rem
Phase 4	0.060 rem
	<u>---</u>

Total 2.862 rem
(estimate
with
multiplier)

Actual budget exposure $1.145 \text{ rem} \times 2.5 = 2.862 \text{ rem}$

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ATTACHMENT B

ALARA REVIEW

1. Setup phase - This phase includes time for:
 - A. Crane position and setup
 - B. Position of one trailer
 - C. Laydown area establishment
 - D. Mock-up training on Silo 4.
2. Estimates of exposure and time for items in "A" above:
 - A. 3 hours/location
 - a. Silo 4 = 0.11 mrem/hr X 3 hr = 0.33 =
0.33 mrem
 - b. Silo 3 = 0.20 mrem/hr X 3 hr = 0.60 X 2 =
1.20 mrem
 - c. Silo 2 = 5.00 mrem/hr X 3 hr = 15.0 X 2 =
30.00 mrem
 - d. Silo 1 = 5.00 mrem/hr X 3 hr = 15.0 X 2 =
30.00 mrem

Total 61.53 mrem
 - B. Trailer position and setup
 - a. General area of 0.05 mrem/hr
Position and utilities = 8 hr X 0.05 = 0.40
mrem
 - b. General area of 0.23 mrem/hr
Position and utilities = 8 hr X 0.23 = 1.84
mrem

Total 2.24 mrem
 - C. Laydown area for tools
 - a. General area of 0.1 mrem/hr X 2 hr = 0.20
mrem
 - D. Mock-up training of Silo 4
 - a. General area of 0.1 mrem/hr
 - b. Crew of six for 8 hr = 4.80 mrem

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3. Total for setup phase

1.	61.53 mrem
2.	2.24 mrem
3.	0.20 mrem
4.	<u>4.80</u> mrem
	68.77 mrem = 0.07 rem

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ATTACHMENT C

ASSUMPTIONS

1. Silo 3 contains:
 - A. 5100 cy of calcined resources
 - B. 18,000 kg uranium or 6 curies as U-238
 - C. 15 curies Ra-226.
2. Density of Silo 3 material 51.8 pounds/ft³, 0.83g/cc
3. Daughters of U-238 down to Ra-226 are in equilibrium at 6 curies
4. Daughters of Ra-226 down to stable Pb-206 are in equilibrium at 15 curies
5. Work force equals six persons:
 - A. Truck driver
 - B. Crane Operator
 - C. Health physics technician
 - D. Work (dome)
 - E. Worker (standby)
 - F. Supervisor
6. Sampling time (dome work time) = 30 minutes
7. Survey, uncase core, load time = 30 minutes
8. Dose rates:
 - A. General area = 0.2 mrem/hr
 - B. Work area on dome = 0.2 mrem/hr
 - C. Core
 - Contact = 0.60 mrem/hr
 - 1 foot = 0.07 mrem/hr
 - 2 feet = 0.03 mrem/hr
 - 1 meter = 0.02 mrem/hr
 - d. Truck general area = 0.2 mrem/hr

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9. Estimate of exposure for coring phase

A. Whole body

1.	60 minutes at 0.2 mrem/hr = 0.2	
2.	60 minutes at 0.2 mrem/hr = 0.2	
3.	60 minutes at 0.2 mrem/hr = 0.2	
4.	60 minutes at 0.2 mrem/hr = 0.2	
5.	60 minutes at 0.2 mrem/hr = 0.2	
6.	60 minutes at 0.2 mrem/hr = <u>0.2</u>	
		1.2 mrem
		<u>x 4 cores</u>
	Totals	4.8 mrem

B. Extremities per core

4.	18 minutes at 0.6 mrem/hr = 0.18
5.	18 minutes at 0.6 mrem/hr = <u>0.18</u>
	Total 0.36 mrem

4 Cores X 0.36 mrem = 1.44 mrem
 (extremity exposure to the hands)

10. Summary

Exposure estimates for the sampling of metal oxide silo, excluding exposure for setup and removal of crane service. This estimate is covered under a separate heading for total estimated exposure.

Total whole body exposure for 4 Cores = 4.8 mrem.

11. This estimate is for ideal conditions; if the normal problems are encountered. A safety factor of 2.5 will be used in the final total job exposure estimate.

4.8 X 2.5 = 12.0 mrem (metal oxide silo).

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MICROSHIELD 3.08

CASE: Dose rate on contact with a silo 3 core sample.

GEOMETRY: Cylindrical source from side-cylindrical shields.

Distance to detector.....X	4.000	cm
Source length.....L	609.600	cm
Dose point height from base.....Y	304.800	cm
Source cylinder radius.....T1	2.540	cm
Thickness of second shield.....T2	0.635	cm
Microshield inserted air gap.....Air	0.825	cm

Source Volume: 12355.6 cubic centimeters

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>	<u>Air Gap</u>
Air			.001220
Aluminum			
Carbon			
Concrete	.830527		
Hydrogen			
Iron			
Lead			
Lithium			
Nickel			
Tin			
Titanium			
Tungsten			
Urania			
Uranium			
Water		1.250	
Zirconium			

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CASE: Dose rate on contact with a silo 3 core sample.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	4.7532e-05	Bi-214	4.7532e-05
Pa-234	2.4717e-08	Pa-234m	1.8988e-05
Pb-210	4.7532e-05	Pb-214	2.7523e-05
Po-210	4.7532e-05	Po-214	4.7522e-05
Po-218	4.7532e-05	Ra-226	4.7532e-05
Rn-222	4.7532e-05	Th-230	1.9013e-05
Th-234	1.9013e-05	Tl-210	9.5064e-09
U-234	1.9013e-05	U-238	1.9013e-05

RESULTS:

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1424	1.922e+05	3.827e+01	6.075e-02
2	1.6259	5.876e+05	9.019e+01	1.557e-01
3	1.1547	5.230e+05	5.823e+01	1.088e-01
4	.8185	2.299e+05	1.953e+01	3.913e-02
5	.6031	8.530e+05	6.365e+01	1.317e-01
6	.4408	4.540e+04	2.894e+00	5.920e-03
7	.3294	1.008e+06	4.869e+01	9.931e-02
8	.2432	1.416e+05	5.107e+00	9.931e-03
9	.1795	5.827e+04	1.560e+00	2.803e-03
10	.1183	2.913e+03	5.136e-02	8.132e-05
TOTALS:		3.642e+06	3.282e+02	6.141e-01

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Microshield 3.08

CASE: Dose rate at one foot from a silo 3 core sample.
 GEOMETRY 7: Cylindrical source from side - cylindrical shields

Distance to detector.....X	30.40	cm
Source length.....L	609.60	cm
Dose point height from base.....Y	304.80	cm
Source cylinder radius.....T1	2.540	cm
Thickness of second shield.....T2	0.635	cm
Microshield inserted air gap....Air	27.225	cm

Source Volume: 12355.6 cubic centimeters.

MATERIAL DENSITIES (g/cc)

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>	<u>Air Gap</u>
Air			.001220
Aluminum			
Carbon			
Concrete	.830527		
Hydrogen			
Iron			
Lead			
Lithium			
Nickel			
Tin			
Titanium			
Tungsten			
Urania			
Uranium			
Water		1.250	
Zirconium			

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CASE: Dose rate at one foot from a silo 3 core sample.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	4.7532e-05	Bi-214	4.7532e-05
Pa-234	2.4717e-08	Pa-234m	1.8988e-05
Pb-210	4.7532e-05	Pb-214	4.7523e-05
Po-210	4.7532e-05	Po-214	4.7523e-05
Po-218	4.7532e-05	Ra-226	4.7532e-05
Rn-222	4.7532e-05	Th-230	1.9013e-05
Th-234	1.9013e-05	Tl-210	9.5064e-09
U-234	1.9013e-05	U-238	1.9013e-05

RESULTS:

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1424	1.922e+05	4.497e+00	7.138e-03
2	1.6259	5.876e+05	1.060e+01	1.829e-02
3	1.1547	5.230e+05	6.844e+00	1.278e-02
4	.8185	2.299e+05	2.292e+00	4.592e-03
5	.6031	8.530e+05	7.444e+00	1.540e-02
6	.4408	4.540e+04	3.381e-01	6.917e-04
7	.3294	1.008e+06	5.704e+00	1.163e-02
8	.2432	1.416e+05	6.000e-01	1.167e-03
9	.1795	5.827e+04	1.839e-01	3.303e-04
10	.1183	2.913e+03	6.087e-03	9.638e-06
TOTALS:		3.642e+06	3.851e+01	7.804e-02

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Microshield 3.08

CASE: Dose rate at two feet from a silo 3 core sample.
 GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	60.960	cm
Source length.....L	609.600	cm
Dose point height from base.....Y	304.800	cm
Source cylinder radius.....T1	2.540	cm
Thickness of second shield.....T2	0.635	cm
Thickness of third shield.....T3	57.785	cm

Source Volume 12355.6 cubic centimeters

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>	<u>Shield 3</u>
Air			.001220
Aluminum			
Carbon			
Concrete	.830527		
Hydrogen			
Iron			
Lead			
Lithium			
Nickel			
Tin			
Titanium			
Tungsten			
Urania			
Uranium			
Water		1.250	
Zirconium			

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CASE: Dose rate at two feet from a silo 3 core sample.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	4.7532e-05	Bi-214	4.7532e-05
Pa-234	2.4717e-08	Pa-234m	1.8988e-05
Pb-210	4.7532e-05	Pb-214	4.7523e-05
Po-210	4.7532e-05	Po-214	4.7523e-05
Po-218	4.7532e-05	Ra-226	4.7532e-05
Rn-222	4.7532e-05	Th-230	1.9013e-05
Th-234	1.9013e-05	Tl-210	9.5064e-09
U-234	1.9013e-05	U-238	1.9013e-05

RESULTS:

<u>Group #</u>	<u>Energy (MeV)</u>	<u>Activity (photons/sec)</u>	<u>Dose point flux MeV/(sq cm)/sec</u>	<u>Dose rate (mr/hr)</u>
1	2.1424	1.922e+05	2.096e+00	3.327e-03
2	1.6259	5.876e+05	4.938e+00	8.526e-03
3	1.1547	5.230e+05	3.189e+00	5.958e-03
4	.8185	2.299e+05	1.066e+00	2.136e-03
5	.6031	8.530e+05	3.450e+00	7.139e-03
6	.4408	4.540e+04	1.565e-01	3.201e-04
7	.3294	1.008e+06	2.645e+00	5.395e-03
8	.2432	1.416e+05	2.790e-01	5.435e-03
9	.1795	5.827e+04	8.571e-00	1.540e-04
10	.1183	2.913e+03	2.853e-01	1.517e-06
TOTALS:		3.642e+06	1.791e+01	3.350e-02

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Microshield 3.08

CASE: Dose rate on contact with a silo 3 sample container.
 GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	4.00	cm
Source length.....L	20.00	cm
Dose point height from base.....Y	10.00	cm
Source cylinder radius.....T1	3.75	cm
Microshield inserted air gap.....Air	0.25	cm

Source Volume: 883.573 cubic centimeters

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Air Gap</u>
Air		.001220
Aluminum		
Carbon		
Concrete	.830527	
Hydrogen		
Iron		
Lead		
Lithium		
Nickel		
Tin		
Titanium		
Tungsten		
Urania		
Uranium		
Water		
Zirconium		

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CASE: Dose rate on contact with a silo 3 sample container.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 1.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	3.3991e-06	Bi-214	3.3991e-06
Pa-234	1.7675e-09	Pa-234m	1.3597e-06
Pb-210	3.3991e-06	Pb-214	3.3985e-06
Po-210	3.3991e-06	Po-214	3.3985e-06
Po-218	3.3991e-06	Ra-226	3.3991e-06
Rn-222	3.3991e-06	Th-230	1.3597e-06
Th-234	1.3597e-06	Tl-210	6.7983e-10
U-234	1.3597e-06	U-238	1.3597e-06

RESULTS

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(phontons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1424	1.375e+04	8.162e+01	1.295e-01
2	1.6259	4.202e+04	1.914e+02	3.304e-01
3	1.1547	3.740e+04	1.232e+02	2.302e-01
4	.8185	1.644e+04	3.937e+01	7.885e-02
5	.6031	6.100e+04	1.158e+02	2.395e-01
6	.4408	3.246e+03	4.744e+00	9.703e-03
7	.3294	7.207e+04	7.910e+01	1.613e-01
8	.2432	1.013e+04	8.233e+00	1.601e-02
9	.1795	4.167e+03	2.502e+00	4.495e-03
10	.1183	2.084e+02	8.192e-02	1.297e-04
TOTALS		2.604e+05	6.460e+02	
1.200e+00				

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Microshield 3.08

CASE: Dose rate at one foot from a silo 3 sample container.

GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to dector.....X	33.750	cm
Source length.....L	20.000	cm
Dose point height from base.....Y	10.000	cm
Source cylinder radius.....T1	3.750	cm
Thickness of second shield.....T2	30.000	cm

Source Volume: 883.573 cubic centimeters

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>
Air		.001220
Aluminum		
Carbon		
Concrete	.830527	
Hydrogen		
Iron		
Lead		
Lithium		
Nickel		
Tin		
Titanium		
Tungsten		
Urania		
Uranium		
Water		
Zirconium		

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CASE: Dose rate at one foot from a silo 3 sample container.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	3.3991e-06	Bi-214	3.3991e-06
Pa-234	1.7675e-09	Pa-234m	1.3597e-06
Pb-210	3.3991e-06	Pb-214	3.3985e-06
Po-210	3.3991e-06	Po-218	3.3991e-06
Ra-226	3.3991e-06	Rn-222	3.3991e-06
Th-230	1.3597e-06	Th-234	1.3597e-06
Tl-210	6.7983e-10	U-234	1.3597e-06
U-238	1.3597e-06		

RESULTS:

<u>Group</u>	<u>Energy</u>	<u>Activity</u>	<u>Dose point flux</u>	<u>Dose rate</u>
<u>#</u>	<u>(MeV)</u>	<u>(photons)/sec</u>	<u>MeV/(sq cm)/sec</u>	<u>(mr/hr)</u>
1	2.1424	1.375e+04	1.886e+00	2.994e-03
2	1.6259	4.202e+04	4.423e+00	7.636e-03
3	1.1547	3.740e+04	2.844e+00	5.313e-03
4	.8185	1.644e+04	9.210e-01	1.845e-03
5	.6031	6.100e+04	2.782e+00	5.757e-03
6	.4408	3.246e+03	1.185e-01	2.425e-04
7	.3294	7.207e+04	1.997e+00	4.072e-03
8	.2432	1.013e+04	2.103e-01	4.089e-04
9	.1795	4.167e+03	6.465e-02	1.161e-04
10	.1183	2.084e+02	2.167e-03	3.431e-06
	TOTALS:	2.604e+05	1.525e+01	2.839e-02

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Microshield 3.08

CASE: Dose rate at one meter from a silo 3 core sample.
 GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	100.00	cm
Source length.....L	609.60	cm
Dose point height from base.....Y	304.80	cm
Source cylinder radius.....T1	2.54	cm
Thickness of second shield.....T2	0.635	cm
Microshield inserted air gap.....Air	96.825	cm

Source Volume: 12355.6 cubic centimeters

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>	<u>Air Gap</u>
Air			.001220
Aluminum			
Carbon			
Concrete	.830527		
Hydrogen			
Iron			
Lead			
Lithium			
Nickel			
Tin			
Titanium			
Tungsten			
Urania			
Uranium			
Water		1.250	
Zirconium			

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CASE: Dose rate at one meter from a silo 3 core sample.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	4.7532e-05	Bi-214	4.7532e-05
Pa-234	2.4717e-08	Pa-234m	1.8988e-05
Pb-210	4.7532e-05	Pb-214	4.7523e-05
Po-210	4.7532e-05	Po-214	4.7523e-05
Po-218	4.7532e-05	Ra-226	4.7532e-05
Rn-222	4.7532e-05	Th-230	1.9013e-05
Th-234	1.9013e-05	Tl-210	9.5064e-09
U-234	1.9013e-05	U-238	1.9013e-05

RESULTS:

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1424	1.922e+05	1.168e+00	1.854e-03
2	1.6259	5.876e+05	2.751e+00	4.750e-03
3	1.1548	5.230e+05	1.777e+00	3.319e-03
4	.8185	2.299e+05	5.930e-01	1.188e-03
5	.6031	8.530e+05	1.911e+00	3.955e-03
6	.4408	4.540e+04	8.652e-02	1.770e-04
7	.3294	1.008e+06	1.465e+00	2.988e-03
8	.2432	1.416e+05	1.548e-01	3.011e-04
9	.1795	5.827e+04	4.768e-02	8.566e-05
10	.1183	2.913e+03	1.594e-03	2.524e-06
TOTAL		3.642e+06	9.956e+00	1.862e-02

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Microshield 3.08

CASE: Dose rate at two feet from a silo 3 sample
container.
GEOMETRY 7: Cylindrical source from side - cylindrical
shields.

Distance to detector.....X	63.75	cm
Source length.....L	20.00	cm
Dose point height from base.....Y	10.00	cm
Source cylinder radius.....T1	3.75	cm
Thickness of second shield.....T2	60.00	cm

Source volume: 883.573 cubic centimeters

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>
Air		.001220
Aluminum		
Carbon		
Concrete	.830527	
Hydrogen		
Iron		
Lead		
Lithium		
Nickel		
Tin		
Titanium		
Tungsten		
Urania		
Uranium		
Water		
Zirconium		

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CASE: Dose rate at two feet from a silo 3 sample container.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	3.3991e-06	Bi-214	3.3991e-06
Pa-234	1.7675e-09	Pa-234m	1.3597e-06
Pb-210	3.3991e-06	Pb-214	3.3985e-06
Po-210	3.3991e-06	Po-214	3.3985e-06
Po-218	3.3991e-06	Ra-226	3.3991e-06
Rn-222	3.3991e-06	Th-230	1.3597e-06
Th-234	1.3597e-06	Tl-210	6.7983e-10
U-234	1.3597e-06	U-238	1.3597e-06

RESULTS:

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1424	1.375e+04	5.150e-01	8.175e-04
2	1.6259	4.202e+04	1.208e+00	2.085e-03
3	1.1547	3.740e+04	7.767-01	1.451e-03
4	.8185	1.644e+04	2.516e-01	5.039e-04
5	.6031	6.100e+04	7.601e-01	1.573e-03
6	.4408	3.246e+03	3.240e-02	6.627e-05
7	.3294	7.207e+04	5.458e-01	1.113e-03
8	.2432	1.013e+04	5.749e-02	1.118e-04
9	.1795	4.167e+03	1.767e-02	3.175e-05
10	.1183	2.084e+02	5.925e-04	9.381e-07
	TOTAL	2.604e+05	4.165e+00	7.754e-03

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Microshield 3.08

CASE : Dose rate at one meter from a silo 3 sample
container.
GEOMETRY 7: Cylindrical source from side - cylindrical
shields.

Distance to detector.....X	100.00	cm
Source length.....L	20.00	cm
Dose point height from base.....Y	10.00	cm
Source cylinder radius.....T1	3.75	cm
Thickness of second shield.....T2	96.25	cm

Source Volume: 883.573 cubic centimeters.

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>
Air		.001220
Aluminum		
Carbon		
Concrete	.830527	
Hydrogen		
Iron		
Lead		
Lithium		
Tin		
Titanium		
Tungsten		
Urania		
Uranium		
Water		
Zirconium		

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CASE: Dose rate at one meter from a silo 3 sample container.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	3.3991e-06	Bi-214	3.3991e-06
Pa-234	1.7675e-09	Pa-234m	1.3597e-06
Pb-210	3.3991e-06	Pb-214	3.3985e-06
Po-210	3.3991e-06	Po-214	3.3985e-06
Po-218	3.3991e-06	Ra-226	3.3991e-06
Rn-222	3.3991e-06	Th-230	1.3597e-06
Th-234	1.3597e-06	Tl-210	6.7983e-10
U-234	1.3597e-06	U-238	1.3597e-06

RESULTS

<u>Group #</u>	<u>Energy (MeV)</u>	<u>Activity (photons/sec)</u>	<u>Dose point flux MeV/(sq cm)/sec</u>	<u>Dose rate (mr/hr)</u>
1	2.1424	1.375e+04	2.063e-01	3.275e-04
2	1.6259	4.202e+04	4.839e-01	8.354e-04
3	1.1547	3.740e+04	3.112e-01	5.814e-04
4	.8185	1.644e+04	1.008e-01	2.020e-04
5	.6031	6.100e+04	3.050e-01	6.311e-04
6	.4408	3.246e+03	1.301e-02	2.661e-05
7	.3294	7.207e+04	2.192e-01	4.470e-04
8	.2432	1.013e+04	2.309e-02	4.489e-05
9	.1795	4.167e+03	7.098e-03	1.275e-05
10	.1183	2.084e+02	2.379e-04	3.766e-07
	TOTAL	2.604e+05	1.670e+00	3.109e-03

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ATTACHMENT D

ASSUMPTIONS

1. Silos 1 and 2 contain:
 - A. 7222 cy of wet residue
 - B. 11,200 kg uranium or 3.73 curies at U-238
 - C. 3593 curies of Ra-226 at 311 mg Ra-226/ton residue.
2. Density of Silo 1 and 2 material (119 pounds/ft³ or 1.9 g/cc).
3. Daughters of U-238 down to Ra-226 are in equilibrium at 3.73 curies.
4. Daughters of Ra-226 down to stable Pb-206 are in equilibrium at 3593 curies.
5. Work force equals six persons:
 - A. Truck driver
 - B. Crane operator
 - C. Health physics technicians
 - D. Worker (dome)
 - E. Worker (standby)
 - F. Supervisor.
6. Each silo has been evacuated by the radon Removal System within 10 hours prior to start of work, and work is finished before 50 hours have elapsed since evacuation was completed.
7. Average silo dose equivalent at the end of evacuation is 75 mrem/hr or less.
8. Sampling time (dome work time) = 30 minutes.
9. Survey, unlease, load time = 30 minutes.

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10. Dose rates

- A. General area = 5 mrem/hr
- B. Work area on dome = 70 mrem/hr
- C. Core
 - Contact = 85 mrem/hr
 - 1 foot = 10 mrem/hr
 - 2 feet = 4 mrem/hr
 - 1 meter = 3 mrem/hr

11. Estimate of Exposure for Coring Phase

A. Whole Body

- 1. 15 minutes at 5 mr/hr = 1.25 = 1.25
- 2. 60 minutes at 5 mr/hr = 5.00 = 5.00
- 3. 60 minutes at 5 mr/hr = 5.00 = 5.00
- 4. 30 minutes at 70 mr/hr
- 30 minutes at 5mr/hr = 35.00 - 2.5 = 37.50
- 5. 60 minutes at 5 mr/hr = 5.00 = 5.00
- 6. 60 minutes at 5 mr/hr = 5.00 = 5.00

Total mrem = 58.75
 X 8/job mrem = 470.00

B. Extremities Per Core

- 4. 18 minutes at 85 mrem/hr = 25.5 mrem
- 5. 18 minutes at 85 mrem/hr = 25.5 mrem

Total per Core = 51.0 mrem
 = 0.051 rem

Total for 8 Cores = 408.0 mrem
 0.408 rem

12. Summary

Exposure estimates for the sampling phase (excluding exposure for setup and removal of crane and areas) are within the guidelines set forth by DOE Order 5480.1A and this Health and Safety Plan (i.e., total whole body dose to crew = 58.75 mrem/core or 470 mrem/job).

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13. Ideal conditions for exposure should use multiplier for safety and unforeseen problems. Using a multiplier of 2.5 will raise the exposure level to:

- W/B per core = $58.75 \text{ mrem} \times 2.5 = 147 \text{ mrem/core}$

OR

- Total exposure of $147 \times 8 = 1176 \text{ mrem}$.

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Microshield 3.08

CASE: Dose rate on contact with a silo 1 or 2 core samples.

GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	4.00	cm
Source length.....L	609.60	cm
Dose point height from base.....Y	304.80	cm
Source Cylinder radius.....T1	2.54	cm
Thickness of second shield.....T2	0.635	cm
Microshield inserted air gap.....Air	0.825	cm

Source Volume: 12355.6 cubic centimeters

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>	<u>Air gap</u>
Air			.001220
Aluminum			
Carbon			
Concrete	1.90		
Hydrogen			
Iron			
Lead			
Lithium			
Nickel			
Tin			
Titanium			
Tungsten			
Urania			
Uranium			
Water		1.250	
Zirconium			

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CASE: Dose rate on contact with a silo 1 or 2 core sample.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in Shield 2.

INTEGRATION PARAMETERS

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	6.7434e-03	Bi-214	6.7434e-03
Pa-234	1.0860e-08	Pa-234m	8.3540e-06
Pb-210	6.7434e-03	Pb-214	6.7421e-03
Po-210	6.7434e-03	Po-214	6.7421e-03
Po-218	6.7434e-03	Ra-226	6.7434e-03
Rn-222	6.7434e-03	Th-230	8.3540e-03
Th-234	8.3540e-06	Tl-210	1.3487e-06
U-234	8.3540e-06	U-238	8.3540e-06

RESULTS

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1425	2.727e+07	5.233e+03	8.306e+00
2	1.6259	8.334e+07	1.232e+04	2.127e+01
3	1.1560	7.357e+07	7.857e+03	1.467e+01
4	.8174	3.190e+07	2.631e+03	5.270e+00
5	.6031	1.210e+08	9.030e+03	1.868e+01
6	.4408	6.429e+06	4.131e+02	8.449e-01
7	.3294	1.430e+08	6.789e+03	1.385e+01
8	.2433	2.007e+07	6.907e+02	1.343e+00
9	.1797	8.184e+06	2.032e+02	3.651e-01
10	.1183	1.280e+03	1.971e-02	3.121e-02
TOTALS:		5.147e+08	4.516e+04	8.460e+01

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Microshield 3.08

CASE: Dose rate at one foot from a silo 1 or 2 core sample.
 GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	30.40	cm
Source length.....L	609.60	cm
Dose point height from base.....Y	304.80	cm
Source cylinder radius.....T1	2.54	cm
Thickness of second shield.....T2	0.635	cm
Microshield inserted air gap.....Air	27.225	cm

Source Volume 12355.6 cubic centimeters.

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>	<u>Air Gap</u>
Air			.001220
Aluminum			
Carbon			
Concrete	1.90		
Hydrogen			
Iron			
Lead			
Lithium			
Nickel			
Tin			
Titanium			
Tungsten			
Urania			
Uranium			
Water		1.250	
Zirconium			

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CASE: Dose rate at one foot from a silo 1 or 2 core sample.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	6.7434e-03	Bi-214	6.7434e-03
Pa-234	1.0860e-08	Pa-234m	8.3540e-06
Pb-210	6.7434e-03	Pb-214	6.7421e-03
Po-210	6.7434e-03	Po-214	6.7421e-03
Po-218	6.7434e-03	Ra-226	6.7434e-03
Rn-222	6.7434e-03	Th-230	8.3540e-06
Th-234	8.3540e-06	Tl-210	1.3709e-06
U-234	8.3540e-06	U-238	8.3540e-06

RESULTS

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1425	2.727e+07	6.185e+02	9.817e-01
2	1.6259	8.334e+07	1.457e+03	2.516e+00
3	1.1560	7.357e+07	9.313e+02	1.739e+00
4	.8174	3.190e+07	3.119e+02	6.250e-01
5	.6031	1.210e+08	1.071e+03	2.216e+00
6	.4408	6.429e+06	4.908e+01	1.004e-01
7	.3294	1.430e+08	8.096e+02	1.651e+00
8	.2433	2.007e+07	8.268e+01	1.608e-01
9	.1797	8.184e+06	2.440e+01	4.385e-02
10	.1183	1.280e+03	2.380e-03	3.768e-06
	TOTALS:	5.147e+08	5.356e+03	1.003e+01

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Microshield 3.08

CASE: Dose rate at two feet from a silo 1 or 2 core sample.

GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	60.96	cm
Source length.....L	609.60	cm
Dose point height from base.....Y	304.80	cm
Source cylinder radius.....T1	2.54	cm
Thickness of second shield.....T2	0.635	cm
Thickness of third shield.....T3	57.785	cm

Source Volume: 12355.6 cubic centimeters

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>	<u>Shield 3</u>
Air			.001220
Aluminum			
Carbon			
Concrete	1.90		
Hydrogen			
Iron			
Lead			
Lithium			
Nickel			
Tin			
Titanium			
Tungsten			
Urania			
Uranium			
Water		1.250	
Zirconium			

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CASE: Dose rate at two feet from a silo 1 or 2 core sample.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	6.7434e-03	Bi-214	6.7434e-03
Pa-234	1.0860e-08	Pa-234m	8.3540e-06
Pb-210	6.7434e-03	Pb-214	6.7421e-03
Po-210	6.7434e-03	Po-214	6.7421e-03
Po-218	6.7434e-03	Ra-226	6.7434e-03
Rn-222	6.7434e-03	Th-230	8.3540e-06
Th-234	8.3540e-06	Tl-210	1.3709e-06
U-234	8.3540e-06	U-238	8.3540e-06

RESULTS

<u>Group #</u>	<u>Energy (MeV)</u>	<u>Activity (photons/sec)</u>	<u>Dose point flux MeV/(sq cm)/sec</u>	<u>Dose rate (mr/hr)</u>
1	2.1425	2.727e+07	2.898e+02	4.600e-01
2	1.6259	8.334e+07	6.833e+02	1.180e+00
3	1.1560	7.357e+07	4.373e+02	8.168e-01
4	.8174	3.190e+07	1.465e+02	2.934e-01
5	.6031	1.210e+08	5.022e+02	1.039e+00
6	.4408	6.429e+06	2.305e+01	4.715e-02
7	.3294	1.430e+08	3.818e+02	7.787e-01
8	.2433	2.007e+07	3.916e+01	7.614e-02
9	.1797	8.184e+06	1.160e+01	2.085e-02
10	.1183	1.280e+03	1.139e-03	1.804e-06
	TOTALS	5.147e+08	2.515e+03	4.712e+00

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Microshield 3.08

CASE: Dose rate at one meter from a silo 1 or 2 core samples.

GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	100.00	cm
Source length.....L	609.60	cm
Dose point height from base.....Y	304.80	cm
Source cylinder radius.....T1	2.54	cm
Thickness of second shield.....T2	0.635	cm
Microshield inserted air gap.....Air	96.825	cm

Source Volume: 12355.6 cubic centimeters.

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>	<u>Air gap</u>
Air			.001220
Aluminum			
Carbon			
Concrete	1.90		
Hydrogen			
Iron			
Lead			
Lithium			
Nickel			
Tin			
Titanium			
Tungsten			
Urania			
Uranium			
Water		1.250	
Zirconium			

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CASE: Dose rate at one meter from a silo 1 or 2 core sample.

BUILDUP FACTOR: based on TAYLOR method. Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	6.7434e-03	Bi-214	6.7434e-03
Pa-234	1.0860e-08	Pa-234m	8.3540e-06
Pb-210	6.7434e-03	Pb-214	6.7421e-03
Po-210	6.7434e-03	Po-214	6.7421e-03
Po-218	6.7434e-03	Ra-226	6.7434e-03
Rn-222	6.7434e-03	Th-230	8.3540e-06
Th-234	8.3540e-06	Tl-210	1.3709e-06
U-234	8.3540e-06	U-238	8.3540e-06

RESULTS

<u>Group #</u>	<u>Energy (MeV)</u>	<u>Activity (photons/sec)</u>	<u>Dose point flux MeV/(sq cm)/sec</u>	<u>Dose rate (mr/hr)</u>
1	2.1425	2.727e+07	1.622e+02	2.575e-01
2	1.6259	8.334e+07	3.827e+02	6.607e-01
3	1.1560	7.357e+07	2.452e+02	4.579e-01
4	.8174	3.190e+07	8.207e+01	1.644e-01
5	.6031	1.210e+08	2.810e+02	5.814e-01
6	.4408	6.429e+06	1.291e+01	2.640e-02
7	.3294	1.430e+08	2.146e+02	4.376e-01
8	.2433	2.007e+07	2.210e+01	4.297e-02
9	.1797	8.184e+06	6.575e+00	1.181e-02
10	.1183	1.280e+03	6.503e-04	1.030e-06
	TOTAL	5.147e+08	1.409e+03	2.641e+00

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Microshield 3.08

CASE: Dose rate on contact with a silo 1 or 2 samples container.

GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	4.00	cm
Source length.....L	20.00	cm
Dose point height from base.....Y	10.00	cm
Source cylinder radius.....T1	3.75	cm
Microshield inserted air gap.....Air	0.25	cm

Source Volume: 883.573 cubic centimeters.

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Air gap</u>
Air		.001220
Aluminum		
Carbon		
Concrete	1.90	
Hydrogen		
Iron		
Lead		
Lithium		
Nickel		
Tin		
Titanium		
Tungsten		
Urania		
Uranium		
Water		
Zirconium		

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CASE: Dose rate on contact with a silo 1 or 2 sample container.

BUILDUP FACTOR: based on TAYLOR method.

Using the characteristics of the materials in shield 1.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	4.8224e-04	Bi-214	4.8224e-04
Pa-234	7.7663e-10	Pa-234m	5.9741e-07
Pb-210	4.8224e-04	Pb-214	4.8214e-04
Po-210	4.8224e-04	Po-214	4.8214e-04
Po-218	4.8224e-04	Ra-226	4.8224e-04
Rn-222	4.8224e-04	Th-230	5.9741e-07
Th-234	5.9741e-07	Tl-210	9.6447e-08
U-234	5.9741e-07	U-238	5.9741e-07

RESULTS

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1425	1.950e+06	1.098e+04	1.743e+01
2	1.6259	5.960e+06	2.579e+04	4.452e+01
3	1.1560	5.261e+06	1.650e+04	3.081e+01
4	.8174	2.281e+06	5.205e+03	1.043e+01
5	.6031	8.651e+06	1.606e+04	3.323e+01
6	.4408	4.597e+05	6.576e+02	1.345e+00
7	.3294	1.022e+07	1.072e+04	2.186e+01
8	.2433	1.435e+06	1.081e+03	2.102e+00
9	.1797	5.853e+05	3.156e+02	5.672e-01
10	.1183	9.156e+01	2.016e-02	4.776e-05
	TOTALS:	3.681e+07	8.440e+04	1.623e+02

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Microshield 3.08

CASE: Dose rate at one foot from a silo 1 or sample container.

GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	33.75	cm
Source length.....L	20.00	cm
Dose point height from base.....Y	10.00	cm
Source cylinder radius.....T1	3.75	cm
Thickness of second shield.....T2	30.00	cm

Source Volume: 883.573 cubic centimeters.

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>
Air		.001220
Aluminum		
Carbon		
Concrete	1.90	
Hydrogen		
Iron		
Lead		
Lithium		
Nickel		
Tin		
Titanium		
Tungsten		
Urania		
Uranium		
Water		
Zirconium		

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CASE: Dose rater at one foot from a silo 1 or 2 sample container.

BUILDUP FACTOR: based on TAYLOR method.

Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclides</u>	<u>Curies</u>
Bi-210	4.8224e-04	Bi-214	4.8224e-04
Pa-234	7.7663e-10	Pa-234m	5.9741e-07
Pb-210	4.8223e-04	Pb-214	4.8214e-04
Po-210	4.8224e-04	Po-214	4.8214e-04
Po-218	4.8224e-04	Ra-226	4.8224e-04
Rn-222	4.8224e-04	Th-230	5.9741e-07
Th-234	5.9741e-07	Tl-210	9.6447e-08
U-234	5.9741e-07	U-238	5.9741e-07

RESULTS

<u>Group #</u>	<u>Energy (MeV)</u>	<u>Activity (photons/sec)</u>	<u>Dose point flux MeV/(sq cm)/sec</u>	<u>Dose rate (mr/hr)</u>
1	2.1425	1.950e+06	2.602e+02	4.130e-01
2	1.6259	5.960e+06	6.123e+02	1.057e+00
3	1.1560	5.261e+06	3.922e+02	7.326e-01
4	.8174	2.281e+06	1.273e+02	2.550e-01
5	.6031	8.651e+06	4.117e+02	8.519e-01
6	.4408	4.597e+05	1.793e+01	3.667e-02
7	.3294	1.022e+07	2.970e+02	6.057e-01
8	.2433	1.435e+06	3.050e+01	5.931e-02
9	.1797	5.853e+05	9.057e+00	1.627e-02
10	.1183	9.156e+01	8.927e-04	1.414e-06
	TOTAL:	3.680e+07	2.158e+03	4.020e+00

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Microshield 3.08

CASE: Dose rate at two feet from a silo 1 or 2 sample container.

GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	63.75	cm
Source length.....L	20.00	cm
Dose point height from base.....Y	10.00	cm
Source cylinder radius.....T1	3.75	cm
Thickness of second shield.....T2	60.00	cm

Source Volume: 883.573 cubic centimeters.

MATERIAL DENSITIES (g/cc):

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>
Air		.001220
Aluminum		
Carbon		
Concrete	1.90	
Hydrogen		
Iron		
Lead		
Lithium		
Nickel		
Tin		
Titanium		
Tungsten		
Urania		
Uranium		
Water		
Zirconium		

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CASE: Dose rate at two feet from a silo 1 or 2 sample container.

BUILDING FACTOR: based on TAYLOR method.

Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	4.8224e-04	Bi-214	4.8224e-04
Pa-234	7.7663e-10	Pa-234m	5.9741e-07
Pb-210	4.8224e-04	Pb-214	4.8214e-04
Po-210	4.8224e-04	Po-214	4.8214e-04
Po-218	4.8224e-04	Ra-226	4.8224e-04
Rn-222	4.8224e-04	Th-230	5.9741e-07
Th-234	5.9741e-07	Tl-210	9.6447e-08
U-234	5.9741e-07	U-238	5.9741e-07

RESULTS

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1425	1.950e+06	7.108e+01	1.128e-01
2	1.6259	5.960e+06	1.673e+02	2.888e-01
3	1.1560	5.261e+06	1.072e+02	2.002e-01
4	.8174	2.281e+06	3.478e+01	6.967e-02
5	.6031	8.651e+06	1.125e+02	2.328e-01
6	.4408	4.597e+05	4.900e+00	1.002e-02
7	.3294	1.022e+07	8.121e+01	1.656e-01
8	.2433	1.435e+06	8.344e+00	1.622e-02
9	.1797	5.853e+05	2.478e+00	4.453e-03
10	.1183	9.156e+01	2.445e-04	3.872e-07
	TOTAL:	3.681e+07	5.897e+02	1.101e+00+

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Microshield 3.:08

CASE: Dose rate at one meter from a silo 1 or 2 sample container.

GEOMETRY 7: Cylindrical source from side - cylindrical shields.

Distance to detector.....X	100.00	cm
Source length.....L	20.00	cm
Dose point height from base.....Y	10.00	cm
Source cylinder radius.....T1	3.75	cm
Thickness of second shield.....T2	96.25	cm

Source Volume: 883.573 cubic centimeters

MATERIAL DENSITIES (g/cc):.

<u>Material</u>	<u>Source</u>	<u>Shield 2</u>
Air		.001220
Aluminum		
Carbon		
Concrete	1.90	
Hydrogen		
Iron		
Lead		
Lithium		
Nickel		
Tin		
Titanium		
Tungsten		
Urania		
Uranium		
Water		
Zirconium		

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CASE: Dose rate at one meter from a silo 1 or 2 sample container.

BUILDUP FACTOR: based on TAYLOR method.

Using the characteristics of the materials in shield 2.

INTEGRATION PARAMETERS:

Number of lateral angle segments (Ntheta)..... 5
 Number of azimuthal angle segments (Npsi)..... 5
 Number of radial segments (Nradius)..... 5

SOURCE NUCLIDES:

<u>Nuclide</u>	<u>Curies</u>	<u>Nuclide</u>	<u>Curies</u>
Bi-210	4.8224e-04	Bi-214	4.8224e-04
Pa-234	7.7663e-10	Pa-234m	5.9741e-07
Pb-210	4.8224e-04	Pb-214	4.8214e-04
Po-210	4.8224e-04	Po-214	4.8214e-04
Po-218	4.8224e-04	Ra-226	4.8224e-04
Rn-222	4.8224e-04	Th-230	5.9741e-07
Th-234	5.9741e-07	Tl-210	9.6447e-08
U-234	5.9741e-07	U-238	5.9741e-07

RESULTS

<u>Group</u> <u>#</u>	<u>Energy</u> <u>(MeV)</u>	<u>Activity</u> <u>(photons/sec)</u>	<u>Dose point flux</u> <u>MeV/(sq cm)/sec</u>	<u>Dose rate</u> <u>(mr/hr)</u>
1	2.1425	1.950e+06	2.847e+01	4.519e-02
2	1.6259	5.960e+06	6.701e+01	1.157e-01
3	1.1560	5.261e+06	4.293e+01	8.018e-02
4	.8174	2.281e+06	1.393e+01	2.792e-02
5	.6031	8.651e+06	4.510e+01	9.332e-02
6	.4408	4.597e+05	1.965e+00	4.019e-03
7	.3294	1.022e+07	3.256e+01	6.641e-02
8	.2433	1.435e+06	3.345e+00	6.505e-03
9	.1797	5.853e+05	9.936e-01	1.785e-05
10	.1183	9.156e+01	9.801e-05	1.552e-07
	TOTALS:	3.681e+07	2.663e+02	4.410e-01

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ATTACHMENT E

Survey/Handling/Sectioning/Packaging/Decon - Silo 3

1. On-site analytical methods (surveys)

- A. Visual inspection 0.25 hr X 4 cores X 0.20 mrem/hr = 0.20
B. Video recording 0.25 hr X 4 cores X 0.20 mrem/hr = 0.20
C. Radiological scanning 0.25 hr X 4 cores X 0.20 mrem/hr

= 0.20
0.60 mrem
2 X 0.6 = 1.20 mrem

2. Handling

A. Transport to and storage of samples at on-site		
	laydown area =	5.0 mrem
B. Waste from sampling operations		= 5.0 mrem
C. Decon	1 hr X 0.2 cores X 0.20 mrem/hr X 2 men	= <u>1.6</u> mrem
		11.6

3. Sectioning

- A. Cut into 30-inch lengths = 8 cuts/core X 4 cores = 32 cuts
B. Cut for sample = 8 cuts/4 samples X 4 cores = 32 cuts
64 cuts

$$64 \text{ cuts} \times 0.1 \text{ hr} \times 2 \text{ men} \times 0.2 \text{ mrem/hr} = \frac{2.56}{(\text{man mrem})}$$

TOTAL 15 mrem = 2.56

1. Survey Silos 1 and 2

- A. Visual inspection -

$$\frac{0.25 \text{ hr}}{\text{core}} \times 12 \text{ cores} \times \frac{5 \text{ mrem}}{\text{hr}} = \frac{15 \text{ mrem}}{\text{man}} \times 2 = 30 \text{ mrem}$$
- B. Video -

$$\frac{0.25 \text{ hr}}{\text{core}} \times 12 \text{ cores} \times \frac{5 \text{ mrem}}{\text{hr}} = \frac{15 \text{ mrem}}{\text{man}} \times 2 = 30 \text{ mrem}$$

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C. Radiological -

$$\frac{0.25 \text{ hr}}{\text{core}} \times 12 \text{ cores} \times \frac{5 \text{ mrem}}{\text{hr}} = \frac{15 \text{ mrem}}{\text{man}} \times 2 = 30 \text{ mrem}$$

TOTAL: 90 mrem

$$90 \text{ mrem} \times 2.5 = 225 \text{ mrem} = 0.225 \text{ rem.}$$

2. Sectioning

A. Cut into 30-inch lengths $\frac{8 \text{ cuts}}{\text{core}} \times 12 \text{ cores} = 96$

B. Cuts for sample $\frac{8 \text{ cuts}}{4 \text{ samples}} \times 12 \text{ cores} = 96$

TOTAL: 192 cuts

C. $192 \text{ cuts} \times 0.1 \text{ hr/cut} \times 5 \text{ mrem/hr} \times 2 \text{ men} = 192 \text{ mrem}$

$$192 \times 2.5 = 480 \text{ mrem or } 0.480 \text{ REM}$$

3. Decontamination/Handling

A. Decontamination $\frac{1 \text{ hr}}{\text{core}} \times 12 \text{ cores} \times 2 \text{ men} \times \frac{5 \text{ mrem}}{\text{hr}} = 120 \text{ mrem}$

B. Handling of Core $\frac{1 \text{ hr}}{\text{core}} \times 12 \text{ cores} \times 2 \text{ men} \times \frac{5 \text{ mrem}}{\text{hr}} = 120 \text{ mrem}$

C. Waste handling = 20 mrem

TOTAL: 260 mrem

$$260 \text{ mrem} \times 2.5 \text{ (factor)} = 650 \text{ mrem } 0.650 \text{ rem.}$$

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ATTACHMENT F

4a.	Crane removal	2 hrs X $\frac{0.2 \text{ mrem}}{\text{hr}}$	=	0.4 mrem
4b.	Trailer removal	8 hrs X $\frac{0.2 \text{ mrem}}{\text{hr}}$	=	1.6 mrem
4c	Tool removal	4 hrs X $\frac{0.5 \text{ mrem}}{\text{hr}}$	=	<u>2.0</u> mrem
		TOTAL:		4.0 mrem
4d	Waste cleanup		=	<u>20.0</u> mrem
		TOTAL:		24.0 mrem

24 mrem X 2.5 (factor) = 6.0 mrem or 0.060 rem.

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ATTACHMENT G

Assumptions

1. Radium activity in core will be 343 nanocuries/gram.
2. Radon is in secular equilibrium with radium in the core.
3. Fifty percent of available radon will be released when transferring core material to sample container.
4. Affected breathing zone with no ventilation is 8 ft³.
5. Ventilation flow rate from trailer will be 1000 cfm.
6. Maximum core volume transferred per operation will be 1000 cc.
7. Density of core material is 1.9 grams/cc.
8. Twenty-five percent of core material will be transferred in 1 day.

(1000 cc) (1.9g/cc) (343 nanocuries) (50% release) = source term
 gram

$3/3 \times 10^5$ nanocuries or 3.3×10^2 microcuries

(a) Immediate breathing zone - no ventilation

$\frac{3.3 \times 10^2 \text{ microcuries}}{(8\text{ft}^3) (28,316 \text{ cc/ft}^3)} \quad 1.5 \times 10^{-3} \text{ u Ci/cc}$

(b) Total radon discharged

(12 cores) ($.68 \frac{\text{ft}^3}{\text{Core}}$) (53,800 grams) (343 Nanocuries) (50% release) =
 gram
 25%
 Material

1.9×10^7 nanocuries discharged or 1.9×10^4 microcuries

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(c) Rate of radon discharge

$$\frac{1.9 \times 10^4 \text{ microcuries}}{(1000 \text{ cfm})(480 \text{ minutes})(28,316 \text{ cc/ft}^3)} = 1.4 \times 10^{-6} \text{ microcuries/cc}$$

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4.0 NEPA CHECKLIST

(UNDER SEPARATE REVIEW)

STRUCTURAL INTEGRITY OF SILO DOMES DURING
K-65 SAMPLING OPERATIONS

STRUCTURAL INTEGRITY OF SILO DOMES DURING
K-65 SAMPLING OPERATIONS

Due to environmental elements, the K-65 silo domes have deteriorated and are considered the weakest structural component of the silo system. The recent placement of dome covers over the structurally deficient 20-foot center portion of the domes was considered only as a temporary remedial solution (1 to 2 years). Since final remediation plans for the K-65 silos will take at least 3 years to develop and implement, additional remedial actions to provide for continued safe containment of the K-65 residues are being considered.

The continuing concern regarding the structural integrity of the silo domes was instrumental in the development of the operational procedures for the K-65 sampling program. The use of cranes located away from the silos was dictated by the constraint on placing heavy equipment on the domes. The specified size of the crane was based on the need to maintain a factor of safety in relation to the moment arm created by the weight of the sampling unit and the resistance forces during sample withdrawal. This will minimize the risk of the crane overturning or failure of the cantilevered beam. A repositioning of the crane for each pair of samples will keep the length of the moment arm at a minimum.

The probability of cable failure (resulting in a possible impact force on the dome by the falling sampler apparatus) is low considering the high tensile strength of the cable. The use of the dynamometer will further reduce such a risk by monitoring the tension force created by sample resistance during withdrawal. Any significant resistance will be overridden by the start up of the vibratory action of the Vibra Corer.

Any loads that are on the domes during sampling will be kept at an acceptable level. Due to ALARA considerations, the maximum number of sampling personnel on the dome at any given time will be limited to three to four individuals. Recent operations at the silos (e.g. the exterior foaming project) have shown that such loads can be supported. As an additional safeguard, no personnel or other loading will be allowed within the 20-foot central portion of the dome occupied by the plywood and steel cap. This portion is considered the most

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susceptible to structural failure due to the reduced thickness of the concrete in this area. It is also noteworthy that the snow load assumed under the worst-case structural analysis will not be of concern during the sampling program, thereby providing an additional factor of safety in the allowable loadings.

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SECTION 6

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ATTACHMENTS

- ATTACHMENT 1 Project Quality Assurance Objectives
- ATTACHMENT 2 Internal Quality Control Checks and Frequency
- ATTACHMENT 3 Preventative Maintenance
- ATTACHMENT 4 Equipment Calibration/Maintenance
- ATTACHMENT 5 Document Control
- ATTACHMENT 6 Chain of Custody Procedures
- ATTACHMENT 7 Data Reduction, Validation, and Reporting
- ATTACHMENT 8 Sample Collection Procedures
- ATTACHMENT 9 Laboratory Testing Program Initiation
- ATTACHMENT 10 Radiation Survey with FIDLER Detector (Field)
- ATTACHMENT 11 WMCO Solid Waste Handling Procedures

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ATTACHMENT 1

1.0 PROJECT QUALITY ASSURANCE OBJECTIVES

Project quality objectives are:

- o Scientific data will be of sufficient or greater quality to meet scientific and legal scrutiny.
- o Data will be gathered or developed in accordance with procedures appropriate for the intended use of the data.
- o Data will be of known or acceptable precision, accuracy, completeness, representativeness, and comparability as required by the FMPC project.

Fundamental mechanisms that will be employed to achieve these quality goals can be categorized as prevention, assessment, and correction. These include:

- o Prevention of errors by planning, documented instructions and procedures, and careful selection and training of skilled, qualified personnel.
- o Quality assessment through a program of audits and surveillances to supplement continual informal review.
- o Correction for prevention of recurrence of conditions adverse to quality.

The procedures contained or referred to herein have been taken from:

- o IT Analytical Services Quality Assurance Manual.
- o IT Engineering Services Quality Assurance Manual.
- o IT/Radiological Sciences Laboratory Quality Assurance Manual.
- o IT/Radiological Sciences Laboratory Radioanalytical Methodology and Procedures Manual.
- o Laboratory-Specific Attachments for RSL, Mixed Waste Laboratory, Middlebrook Pike Laboratory, and Export Geotechnical Laboratory.

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- o RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD), September 1986.
- o Code of Federal Regulations (CFR), 40 CFR 261, Appendix II, "EP Toxicity Test Procedures."
- o U.S. EPA Quality Assurance Handbook (U.S. EPA 600/9-76-005).
- o Proposed Sampling and Analytical Methodologies for Addition to Test Methods for Evaluating Solid Waste Physical/Chemical Methods, U.S. EPA, (PB85-103026).
- o American Society for Testing and Materials (ASTM) Standards, Section 11, Volumes II.01 and II.02, "Water," and Section 4, Volume 04.08, "Soil and Rock, Building Stones."
- o American Public Health Association, Standard Methods for the Examination of Water and Waste Water, 16th Edition, 1985.
- o Methods for Chemical Analysis of Water and Wastes (U.S. EPA-600/4-79-020).
- o Federal Register, Volume 49, October 26, 1984, 40 CFR 136, pp. 43234-43436.
- o Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, U.S. EPA (SW-846).
- o Handbook for Sampling and Sample Preservation of Water and Waste Water, U.S. EPA (PB83-124503).
- o Field and Laboratory Methods Applicable to Overburdens and Mine Soil, (U.S. EPA-600/2-80-054).
- o Prescribed Procedures for Measurement of Radioactivity in Drinking Water, (U.S. EPA-600/4-80-032).
- o Code of Federal Regulations, 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants."
- o American National Standards Institute (ANSI) NQA-1, Quality Assurance Program Requirements for Nuclear Facilities.

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- o USNRC Regulatory Guide 4.15, Revision 1, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment."
- o Chemical Analytical Services for Multi-Media Multi-Concentration Metals and Inorganics, U.S. EPA (WA-87-K026).
- o Chemical Analytical Services for Multi-Media Multi-Concentration Organics, GC/MS Techniques, U.S. EPA (WA-87-K236).
- o Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, U.S. EPA, (QAMS 005/80).

1.1 Analytical Quality Assurance Objectives for Data

Quality assurance (QA) objectives have been established for precision, accuracy, completeness, representativeness, and comparability for each major measurement parameter for the FMPC project. These objectives are presented in Tables 1-1, 1-2, and 1-3, and are pertinent to both analytical laboratories and field procedures. Data will be calculated and reported in units consistent with Contract Laboratory Program (CLP) analytical procedures and other organizations reporting similar data to allow for comparability. Definitions for precision, accuracy, completeness, representativeness, and comparability are as follows:

- o Precision - A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Comparison of replicate values is best expressed as the relative percent difference (RPD). Various measures of precision exist depending upon the "prescribed similar conditions."
- o Accuracy - The degree of agreement of a measurement (or an average of replicate measurements), X , with an accepted reference or true value, T , usually expressed as the difference between the two values, $X - T$, or the difference as a percentage of the

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reference or true value, $100 (X - T)/T$, and sometimes expressed as a ratio, X/T . Accuracy is a measure of the bias in a system.

- o Completeness - A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions.
- o Representativeness - Expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental concern.
- o Comparability - Expresses the confidence with which one data set can be compared to another.

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TABLE 1-1

GENERAL CHEMISTRY AND METALS
 METHOD REFERENCES AND QUALITY CONTROL OBJECTIVES
 FEED MATERIALS PRODUCTION CENTER
 FERNALD, OHIO

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION RSD %	TYPICAL ACCURACY % OF RECOVERY	EXPECTED COMPLETENESS (%)	EXPECTED METHOD DETECTION LIMIT(l)	METHOD NO. REFERENCE
Alkalinity	pH meter	Daily (water)	110	-	90	1000 ug/l (g) (water)	310.1 1
		Daily (solids)	110	-	90	500 mg/kg (h) (solids)	3.2.3 2
Aluminum	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	100 ug/l (water)	200.7 12
		Daily (solids)	110	120	90	20 mg/kg (solids)	200.7 12
Ammonia	Distillation with UV/VIS Spectrophotometer	Daily (water)	110	120	90	50 ug/l (water)	350.2 1
		Daily (solids)	110	120	90	2 mg/kg (solids)	33-2, 350.2 11, 1
Antimony	Specific Ion Meter/ Microprocessor	Daily (water)	110	120	90	50 ug/l (water)	350.2 1
		Daily (solids)	110	120	90	2 mg/kg (solids)	33-2, 350.2 11, 1
Antimony	Atomic Absorption Spectrophotometer	Daily (water)	110	120	90	10 ug/l (water)	204.1, 204.2 1
		Daily (solids)	110	120	90	2 mg/kg (solids)	7040, 7041 3
Arsenic	Atomic Absorption Spectrophotometer	Daily (water)	110	120	90	10 ug/l (water)	206.2 1
		Daily (solids)	110	120	90	2 mg/kg (solids)	7060 3

See footnotes at end of table.

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TABLE 1-1
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION RPD X (s)	TYPICAL ACCURACY X OF RECOVERY	EXPECTED COMPLETENESS	EXPECTED METHOD DETECTION LIMIT (1)	METHOD NO.	REFERENCE
Barium	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	100 ug/l (water)	200.7	12
		Daily (solids)	110	120	90	20 mg/kg (solids)	200.7	12
Beryllium	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	5 ug/l (water)	200.7	12
		Daily (solids)	110	120	90	1 mg/kg (solids)	200.7	12
Boron	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	10 ug/l (water)	200.7	12
		Daily (solids)	110	120	90	2 mg/kg (solids)	200.7	12
Cadmium	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	5 ug/l (water)	200.7	12
		Daily (solids)	110	120	90	1 mg/kg (solids)	200.7	12
Calcium	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	100 ug/l (water)	200.7	12
		Daily (solids)	110	120	90	20 mg/kg (solids)	200.7	12

See footnotes at end of table.

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TABLE 1-1
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION RPD X(%)	TYPICAL ACCURACY % OF RECOVERY	EXPECTED COMPLETENESS (%)	EXPECTED METHOD DETECTION LIMIT(1)	METHOD NO. REFERENCE
Cation Exchange Capacity	Atomic Absorption Spectrophotometer	Daily (solids)	±10	±20	90	1 mg/kg (solids)	3.2-17 2
Chloride	Buret/Indicator	Daily (water) Daily (solids)	±10 ±10	±20 ±20	90 90	500 ug/l (water) 5 mg/kg (solids)	325.3 1 10-2,325.3 11,1
Chromium (Total)	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water) Daily (solids)	±10 ±10	±20 ±20	90 90	10 ug/l (water) 2 mg/kg (solids)	200.7 12 200.7 12
Chromium VI	UV/VIS Spectrophotometer	Daily (water) Daily (solids)	±10 ±10	±20 ±20	90 90	10 ug/l (water) 1 mg/kg (solids)	7196 3 7196 3
Cobalt	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water) Daily (solids)	±10 ±10	±20 ±20	90 90	10 ug/l (water) 2 mg/kg (solids)	200.7 12 200.7 12
Copper	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water) Daily (solids)	±10 ±10	±20 ±20	90 90	10 ug/l (water) 2 mg/kg (solids)	200.7 12 200.7 12
Cyanide (Total)	Distillation with UV/VIS Spectrophotometer	Daily (water) Daily (solids)	±10 ±10	±20 ±20	90 90	20 ug/l (water) 0.50 mg/kg (solids)	335.2 1 9010 3
Dissolved Solids (Total)	Filtration/ Analytical Balance	3 months (water)	±10	-	90	1000 ug/l (water)	160.1 1

See footnotes at end table.

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TABLE 1-1
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION RPD X(a)	TYPICAL ACCURACY X OF RECOVERY	EXPECTED COMPLETENESS	EXPECTED METHOD DETECTION LIMIT(l)	METHOD NO. REFERENCE
Fluoride	pH meter with Specific Ion Electrode	Daily (water)	±10	±20	90	100 ug/l (water)	340.2
		Daily (solids)	±10	±20	90	1 mg/kg (solids)	10-2,340.2
Iron	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	±10	±20	90	100 ug/l (water)	200.7
		Daily (solids)	±10	±20	90	20 mg/kg (solids)	200.7
Iron (Leachable)	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (solids)	±10	±20	90	1 mg/kg (solids)	200.7(u)
Lead	Atomic Absorption Spectrophotometer	Daily (water)	±10	±20	90	5 ug/l (water)	239.1,239.2
		Daily (solids)	±10	±20	90	1 mg/kg (solids)	7420,7421
Lithium	Atomic Absorption Spectrophotometer	Daily (water)	±10	±20	90	100 ug/l (water)	303A
		Daily (solids)	±10	±20	90	2 mg/kg (solids)	303A
Magnesium	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	±10	±20	90	100 ug/l (water)	200.7
		Daily (solids)	±10	±20	90	20 mg/kg (solids)	200.7

See footnotes at end of table.

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TABLE 1-1
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION RPD X (a)	TYPICAL ACCURACY % OF RECOVERY	EXPECTED COMPLETENESS	EXPECTED METHOD DETECTION LIMIT (1)	METHOD NO. REFERENCE
Manganese	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water) Daily (solids)	110 110	120 120	90 90	10 ug/l (water) 2 mg/kg (solids)	200.7 12 200.7 12
Manganese (leachable)	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (solids)	110	120	90	1 mg/kg (solids)	200.7(e) 5,12
Mercury	Atomic Absorption Spectrophotometer	Daily (water) Daily (solids)	110 110	120 120	90 90	0.2 ug/l (water) 0.10 mg/kg (solids)	245.1 1 7471 1
Molybdenum	Atomic Absorption Spectrophotometer	Daily (water) Daily (solids)	110 110	120 120	90 90	10 ug/l (water) 2 mg/kg (solids)	246.1, 246.2 1 246.1, 246.2 1
Nickel	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water) Daily (solids)	110 110	120 120	90 90	30 ug/l (water) 6 mg/kg (solids)	200.7 12 200.7 12
Nitrate	UV/VIS Spectrophotometer	Daily (water) Daily (solids)	110 110	120 120	90 90	100 ug/l (water) 1 mg/kg (solids)	352.1 1 10-2, 352.1 11,1

See footnotes at end of table.

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TABLE 1-1
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION RPD % (s)	TYPICAL ACCURACY % OF RECOVERY	EXPECTED COMPLETENESS	EXPECTED METHOD DETECTION LIMIT(l)	METHOD NO. REFERENCE
Organic Carbon (Total) (TOC)	Total Organic Carbon Analyzer	Daily (water) Daily (solids)	125 125	120 120	90 90	1000 ug/l (water) 1 mg/kg (solids)	415.1 (1)
Organic Halogens (Total) (TOX)	Total Organic Halide Analyzer	Daily (water) Daily (solids)	110 110	120 120	90 90	10 ug/l (water) 0.1 mg/kg (solids)	9020 9020
Organic Nitrogen (Total)	Distillation with UV/VIS Spectrophotometer	Daily (water) Daily (solids)	110 110	120 120	90 90	1.0 mg/l (water) 2 mg/kg (solids)	351.3 351.3
	Specific Ion Meter/ Microprocessor	Daily (water) Daily (solids)	110 110	120 120	90 90	1.0 mg/l (water) 2 mg/kg (solids)	351.3 351.3
pH	pH meter	Daily (water) Daily (solids)	110 110	- -	90 90	0.05 pH unit (water) 0.05 pH unit (solids)	150.1 3.2.2
Phosphorus	UV/VIS Spectrophotometer	Daily (water) Daily (solids)	110 110	120 120	90 90	10 ug/l (water) 100 ug/kg (solids)	365.2 (1)
Potassium	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water) Daily (solids)	110 110	120 120	90 90	100 ug/l (water) 20 mg/kg (solids)	200.7 200.7
Selenium	Atomic Absorption Spectrophotometer	Daily (water) Daily (solids)	110 110	120 120	90 90	5 ug/l (water) 1 mg/kg (solids)	270.2 7740
Silicon	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water) Daily (solids)	110 110	120 120	90 90	100 ug/l (water) 20 mg/kg (solids)	200.7 200.7

See footnotes at end of table.

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TABLE 1-1
 (Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION RPD X(a)	TYPICAL ACCURACY % OF RECOVERY	EXPECTED COMPLETENESS (X)	EXPECTED METHOD DETECTION LIMIT(l)	METHOD NO. REFERENCE
Silver	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	±10	±20	90	10 ug/l (water)	200.7 12
		Daily (solids)	±10	±20	90	2 mg/kg (solids)	200.7 12
Sodium	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	±10	±20	90	100 ug/l (water)	200.7 12
		Daily (solids)	±10	±20	90	20 mg/kg (solids)	200.7 12
Specific Conductance	Conductivity Meter	Daily (water)	±10	-	90	1 umho/cm (water)	120.1 1
		Daily (solids)	±10	-	90	1 umho/cm (solids)	10-2, 120.1 11, 1
Strontium	Atomic Absorption Spectrophotometer	Daily (water)	±10	±20	90	10 ug/l (water)	303A 6
		Daily (solids)	±10	±20	90	2 mg/kg (solids)	303A 6
Sulfate	UV/VIS Spectrophotometer	Daily (water)	±10	±20	90	2000 ug/l (water)	375.4 1
		Daily (solids)	±10	±20	90	10 mg/kg (solids)	3.2.6 2
Sulfide	Buret/Indicator	Daily (water)	±10	±20	90	500 ug/l (water)	376.1 1
		Daily (solids)	±10	±20	90	10 mg/kg (solids)	9030 3
Thallium	Atomic Absorption Spectrophotometer	Daily (water)	±10	±20	90	10 ug/l (water)	279.1, 279.2 1
		Daily (solids)	±10	±20	90	2.0 mg/kg (solids)	7840, 7841 4

See footnotes at end of table.

TABLE 1-1
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION RPD % (a)	TYPICAL ACCURACY % OF RECOVERY	EXPECTED COMPLETENESS	EXPECTED METHOD DETECTION LIMIT (i)	METHOD NO. REFERENCE
Tin	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	50 ug/l (water)	200.7 12
		Daily (solids)	110	120	90	10 mg/kg (solids)	200.7 12
Vanadium	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	50 ug/l (water)	200.7 12
		Daily (solids)	110	120	90	10 mg/kg (solids)	200.7 12
Zinc	Inductively Coupled Argon Plasma Emission Spectrometer	Daily (water)	110	120	90	10 ug/l (water)	200.7 12
		Daily (solids)	110	120	90	2 mg/kg (solids)	200.7 12

(a)RPD = relative percent difference.

(b)Each day samples are analyzed.

(c)The indicated relative percent difference is representative of the corresponding U.S. Environmental Protection Agency (U.S. EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) compounds as a group.

(d)The indicated percent recovery range represents the minimum and maximum acceptable value for the indicated U.S. EPA CLP HSL compounds as a group. However, individual percent recovery ranges have been established for each matrix spike compound. Consult "Chemical Analytical Services for Multi-Media Multi-Concentration Organics, GC/MS Techniques," WA-87-K236, U.S. EPA, Washington, D.C., 1987 for more detailed quality assurance/quality control criteria.

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(Continued)

(c) A method number is not assigned to the iron and manganese leaching procedures cited from the corresponding reference.
 (d) A method number is not assigned to the indicated analytical procedures cited from the corresponding reference.
 (e) $\mu\text{g/l}$ equals micrograms per liter or parts per billion (ppb)
 (f) mg/kg equals milligrams per kilogram or parts per million (ppm).
 (g) Method detection limits may vary with sample matrix.

REFERENCES

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- (5) Filipek, L. H., et al., 1981, "Factors Affecting the Partitioning of Cu, Zn, and Pb in Boulder Coatings and Stream Sediments in the Vicinity of a Polymetallic Sulfide Deposit," Chemical Geology, No. 33, pp. 45-64.
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- (7) Federal Register, October 26, 1984, "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," Appendix A, 40 CFR 136, published in Volume 49, No. 209.
- (8) Oceanographics International Corporation, no date, Operating Procedure Manual for 524B Total Carbon System, College Station, Texas.
- (9) Welsh, L. M. and J. D. Blanton, 1973, "Soil Testing and Plant Analysis," Soil Science Society of America, Madison, Wisconsin.
- (10) U.S. Department of the Interior, 1967, "Methods for Analyzing and Testing Coal and Coke," Bulletin 638, U.S. Bureau of Mines, Washington, D.C.
- (11) American Society of Agronomists, 1982, "Methods of Soil Analysis," Part II, "Chemical and Microbial Properties," A. L. Page, Editor, 9, Madison, Wisconsin.
- (12) U.S. Environmental Protection Agency (EPA), 1987, "Chemical Analytical Services for Multi-Media Multi-Concentration Metals and Inorganics," WA-87-K026, Washington, D.C.

TABLE 1-2

CONTRACT LABORATORY PROGRAM (CLP)
HAZARDOUS SUBSTANCE LIST (HSL) COMPOUND
METHOD REFERENCES AND QUALITY CONTROL OBJECTIVES
FEED MATERIALS PRODUCTION CENTRE
PERMAID, OHIO

PARAFFIN	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	PRECISION		ACCURACY		RECOVERY		ACCURACY		EXPECTED COMPLETENESS %	EXPECTED METHOD DETECTION LIMIT (b)		METHOD NO.	REFERENCE
			Water	Solids	Water	Solids	Water	Solids	Water	Solids		Water	Solids		
Volatiles	Gas Chromatograph/ Mass Spectrometers	Daily									90				
Chloroethane			-	-	-	-	-	-	-	-		10	10	10	
Bromoethane			-	-	-	-	-	-	-	-		10	10	10	
Vinyl Chloride			-	-	-	-	-	-	-	-		10	10	10	
Chloroethane			-	-	-	-	-	-	-	-		5	5	5	
Methylene Chloride			-	-	-	-	-	-	-	-		10	10	10	
Acetone			-	-	-	-	-	-	-	-		5	5	5	
Carbon Disulfide			-	-	-	-	-	-	-	-		5	5	5	
1,1-Dichloroethane			14	22	61-145	59-172	-	-	-	-		5	5	5	
1,1-Dichloroethane			-	-	-	-	-	-	-	-		5	5	5	
trans-1,2-Dichloroethane			-	-	-	-	-	-	-	-		5	5	5	
Chloroform			-	-	-	-	-	-	-	-		5	5	5	
1,2-Dichloroethane			-	-	-	-	-	-	-	-		5	5	5	
2-Butanone			-	-	-	-	-	-	-	-		10	10	10	
1,1,1-Trichloroethane			-	-	-	-	-	-	-	-		5	5	5	
Carbon Tetrachloride			-	-	-	-	-	-	-	-		5	5	5	
Vinyl Acetate			-	-	-	-	-	-	-	-		10	10	10	
Bromochloroethane			-	-	-	-	-	-	-	-		5	5	5	
1,1,2,2-Tetrachloroethane			-	-	-	-	-	-	-	-		5	5	5	
1,2-Dichloropropane			-	-	-	-	-	-	-	-		5	5	5	
trans-1,3-Dichloropropane			-	-	-	-	-	-	-	-		5	5	5	
Trichloroethane			14	24	71-120	62-137	-	-	-	-		5	5	5	
Bromochloroethane			-	-	-	-	-	-	-	-		5	5	5	
1,1,2-Trichloroethane			-	-	-	-	-	-	-	-		5	5	5	
Benzene			11	21	76-127	66-142	-	-	-	-		5	5	5	
cis-1,3-Dichloropropene			-	-	-	-	-	-	-	-		5	5	5	

Volatiles

Exhibit D

See footnotes at end of table.

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TABLE 1-2
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	MATRIX SPIKE		SURROGATE SPIKE		EXPECTED COMPLETENESS %	EXPECTED METHOD DEFLECTION LIMITS(%)		METHOD NO.	REFERENCE
			PREDICTION AFUP(m)	ACCURACY % OF RECOVERY	ACCURACY % OF RECOVERY	Water		Solids	Water		
<u>Volatiles</u>											
(Continued):											
2-Chloroethyl Vinyl Ether			-	-	-	-	-	10	10		
Bromoform			-	-	-	-	-	5	5		
2-Hexene			-	-	-	-	-	10	10		
4-Vinyl-2-pentene			-	-	-	-	-	10	10		
Tetrachloroethane			-	-	-	-	-	5	5		
Toluene			17	26-125	59-119	-	-	5	5		
Chlorobenzene			18	25-130	60-131	-	-	5	5		
Ethylbenzene			-	-	-	-	-	5	5		
Styrene			-	-	-	-	-	5	5		
Total Xylene			-	-	-	-	-	5	5		
<u>Semi-volatile Compounds:</u>											
Toluene-d ₃			-	-	-	88-110	81-117	-	-		
p-Bromofluorobenzene			-	-	-	86-115	76-121	-	-		
1,2-Dichloroethane-d ₂			-	-	-	76-116	70-121	-	-		
<u>Acid/Misc-Neutral Extractables</u>											
Methanol		Daily	42	35	11-89	26-90	-	10	10		
Mix (2-Chloroethyl)ether			-	-	-	-	-	10	10		
2-Chlorophenol			40	50	27-123	25-102	-	10	10		
1,3-Dichlorobenzene			-	-	-	-	-	10	10		
1,4-Dichlorobenzene			28	27	36-97	28-106	-	10	10		
Methyl Alcohol			-	-	-	-	-	10	10		
1,2-Dichloroethane			-	-	-	-	-	10	10		
2-Methylphenol			-	-	-	-	-	10	10		
Mix (2-chloroisopropyl) ether			-	-	-	-	-	10	10		
4-Methylphenol			18	38	41-116	41-126	-	10	10		
N-Nitroso-d-n-propylamine			-	-	-	-	-	10	10		
Hexachlorocyclopentadiene			-	-	-	-	-	10	10		
Dibenzene			-	-	-	-	-	10	10		

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TABLE 1-2
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHANGES	PRECISION RPD (%)		MATRIX SPIKE		ACCURACY % OF RECOVERY		SINKGATE SPIKE		EXPECTED COMPLETENESS %	EXPECTED METHOD DEFLECTION LIMIT (b)		METHOD NO.	REFERENCE
			Water	Solids	Water	Solids	Water	Solids	Water	Solids		Water	Solids		
Ald/Minu-Mutual Fairchild (Continued)															
2-Nitrophenol			-	-	-	-	-	-	-	-		10	330		
2,4-Dinitrophenol			-	-	-	-	-	-	-	-		10	330		
Benzoic Acid			-	-	-	-	-	-	-	-		50	1600		
Mis(2-chloroethoxy)ethane			-	-	-	-	-	-	-	-		10	330		
2,4-Dichlorophenol			-	-	-	-	-	-	-	-		10	330		
1,2,4-Trichlorobenzene			28	23	39-98	38-107	-	-	-	-		10	330		
Halophthalene			-	-	-	-	-	-	-	-		10	330		
4-Chloroaniline			-	-	-	-	-	-	-	-		10	330		
Hexachlorobutadiene			42	33	23-97	26-103	-	-	-	-		10	330		
4-Chloro-3-methylphenol			-	-	-	-	-	-	-	-		10	330		
2-Methylnaphthalene			-	-	-	-	-	-	-	-		10	330		
Hexachlorocyclopentadiene			-	-	-	-	-	-	-	-		10	330		
2,4,6-Trichlorophenol			-	-	-	-	-	-	-	-		50	1600		
2,4,5-Trichlorophenol			-	-	-	-	-	-	-	-		10	330		
2-Chloronaphthalene			-	-	-	-	-	-	-	-		50	1600		
2-Nitroaniline			-	-	-	-	-	-	-	-		10	330		
Diethyl phthalate			31	19	46-118	31-137	-	-	-	-		10	330		
Acenaphthylene			-	-	-	-	-	-	-	-		50	1600		
3-Nitroaniline			-	-	-	-	-	-	-	-		10	330		
Acenaphthene			-	-	-	-	-	-	-	-		50	1600		
2,4-Dinitrophenol			50	50	10-80	11-116	-	-	-	-		50	1600		
4-Nitrophenol			-	-	-	-	-	-	-	-		10	330		
Dioxinifer			-	-	-	-	-	-	-	-		50	1600		
2,4-Dinitrotoluene			38	47	24-96	28-89	-	-	-	-		10	330		
2,6-Dinitrotoluene			-	-	-	-	-	-	-	-		10	330		
Diethyl phthalate			-	-	-	-	-	-	-	-		10	330		
4-Chlorophenyl Phenyl Ether			-	-	-	-	-	-	-	-		10	330		
Fluorene			-	-	-	-	-	-	-	-		50	1600		
4-Nitroaniline			-	-	-	-	-	-	-	-		50	1600		
4,6-Dinitro-2-methylphenol			-	-	-	-	-	-	-	-		10	330		
N-Dinitrophenylamine			-	-	-	-	-	-	-	-		10	330		
4-acenaphthyl Phenyl Ether			-	-	-	-	-	-	-	-		10	330		
Hexachlorobenzene			-	-	-	-	-	-	-	-		50	1600		
Hexachlorophenol			50	47	9-103	17-109	-	-	-	-		10	330		
Fluoranthrene			-	-	-	-	-	-	-	-		10	330		

See footnotes at end of table.

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TABLE 1-2
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	MATRIX SPIKE		SURROGATE SPIKE		EXPECTED COMPLETENESS %	EXPECTED METHOD DEFLECTION LIMIT (b) $\mu\text{g/l(c)}$ $\mu\text{g/kg(d)}$		METHOD NO.	REFERENCE
			Precision $\mu\text{g/l(c)}$	Accuracy % of Recovery	Accuracy % of Recovery	Accuracy % of Recovery					
			Water	Solids	Water	Solids					
<u>Acid/Basic/Neutral Extractables (Total found)</u>											
Anthracene			40	47	11-117	29-135	-	10	330		
Di-n-butyl phthalate			-	-	-	-	-	10	330		
Fluoranthene			31	36	26-127	35-162	-	10	330		
Pyrene			-	-	-	-	-	10	330		
Butyl Benzyl Phthalate			-	-	-	-	-	20	660		
3,3'-Dichlorobenzidine			-	-	-	-	-	10	330		
Benz(a)anthracene			-	-	-	-	-	10	330		
Benzo(a, h, i)perylene			-	-	-	-	-	10	330		
Carbazole			-	-	-	-	-	10	330		
Di-n-octyl phthalate			-	-	-	-	-	10	330		
Benzo(b)fluoranthene			-	-	-	-	-	10	330		
Benzo(a)pyrene			-	-	-	-	-	10	330		
Indeno(1,2,3-cd)pyrene			-	-	-	-	-	10	330		
Benzo(a, h)anthracene			-	-	-	-	-	10	330		
Benzo(a, h, i)perylene			-	-	-	-	-	10	330		
<u>SURROGATE COMPOUNDS:</u>											
Chlorobenzene-d5			-	-	-	35-114	23-120	-	-		
2-riuroolophenyl			-	-	-	41-116	30-115	-	-		
p-terphenyl-d14			-	-	-	31-141	18-137	-	-		
Phenol-d5			-	-	-	10-94	24-113	-	-		
2-Phenophenol			-	-	-	21-100	25-121	-	-		
2,6,6-trifluorophenol			-	-	-	10-123	19-122	-	-		
<u>Particle Size/Polychlorinated Biphenyls</u>											
alpha-BHC			-	-	-	-	-	0.05	8.0		
beta-BHC			-	-	-	-	-	0.05	8.0		
gamma-BHC			-	-	-	-	-	0.05	8.0		
hexachlorocyclopentadiene			15	50	56-123	46-127	-	0.05	8.0		
hexachlorocyclopentadiene			20	31	40-111	35-130	-	0.05	8.0		
hexachlorocyclopentadiene			22	43	40-120	34-132	-	0.05	8.0		

Daily

Use Chromatographic

Particle Size/Polychlorinated

Biphenyls

Two footnotes at end of table.

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TABLE 1-2
(Continued)

PARAMETER	INSURANCE	FREQUENCY OF CALIBRATION CHECKS	PRECISION RPD(a)		ACCURACY % OF RECOVERY		SURROGATE SPIKE		EXPECTED COMPLETENESS %	EXPECTED METHOD DETECTION LIMIT (b)		METHOD NO.	REFERENCE
			Water	Solids	Water	Solids	Water	Solids		Water	Solids		
<u>Pesticides/Polychlorinated biphenyls (Continued)</u>													
diopachlor Epoxide	-	-	-	-	-	-	-	-	-	0.05	0.0	-	-
Endosulfan I	-	-	-	-	-	-	-	-	-	0.05	0.0	-	-
Malathion	18	38	32-126	11-136	-	-	-	-	-	0.10	16.0	-	-
4,4'-DDE	-	-	-	-	-	-	-	-	-	0.10	16.0	-	-
Endrin	21	45	50-121	42-139	-	-	-	-	-	0.10	16.0	-	-
Endosulfan II	-	-	-	-	-	-	-	-	-	0.10	16.0	-	-
4,4'-DDD	-	-	-	-	-	-	-	-	-	0.10	16.0	-	-
Endosulfan Sulfate	-	-	-	-	-	-	-	-	-	0.10	16.0	-	-
4,4'-DDT	27	50	38-127	23-136	-	-	-	-	-	0.10	16.0	-	-
Endrin Ketone	-	-	-	-	-	-	-	-	-	0.5	80.0	-	-
Chlorpyrifos	-	-	-	-	-	-	-	-	-	0.5	80.0	-	-
Chlordane	-	-	-	-	-	-	-	-	-	1.0	160.0	-	-
Endrinone	-	-	-	-	-	-	-	-	-	0.5	80.0	-	-
Acroclor 1016	-	-	-	-	-	-	-	-	-	0.5	80.0	-	-
Acroclor 1221	-	-	-	-	-	-	-	-	-	0.5	80.0	-	-
Acroclor 1212	-	-	-	-	-	-	-	-	-	0.5	80.0	-	-
Acroclor 1242	-	-	-	-	-	-	-	-	-	0.5	80.0	-	-
Acroclor 1248	-	-	-	-	-	-	-	-	-	0.5	80.0	-	-
Acroclor 1254	-	-	-	-	-	-	-	-	-	1.0	160.0	-	-
Acroclor 1260	-	-	-	-	-	-	-	-	-	1.0	160.0	-	-

SURROGATE COMPOUNDS

Dibenzylideneacetone

(a)RPD equals relative percent difference.

(b)The indicated detection limits are appropriate to low level water and solids samples. Medium water Contract Detection Limits (CDL) for Volatile, Acid/Base-Neutral Extractable, and Pesticide HSL compounds are 100 times the individual low water CDL. Medium solids CDLs for Volatile, Acid/Base-Neutral Extractable, and Pesticide HSL compounds are 100, 100, and 15 times individual low solid CDL, respectively.

(c)ng/l equals micrograms per liter or parts per billion (ppb).

(d)ng/kg equals micrograms per kilogram or parts per billion (ppb).

(e)The indicated surrogate yields percent recovery limits are for advisory purposes only. These limits are not used to determine whether a sample should be reanalyzed.

REFERENCES

(1)U.S. Environmental Protection Agency (EPA), 1987, "Chemical Analytical Services for Multi-Media, Multi-Concentration Organics, U/MS Techniques," EPA-87-226, Washington, D.C.

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TABLE 1-3

LABORATORY RADIOLOGICAL TESTING
QUALITY CONTROL PERFORMANCE SUMMARY
FEND MATERIALS PRODUCTION CENTER
VERMILION, OHIO

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	PRECISION ± MSd (a)	TYPICAL ACCURACY ± MSd (b)	COMPLETENESS (%)	EXPECTED METHOD DETECTION LIMIT (c)	METHOD NO.	REFERENCE
Gross Alpha	Tennelec low Background Alpha/Beta Counting System	Daily (c)	±20	±30	90	1.0 pCi/l (l/h) (water)	MSL-308	1
	or							
	Ludlum Scaler Scintillation Counters Models 1000, 2000, and 2200	Daily	±20	±30	90			
Gross Beta	Tennelec low Background Alpha/Beta Counting System	Daily	±20	±30	90	4.0 pCi/l (h) (water)	MSL-308	1
Radium-226	Alpha Spectrometer	Daily	±20	±30	90	1.0 pCi/l (water) 300 pCi/kg (solid)	MSL-309 MSL-201, MSL-309	2, 3, 4, 5 2, 3, 4, 5
	and/or							
	Nuclear Data Computer Based Gamma Spectrometer Model M9900 (Data System Only)	NA	NA (d)	NA	NA			
Radium-223	Tennelec low Background Alpha/Beta Counting System	Daily	±20	±30	90	3.0 pCi/l (water) 500 pCi/kg (solid)	MSL-309 MSL-201, MSL-309	2, 3, 4, 5 2, 3, 4, 5
Strontium-90	Tennelec low Background Alpha/Beta Counting System	Daily	±20	±30	90	5 pCi/l (water) 500 pCi/kg (solid)	MSL-305 MSL-201, MSL-305	6, 7, 8 6, 7, 8
Technetium-99	Packard Liquid Scintillation Spectrometer	Daily	±20	±30	90	30 pCi/l (water) 900 pCi/kg (solid)	MSL-310 MSL-201, MSL-310	9 9
Barium, Isotopic	Alpha Spectrometer	Daily	±20	±30	90	1.0 pCi/l (water) 600 pCi/kg (solid)	MSL-304 MSL-201, MSL-304	2, 3, 4, 5 2, 3, 4, 5
	and							
	Nuclear Data Computer Based Gamma Spectrometer Model M9900 (Data System Only)	NA	NA	NA	NA			

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See footnotes at end of table.

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TABLE 1-3
 (Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION $\pm$ RSD(a)	TYPICAL ACCURACY $\pm$ Bias(b)	COMPLETENESS (%)	EXPECTED METHOD DETECTION LIMIT(c)	METHOD NO.	REFERENCE
Radium, Isotopic Uranium, Total	Alpha Spectrometer	Daily	± 20	± 10	90	1.0 pCi/l (water) 600 pCi/kg (solid)	MSL-304	2, 3, 4, 5
	and Nuclear Data Computer Based Gamma Spectrometer Model MD9900 (Data System Only)	NA	NA	NA	NA	1.0 pCi/l (water) 600 pCi/kg (solid)	MSL-201, MSL-304	2, 3, 4, 5
Plutonium, Isotopic	Alpha Spectrometer	Daily	± 20	± 10	90	1.0 pCi/l (water) 600 pCi/kg (solid)	MSL-304	2, 3, 4, 5
	and Nuclear Data Computer Based Gamma Spectrometer Model MD9900 (Data System Only)	NA	NA	NA	NA	1.0 pCi/l (water) 600 pCi/kg (solid)	MSL-201, MSL-304	2, 3, 4, 5
Neptunium-237	Alpha Spectrometer	Daily	± 20	± 10	90	1.0 pCi/l (water) 600 pCi/kg (solid)	MSL-304	2, 3, 4, 5
	and Nuclear Data Computer Based Gamma Spectrometer Model MD9900 (Data System Only)	NA	NA	NA	NA	1.0 pCi/l (water) 600 pCi/kg (solid)	MSL-201, MSL-304	2, 3, 4, 5
Cesium-137 Gross Spec	Intrinsic Germanium Detectors	Daily	± 20	± 10	90	20 pCi/l (water) 200 pCi/kg (solid)	MSL-201, MSL-112 MSL-201, MSL-112	1
	and Nuclear Data Computer Based Gamma Spectrometer Model MD9900 (Data System Only)	NA	NA	NA	NA			

See footnotes at end of table.

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TABLE 1-3
(Continued)

PARAMETER	INSTRUMENT	FREQUENCY OF CALIBRATION CHECKS	TYPICAL PRECISION ± MSD(a)	TYPICAL ACCURACY ± MSD(b)	COMPLETENESS (c)	EXPECTED METHOD DETECTION LIMIT(d)	METHOD NO.	REFERENCE
Anthracene-10b	Intrinsic Gravitimetric Detector	daily	±20	±10	90	150 pCi/l (water) 1 nCi/kg (solids)	MSL-201, MSL-112 MSL-201, MSL-112	1 1
	and							
	Nuclear Data Computer Based Gamma Spectrometer Model MDS900 (Data System Unit)	NA	10A	NA	NA			

(a) Precision is expressed as the percent relative standard deviation of the corresponding method.

(b) Accuracy is expressed as the percent bias of the analyzed versus actual spike concentration for the indicated method.

(c) Each day samples are analyzed.

(d) The indicated instrument is a system used for data acquisition and reduction. Therefore, analytical definitions of method precision and accuracy are not applicable.

(e) The indicated method detection limits (MDLs) represent the 95 percent confidence limit for false detection and false rejection discrimination.

(f) pCi/l = picocuries per liter.

(g) pCi/kg = picocuries per kilogram.

(h) For sample with solids <200 ppm.

REFERENCES

- (1) Kreyler, H. L. and E. L. Whitteker, August 1980, "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032, U.S. Environmental Protection Agency (U.S. EPA).
- (2) Adams, R. A. and G. E. Moore, 1953, "The Separation of Pu (V) and Pu (III) with HCl Mixture," Journal of American Chemical Society 77, p. 1383.
- (3) Fish, Leon, March 1959, "Quantitative Radiochemical Analysis by Ion Exchange," Analytical Chemistry 31, pp. 346-349.
- (4) Campbell, E. E. and W. H. Rose, October 10-11, 1963, "Determination of Plutonium in Urine by Ion Exchange," Proceedings of the Ninth Annual Conference on Bioassay and Analytical Chemistry, San Diego, Cal.
- (5) Huntley, L. C., May 1978, Radiochemical Procedures of the Industrial Safety and Applied Health Physics Division, Oak Ridge National Laboratory, ORNL/IN-6372.
- (6) Jones, R. M., M. E. Mallon, and L. E. Connelin, June 1963, IN-2813, pp. 21-26.
- (7) Switt, E. H., 1960, A System of Chemical Analysis, Prentice-Hall, New York, p. 376.
- (8) Willard, H. H. and G. M. Woodhead, 1976, "Separation of Barium, Radium, and Lead from Calcium and Other Metals," Ind. Eng. Chem., Anal. Ed., 48, p. 414.
- (9) Anderson, Edward, November 1960, The Radiochemistry of Barium, National Academy of Sciences - National Research Council.

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1.2 Sample Matrix

The QA objectives for sample data will be verified using field and laboratory QC samples. The sample groups, measurement parameter, number of samples per parameter, and field and laboratory QC sample number are presented as a sample matrix in Table 1-4.

TABLE 1-4
SAMPLE MATRIX

SAMPLE GROUP	MEASUREMENT PARAMETER ^a	NUMBER OF SAMPLES	QC SAMPLES (% OF TOTAL)	
			FIELD (15%)	LAB (10%)
Biological	Org./Inorg.	10	2	1
Biological	Radiological (Rad)	121	18	12
Ground Water	Extended HSL	37	6	4
Ground Water	Dioxins	7	1	1
Ground Water	RCRA	628	95	63
Ground Water	Rad	628	95	63
Sediment	Grain Size	15	0	2
Sediment	Extended HSL	17	3	2
Sediment	Rad Full	39	6	4
Sediment	Rad Limited	38	6	4
Subsurface Soil	Geochemical	35	6	4
Subsurface Soil	Geotechnical	20	0	2
Subsurface Soil	HSL Org./Inorg.	30	5	3
Subsurface Soil	Rad	118	18	12
Surface Soil	Extended HSL	10	2	1
Surface Soil	Rad	281	42	28
Surface Soil	Rad Limited	84	13	9
Surface Water	H ₂ O General	49	8	5
Surface Water	Extended HSL	7	2	1
Surface Water	Rad Full	45	7	5
Surface Water	Rad Limited	55	9	6
Urinalysis	Isotopic Uranium	90	0	9

^aParameters are defined in the Sampling Plan.

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1.3 Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness

As part of the analytical QC program, the laboratory will apply the precision and accuracy criteria specified in the U.S. EPA CLP protocols previously cited for each parameter that is analyzed. When the analysis of a sample set is completed, the QC data generated are reviewed and evaluated to validate the data set. The review is based on the following criteria:

- o Reagent/Method Blank Evaluation - The reagent and/or method blank results are evaluated for high readings characteristic of background contamination. If high blank values are observed, laboratory glassware and reagents should be checked for contamination, and the analysis of future samples should be halted until the system can be brought under control. A high background is defined as a background value sufficient enough to result in a difference in the sample values, which, if not corrected, is greater than or equal to the smallest significant digit known to be true. A method blank should contain no greater than two times the parameter detection limit for most parameters.^{1,2,3,4,5}
- o Field and Trip Blank Evaluation - Field and trip blank results are evaluated for high readings similar to the reagent and/or method blanks described above. If high field blank readings are encountered (i.e., a value sufficient enough to result in a difference in the sample values, which, if not corrected, is greater than or equal to the

¹Criteria are referenced as applicable to volatile organic compounds.

²Criteria are referenced as applicable to base-neutral and acid extractable organic compounds (including pesticides and PCBs).

³Criteria are referenced as applicable to metals.

⁴Criteria are referenced as applicable to wet chemistry (e.g., cyanide, fluoride, and nitrate).

⁵Criteria are referenced as applicable to radiological.

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smallest significant digit known to be true), the procedure for sample collection, shipment, and laboratory analysis should be reviewed. If both the reagent and/or method blanks and the field blanks exhibit significant background contamination, the source of contamination is probably within the laboratory. Ambient air in the laboratory and reagents should be checked as possible sources of contamination. High field blank readings may also be due to contaminated sample bottles or cross-contamination due to sample leakage and poorly-sealed sample containers.^{1,5}

- o Standard Calibration Curve and Response Factor Evaluation - The calibration curve or midpoint calibration standard (check standard) is evaluated daily to determine curve linearity through its full range and that sample values are within the range defined by the low and high standards. If the curve is not linear, sample values must be corrected for nonlinearity by deriving sample concentrations from a graph or by using an appropriate algorithm to find a nonlinear curve to fit the standards. In addition, if average response factors are used to calculate sample concentrations, these factors will be verified on a daily basis. Verification of calibration curves and response factors is accomplished when the evaluated response for any parameter varies from the calibrated response by less than ranges given in the applicable test methods listed in the U.S. EPA CLP protocols.^{1,2,3,4}
- o Duplicate Sample Evaluation - Duplicate sample analysis is used to determine the precision of the analytical method for the sample matrix. The duplicate results are used to calculate the precision as defined by the RPD. If the precision value exceeds the control limit, the sample set must be reanalyzed for the parameter in question. Precision limits will be updated periodically following review of the data. Typical values of precision are given in Tables 1-1 through 1-3.
- o QC Check Standard Evaluation - The results of QC check standard analysis are compared with the true values, and the percent recovery of the check standard is calculated. If correction is required (excessive or inadequate percent recovery), the

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check standard should be reanalyzed to demonstrate that the corrective action has been successful.^{1,2,3,4}

- o Surrogate Standard Analyses - Surrogate standard determinations should be performed on all samples and blanks for GC/MS analyses. All samples and blanks are fortified with surrogate spiking compounds before purging or extraction to monitor preparation and analysis of samples. Recoveries should meet U.S. EPA CLP acceptance criteria as presented in Table 1-2. If acceptance criteria are not met, corrective action is taken to correct the problem and the affected sample is reanalyzed.^{1,2}
- o Matrix Spike/Matrix Spike Duplicate Evaluation- The observed recovery of the spike versus the theoretical spike recovery is used to calculate accuracy as defined by the percent recovery. If the accuracy value exceeds the control limit for the given parameter (Tables 1-1 through 1-3), the appropriate laboratory personnel are notified and corrective action is taken before the sample set is reanalyzed for the parameter in question. The RPD between duplicate matrix spikes is also assessed to evaluate the precision of volatile, acid/base-neutral extractable, and pesticide/PCB analyses. The acceptance criteria in Table 1-2 must be achieved or corrective action must be taken before the affected samples are reanalyzed.^{1,2,3,4}

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ATTACHMENT 2

2.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

Internal QC checks are performed to verify the resulting quality of the measurement tasks of the field and laboratory investigation and associated tasks.

2.1 Training

The WMCO personnel working on the K-65 sampling project will be properly trained, qualified individuals. Prior to commencement of field work, the field personnel will be given instructions specific to the K-65 sampling project, covering the following areas:

- o Organization and lines of communication and authority;
- o Description of the work areas;
- o Overview of the Implementation Plan;
- o Documentation requirements;
- o Documentation of recurring training;
- o Decontamination procedures;
- o Emergency procedures; and
- o Sampling methods for the procedures that field personnel are authorized to perform.

Training of field personnel will be provided by the task manager or a qualified designee. Documentation of training will be recorded.

2.2 Procurement/Control of Subcontractors

Controls identified as necessary for subcontractor procurement and furnishing quality-related items and/or services will be based on the effect an item or service will have on project results.

The responsibility for quality compliance will be delegated to a subcontractor in the procurement documents, provided that the subcontractor has

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documented an acceptable QA program. If a subcontractor does not have such a program, WMC0 will use the procurement documents to 'pass down' the performance of specific quality requirements. The 'pass down' provides that appropriate requirements can be met without asking the subcontractors to have their own individual QA programs. If necessary, prequalification audits may be performed by QA personnel to determine subcontractor acceptability.

To verify subcontractor conformance to project quality requirements, WMC0 (or designee) will, as necessary, perform field inspections, review subcontractor-prepared documentation, and perform audits of subcontractor activities. Subcontractors will provide access to their work areas and records for inspection and auditing.

For field operations, WMC0 (or designee) project personnel will perform an inspection of each subcontractor prior to starting work. The intention of this check is to verify that the subcontractor has fulfilled the requirements necessary to perform the activities. The inspection will include the type and condition of equipment, calibration of equipment, and qualifications of personnel. If requirements are not met, sufficient grounds for suspension of activities exist. Equipment that does not meet project requirements will not be used without repair or replacement to the satisfaction of the site manager.

2.3 Quality Assurance Review of Reports, Plans, and Specifications

Prior to the issuance of a final report, it will be reviewed by members of the K-65 Sampling Team and the task manager or designated representative.

2.4 Quality Control Checks and Procedures

This section describes the QC operations that must be performed to satisfy the analytical requirements of the contract. All QC operations must be performed in accordance with the following procedures for inorganic and organic parameters, respectively:

- o U.S. Environmental Protection Agency, 1985, "Chemical Analytical Services for Multi-Media Multi-Concentration Metals and Inorganics," WA-87-K026, Washington, D.C.

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- o U.S. Environmental Protection Agency, 1985, "Chemical Analytical Services for Multi-Media Multi-Concentration Organics, GC/MS Techniques," WA-87-K236, Washington, D.C.

2.4.1 Inorganic Quality Control

QC procedures have already been described with the appropriate analytical procedures in Attachment 9. The purpose of this section is to augment those QC procedures and to summarize the minimum QC requirements for inorganic analysis.

Accordingly, the following QC operations must be performed:

- o Initial calibration;
- o Initial calibration verification (QC sample);
- o Continuing calibration verification;
- o Calibration blank;
- o Preparation (method) blank analysis;
- o ICP interference check sample analysis;
- o ICP serial dilution analysis;
- o Matrix spike analysis;
- o Duplicate sample analysis;
- o Graphite furnace atomic absorption spectrophotometry QC analysis (Method of Standard Additions may be required under conditions);
- o Method of Standard Additions; and
- o Laboratory QC sample analysis (performance evaluation samples).

2.4.1.1 Initial Calibration

For atomic absorption systems, calibration standards are prepared by diluting the stock metal solutions at the time of analysis. Calibration standards must be

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prepared fresh each time an analysis is to be made and discarded after use. Prepare a blank and at least three calibration standards in graduated amounts in the appropriate range. One atomic absorption calibration standard must be at the contract-required detection limit, except for mercury. The calibration standards must be prepared using the same type of acid or combination of acids and the same concentration that will result in the samples following sample preparation. Beginning with the blank and working toward the highest standards, aspirate or inject the solutions and record the readings. Calibration standards for furnace procedures should be prepared as described in the individual methods for that metal.

For cyanide and mercury, follow the calibration procedures outlined in Attachment 9. One cyanide calibration standard must be at the contract-required detection limit. For ICP systems, calibrate the instrument according to instrument manufacturer's recommended procedures.

2.4.1.2 Initial Calibration Verification (Quality Control Sample)

After the ICP, atomic absorption, and cyanide systems have been calibrated, the accuracy of the initial calibration will be verified and documented for every analyte by the analysis of U.S. EPA initial calibration verification solution. The initial calibration verification solution or QC sample is a solution obtained from an outside source having known concentration values to be used to verify the calibration standards.

The initial calibration verification standard must be run at each wavelength used for analysis.

If the initial calibration verification solution is not available from U.S. EPA, or where a certified solution of an analyte is not available from any source, analyses will be conducted on an independent standard at a concentration other than that used for calibration, but within the calibration range. An independent standard is defined as a standard composed of the analytes from a different source than those used in the standard for the initial calibration. For ICP, the initial calibration verification solution must be run at each wavelength used in the analysis of the sample. When measurements

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exceed the control limits, the analysis must be terminated, the problem corrected, the instrument recalibrated, and the calibration reverified.

The values for the initial and subsequent continuing calibration verifications shall be recorded on Form II (Appendix A) for ICP, atomic absorption, and cyanide analyses, as indicated. Hexavalent chromium, nitrate, and fluoride analyses will follow the same requirements as cyanide.

2.4.1.3 Continuing Calibration Verification

To provide calibration accuracy during each analysis run, one of the following standards is to be used for continuing calibration verification and must be analyzed for each analyte at a frequency of 10 percent or every two hours during an analysis run, whichever is more frequent. The standard must also be analyzed for each analyte at the beginning of the run and after the last analytical sample. The analyte concentrations in the continuing calibration standard must be one of the following solutions at or near the mid-range levels of the calibration curve:

- o U.S. EPA solutions;
- o NBS Standard Reference Material 1643a; and
- o A laboratory-prepared standard solution. This solution must be from an outside source other than one used to prepare the calibration standards.

The following initial and continuing calibration verification control limits must be met before analysis can proceed.

<u>Analytical Method</u>	<u>Inorganic Species</u>	<u>Percent of True Value</u>
ICP/AA	Metals	90-110
Cold Vapor AA	Mercury	80-120
Other Parameters	i.e., cyanide	85-115

The same calibration standard must be used throughout the analysis runs for a case of samples received.

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If the deviation of the continuing calibration verification is greater than the control limits specified above, the instrument must be recalibrated and the preceding 10 samples are analyzed for the analytes affected. Information regarding the continuing verification of calibration will be recorded on Form II (Appendix A) for ICP, atomic absorption, and cyanide as indicated. Hexavalent chromium, nitrate, and fluoride follow the same requirements as cyanide.

2.4.1.4 Calibration Blank

A calibration blank (zero standard) is analyzed each time the instrument is calibrated, at the beginning and the end of the run, and at a frequency of 10 percent during the run. The results for the calibration blank solution will be recorded on Form III (Appendix A) for ICP, atomic absorption, and cyanide analyses, as indicated. Hexavalent chromium, nitrate, and fluoride analyses will follow the same requirements as cyanide. Blanks are to be reported down to the instrument detection limit. If this blank result is greater than the contract-required detection limit (Table 1-1), terminate analysis, correct the problem, and recalibrate.

2.4.1.5 Preparation (Method) Blank Analysis

At least one preparation blank (or method blank) consisting of deionized distilled water processed through each sample preparation procedure (i.e., water, solids) must be prepared and analyzed with every 20 samples received or with each batch of samples digested, whichever is more frequent. Each data package must contain the results of all of the preparation blank analyses associated with the samples.

This blank is to be reported for each sample set and used in all analyses to ascertain whether or not sample concentrations reflect contamination in the following manner:

- o If the concentration of the blank is less than or equal to the contract-required detection level (Table 1-1), no correction of sample results is performed.

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- o If the concentration of the blank is above the contract-required detection level for any group of samples associated with a particular blank, the concentration of the sample with the least concentrated analyte must be 10 times the blank concentration; all samples associated with the blank and less than 10 times the blank concentration must be redigested and reanalyzed, with the exception of an identified aqueous-soil field blank. The sample value is not to be corrected for the blank value.

The values for the preparation blank will be recorded in ug/l on Form III (Appendix A) for ICP, atomic absorption, and cyanide analyses, as indicated. Hexavalent chromium, nitrate, and fluoride analyses will follow the same requirements as cyanide.

2.4.1.6 ICP Interference Check Sample Analysis

To verify interelement and background correction factors, the IT laboratory must analyze and report the results for an ICP interference check sample at the beginning and end of each sample analysis run (or a minimum of twice per eight-hour working shift, whichever is most frequent). The ICP interference check sample must be obtained from the U.S. EPA, if available. Results for the check sample analysis during the analytical runs must fall within the control limit of ± 20 percent of the true value for the analytes included in the interference check sample. If not, terminate the analysis, correct the problem, recalibrate, reverify the calibration, and reanalyze the samples. If the ICP interference check sample is not available from the U.S. EPA, an independent ICP check sample must be prepared with interferant and analyte concentrations at the levels specified in the previously referenced U.S. EPA CLP protocol. The mean value and standard deviation must be established by initially analyzing the check sample at least five times repetitively for each parameter on Form IV (Appendix A). Results must fall within the control limit of ± 20 percent of the established mean value.

Results of all interference check sample analyses for all ICP parameters must be recorded on Form IV (Appendix A).

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2.4.1.7 ICP Serial Dilution Analysis

Prior to reporting concentration data for the analyte elements, the IT laboratory must analyze and report the results of the ICP serial dilution analysis. The ICP serial dilution analysis must be performed on each group of samples of a similar matrix type (i.e., water, soil) and concentration (i.e., low, medium) for each set of samples, or for each 20 samples received, whichever is more frequent. Samples identified as field blanks cannot be used for serial dilution analysis. If the analyte concentration is sufficiently high (minimally a factor of 10 above the instrumental detection limit after dilution), an analysis of a 1:4 dilution must agree within 10 percent of the original determination. If the dilution analysis is not within 10 percent, a chemical or physical interference effect should be suspected, and the data should be flagged with an "E". Serial dilution results must be reported on QC Report Form IX (Appendix A).

2.4.1.8 Matrix Spike Analysis

The spiked sample analysis is designed to provide information about the effect of the sample matrix on the digestion and measurement methodology. The spike is added before the digestion and prior to any distillation steps (i.e., CN). At least one spiked sample analysis must be performed on each group of samples of a similar matrix type (i.e., water, soil) and concentration (i.e., low, medium) for each set of samples or for each 20 samples received, whichever is more frequent. Samples identified as field blanks cannot be used for spiked sample analysis. The analyte spike must be added in the amount given in the U.S. EPA CLP protocol for each element analyzed. If two analytical methods are used to obtain the reported values for the same element for a set of samples (i.e., ICP, atomic absorption), spike samples must be run by each method used. If the spike recovery is not within the limits of 75 to 125 percent, the data of all samples received associated with that spiked sample must be flagged with the letter, "N". An exception to this rule is granted in situations where the sample concentration exceeds the spike concentration by a factor of four or more. In such a case, the spike recovery should not be considered and the data will be reported unflagged even if the percent recovery does not meet the 75 to 125 percent recovery criteria. In the instance where there is more than one spiked sample per

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matrix per sample set, if one spike sample recovery is not within contract criteria, flag all of the samples of the same matrix in the set. Individual component percent recoveries are calculated using the following equation from the CLP methods in WA-87-K026.

$$\text{Percent Recovery} = \frac{(\text{SSR} - \text{SR})}{\text{SA}} \times 100$$

Where:

SSR = Spiked Sample Result
 SR = Sample Result
 SA = Spike Added

When the sample concentration is less than the instrument detection limit, use SR=0 for purposes of calculating the percent recovery. The spiked sample results must be reported on Form V (Appendix A) for ICP, atomic absorption, and cyanide analyses, as indicated. Hexavalent chromium, nitrate, and fluoride analyses will follow the same requirements as cyanide.

2.4.1.9 Duplicate Sample Analysis

At least one duplicate sample must be analyzed from each group of samples of a similar matrix type (i.e., water, soil) for each set of samples or for each 20 samples received, whichever is more frequent. Samples identified as field blanks cannot be used for duplicate sample analysis. If two analytical methods are used to obtain the reported values for the same element for a set of samples (i.e., ICP, atomic absorption), duplicate samples must be run by each method used. The RPD for each component is calculated using the following equation from the CLP methods in WA-87-K026.

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

Where:

RPD = Relative Percent Difference
 D₁ = First Sample Value
 D₂ = Second Sample Value (Duplicate)

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The results of the duplicate sample analysis must be reported on Form VI (Appendix A). A control limit of ± 20 percent for RPD will be used for sample values greater than five times the contract-required detection limit. A control limit of $\pm$ the contract-required detection limit will be used for sample values less than five times the contract-required detection limit (Table 1-1), and this control limit ($\pm$ contract-required detection limit) should be entered in the "Control Limit" column on form VI. If one result is above the five-times contract-required detection limit level and the other is below, use the $\pm$ contract-required detection limit criteria. If either sample value is less than the contract-required detection limit, the RPD is not calculated and is indicated as "NC" on Form VI.

If the duplicate sample results are outside of the control limits, flag all of the data for samples received associated with that duplicate sample with an "*" on Forms I and V. In the instance where there is more than one duplicate sample per set, if one duplicate result is not within contract criteria, flag all of the samples of the same matrix in the set. Hexavalent chromium, nitrate, and fluoride will follow the same requirements as cyanide.

2.4.1.10 Graphite Furnace Atomic Absorption Spectrophotometry QC Analyses

Because of the nature of the graphite furnace atomic absorption technique, the special procedures summarized in Exhibit E of WA-87-K026 will be required for quantitation. In general, a single-point method of addition or post-digestion spike at twice the method detection limit must be performed on every sample for arsenic and selenium. If the post-digestion spike recovery is not between 85 and 115 percent, the sample must be reanalyzed by the method of standard addition.

All furnace analyses, except during full methods of standard addition, will require duplicate injections for which the average absorbance or "concentration" will be reported. All analyses must fall within the calibration range. The raw data package must contain absorbance or "concentration" values, the average value, and the relative standard deviation (RSD) or coefficient of variation (CV). For concentrations greater than the contract-required detection limit, the duplicate injection readings must agree within 20 percent RSD or

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CV, or the sample must be rerun once. If the readings are still out, flag the value with an "M" on Form I (Appendix A).

2.4.1.11 Method of Standard Additions

The method of standard additions (MSA) will be used for the analysis of EP toxicity extracts for metals and whenever a new sample matrix is being analyzed.

The following procedures will be incorporated into MSA analyses:

- o Data from MSA calculations must be within the linear range as determined by the calibration curve generated at the beginning of the analytical run.
- o The sample and three spikes must be analyzed consecutively for MSA quantitation (the "initial" spike run data is specifically excluded from use in the MSA quantitation). Only single injections are required for MSA quantitation.

Spikes should be prepared such that:

- Spike 1 is approximately 50 percent of the sample absorbance;
- Spike 2 is approximately 100 percent of the sample absorbance; and
- Spike 3 is approximately 150 percent of the sample absorbance.

The data for each MSA analysis should be clearly identified in the raw data documentation along with the slope, intercept, and correlation coefficient (r) for the least squares fit of the data and the results reported on Form VIII (Appendix A). Reported values obtained by MSA are flagged on the data sheet (Form I, Appendix A) with the letter "s".

If the correlation coefficient (r) for a particular analysis is less than 0.995, the MSA analyses must be repeated once. If the correlation coefficient is still <0.995, the results on Form I must be flagged with "+".

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2.4.1.12 Laboratory Control Sample (LCS) Analysis
(Performance Evaluation Samples)

Aqueous laboratory QC samples must be analyzed for each analyte using the same sample preparation and analytical methods employed for the samples.

The aqueous LCS solution must be obtained from U.S. EPA (if unavailable, the U.S. EPA initial calibration verification solution may be used). The aqueous LCS must be prepared and analyzed with the samples for each of the procedures applied to each set of samples received. One aqueous LCS must be analyzed for every 20 samples received or for each batch of samples digested, whichever is more frequent. Each data package must contain the results of all of the LCS analyses associated with the samples on that set. For cyanide, the distilled mid-range calibration standard may be used as the aqueous LCS. An aqueous LCS is not required for mercury analysis.

All aqueous LCS results will be reported on Form VII (Appendix A) interims of true concentration and percent recovery as calculated by the following equation from the CLP method in WA-87-K026.

$$\text{Percent R} = (\text{Observed/True}) \times 100$$

In the above equation, "observed" is the measured concentration. If the percent recovery for the aqueous LCS falls outside of the control limits of 80 to 120 percent, the analyses must be terminated, the problems corrected, and the previous samples associated with that LCS reanalyzed (i.e., previous 19 samples or the batch of samples from the set).

Once a month, a solid LCS available from EMSL-LV must be prepared and analyzed using each of the procedures applied to the solid samples received. If this U.S. EPA solid LCS is unavailable, other U.S. EPA QC check samples or other certified materials may be used.

The monthly results of the solid LCS samples should be reported on a duplicate Form VII (Appendix A) and submitted monthly to EMSL/Las Vegas and SMO on the fifteenth of every month.

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If the percent recovery for the solid LCS sample is outside of the control limits established by U.S. EPA or other suppliers of the LCS, no further sample analyses may be done until the analytical problems are solved and satisfactory LCS results are obtained.

2.4.2 Organic Quality Control

The following sections summarize the QC requirements described in Exhibit E of WA-87-K236 for the analysis of HSL organic compounds by GC/MS and GC. Specifically, the following QC operations must be performed:

- o Tuning and GC/MS mass calibration;
- o Calibration of the GC/MS system;
- o Continuing calibration of the GC/MS system;
- o Preparation (method) blank analysis;
- o Surrogate standard spike analysis;
- o Matrix spike/matrix spike duplicate analysis (MS/MSD); and
- o Pesticide and PCB QC requirements.

2.4.2.1 Tuning and GC/MS Mass Calibration

Prior to initiating any ongoing data collection, it is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria. This is accomplished through the analysis of DFTPP or BFB.

Decafluorotriphenylphosphine (DFTPP) - Each GC/MS system used for the analysis of semivolatile or pesticide HSL compounds must be hardware tuned to meet the abundance criteria listed in Table 2-1 for a 50 nanogram injection of DFTPP. DFTPP may be analyzed separately or as part of the calibration standard. The criteria must be demonstrated daily or for each 12-hour period, whichever is more frequent, before samples can be analyzed. DFTPP must be injected to meet this criterion. Background-subtraction should be straightforward and designed only to eliminate column bleed or instrument background ions. Background subtraction actions resulting in spectral distortions for the sole purpose of meeting the method

TABLE 2-1
DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

MASS	ION ABUNDANCE CRITERIA
51	30.0 - 60.0 percent of mass 198
68	Less than 2.0 percent of mass 69
69	Mass 69 relative abundance
70	Less than 2.0 percent of mass 69
127	40.0 - 60.0 percent of mass 198
197	Less than 1.0 percent of mass 198
198	Base peak, 100 percent relative abundance
199	5.0 - 9.0 percent of mass 198
275	10.0 - 30.0 percent of mass 198
365	Greater than 1.00 percent of mass 198
441	Present but less than mass 443
442	Greater than 40 percent of mass 198
443	17.0 - 23.0 percent of mass 442

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specifications are contrary to the objectives of QA and are unacceptable. Instrument conditions must be consistent with those used in sample analysis.

Bromofluorobenzene (BFB) - Each GC/MS system used for the analysis of volatile HSL compounds must be hardware tuned to meet the abundance criteria listed in Table 2-2 for a maximum of a 50 nanogram injection of BFB. This criterion must be demonstrated daily or for each 12-hour time period, whichever is more frequent. Background subtraction should be straightforward and designed only to eliminate column bleed or instrument background ions. Background subtraction actions resulting in spectral distortions for the sole purpose of meeting the contract specifications are contrary to the objectives of QA and are unacceptable.

Documentation of the mass calibration must be provided in the form of a bar graph plot and as a mass listing. The laboratory is required to complete a Form V (Appendix B) and mass calibration each time an analytical system is tuned.

2.4.2.2 Calibration of the GC/MS System

Prior to the analysis of samples and after tuning criteria have been met, the GC/MS system must initially be calibrated at a minimum of five concentrations to determine the linearity of response utilizing HSL compound standards. For GC/MS analysis, typical linear ranges of zero to 400 nanograms for base neutrals, zero to 1,000 nanograms for phenols, and zero to 1,000 nanograms for volatiles. Once the system has been calibrated, the calibration must be verified each 12-hour time period for each GC/MS system.

Volatile HSL Compounds - Initial calibration of volatile HSL compounds is required at 20, 50, 100, 150, and 200 ug/l. Surrogate and internal standards shall be used with each of the calibration standards. Utilizing the analytical protocol specified in Exhibit D of WA-87-K236, will result in 100 to 1,000 total nanograms analyzed. If an analyte saturates at the 200 ug/l concentration level, and the GC/MS system is calibrated to achieve a detection sensitivity of no less than 5 ug/l, the laboratory must document it on Form VI (Appendix B) and proceed with a four-point initial calibration for that specific analyte. Secondary ion quantitation is only allowed when there are sample Table

TABLE 2-2
BFB KEY IONS AND ION ABUNDANCE CRITERIA

MASS	ION ABUNDANCE CRITERIA
50	15.0 to 40.0 percent of the base peak
75	30.0 to 60.0 percent of the base peak
95	Base peak, 100 percent relative abundance
96	5.0 to 9.0 percent of the base peak
173	Less than 2.00 percent of mass 174
174	Greater than 50.0 percent of the base peak
175	5.0 to 9.0 percent of mass 174
176	Greater than 95.0 percent but less than 101.0 percent of mass 174
177	5.0 to 9.0 percent of mass 176

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interferences with the primary ion. Analyze all method blanks and standards under the same condition as the samples.

Acid and Base-Neutral HSL Compounds - Initial calibration of semivolatile HSL compounds is required at 20, 50, 80, 120, and 160 total nanograms. If an analyte saturates at the 160 total nanogram concentration level and the GC/MS system is calibrated to achieve a detection sensitivity of no less than the contract-required detection limit, the laboratory must document in on Form VI (Appendix B) and in the case narrative and proceed with a four-point initial calibration for the specific analyte. The use of a secondary ion for quantification is only allowed when there are sample interferences with the primary ion. Nine compounds, benzoic acid, 2,4-dinitrophenol, 2,4,5-trichlorophenol, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-nitrophenol, 4,6-dinitro-2-methylphenol, and pentachlorophenol will only require a four-point initial calibration at 50, 80, 120, and 160 total nanograms since detection at less than 50 nanograms per injection is difficult.

Analyze each calibration standard and tabulate the area or the primary characteristic ion against concentration for each compound including all contract-required surrogate compounds. The relative retention times of each compound in each calibration run should agree within 0.06 relative retention time units. Late eluting compounds usually will have much better agreement.

Response Factor (RF) Calculations - Using Tables 9-2 and 9-3, calculate the RF for each compound at each concentration level using the following equation from the CLP method in WA-87-K236.

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$$RF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where:

A_x = area of the characteristic ion for the compound to be measured

A_{is} = area of the characteristic ion for the specific internal standard

C_{is} = concentration of the internal standard (ng/ul)

C_x = concentration of the compound to be measured (ng/ul)

Using the RF from the initial calibration, calculate the percent relative standard deviation for compounds labeled as calibration check compounds on Form VI (Appendix B) using the following equation from the CLP method in WA-87-K236.

$$\text{Percent RSD} = \frac{SD}{x} \times 100$$

Where:

SD = standard deviation of initial five response factors (per compound)

x = mean of initial five response factors (per compound)

The percent relative standard deviations for each individual calibration check compound must be less than 30 percent. This criteria must be met for the initial calibration to be valid. Report results are on Form VI (Appendix B).

A system performance check must be performed to check that minimum average response factors are met before the calibration curve is used.

For volatiles, the five system performance check compounds (SPCCs) are chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, and chlorobenzene. The minimum acceptable average response factor for these

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compounds is 0.300; 0.250 for bromoform. These compounds typically have RFs of 0.4 to 0.6 and are used to check compound instability and degradation caused by contaminated lines or active sites in the system.

For semivolatiles, the SPCCs are N-nitroso-di-n-propylamine, hexachlorocyclopentadiene, 2,4-dinitrophenol, and 4-nitrophenol. The minimum acceptable average RF for these compounds is 0.050. These compounds (SPCCs) typically have very long RFs (0.1 to 0.2) and tend to decrease in response as the chromatographic system begins to deteriorate or the standard material begins to deteriorate. These compounds are usually the first to show poor performance. Therefore, they must meet the minimum requirement when the system is calibrated. Report SPCC results on Form VI (Appendix B).

The initial calibration is valid only after both the percent relative standard deviation for calibration check compounds (CCC) and the minimum average RF for SPCC have been met. Only after both criteria are met can sample analysis begin.

2.4.2.3 Continuing Calibration of the GC/MS System

System Performance Check - A calibration standard(s) containing all volatile or semivolatile HSL compounds, including all required surrogates, must be performed each 12 hours during analysis. Compare the RF data from the standard each 12 hours with the mean RF from the initial calibration for a specific instrument. A system performance check must be made each 12 hours. If the SPCC criteria are met, a comparison of RF is made for all compounds. This is the same check that is applied during the initial calibration (Form VI, Appendix B). If the minimum SPCC RF are not met, the system must be evaluated and corrective action must be taken before sample analysis begins.

The minimum RF for volatile SPCC is 0.300 (0.250 for bromoform).

The minimum RF for semivolatile SPCC is 0.050.

Report results on Form VII (Appendix B).

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Calibration Check - After the system performance check is met, calibration check compounds listed on Form VII (Appendix B) are used to check the validity of the initial calibration. Calculate the percent difference using the following equation from the CLP method in WA-87-K236.

$$\text{Percent Difference} = \frac{RF_I - RF_C}{RF_I} \times 100$$

Where:

RF_I = average RF from initial calibration

RF_C = RF from current verification check standard.

If the percent difference for any compound is greater than 20, the laboratory should consider this a warning limit. If the percent difference for each CCC is less than 25 percent, the initial calibration is assumed to be valid. If the criteria are not met (greater than 25 percent difference) for any one calibration-check compound, corrective action must be taken. Problems similar to those listed under SPCC could affect his criteria. If no source of the problem can be determined after corrective action has been taken, a new initial five-point calibration must be generated. This criteria must be met before sample analysis begins.

Concentration Levels for Continuing Calibration - The concentration for each volatile HSL compound in the continuing calibration standard(s) is 50 up/l.

The concentration for each semivolatile HSL compound in the continuing calibration standard(s) is 50 total nanograms. Nine compounds, benzoic acid, 2,4-dinitrophenol, 2,4,5-trichlorophenol, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-nitrophenol, 4,6-dinitro-2-methylphenol, and pentachlorophenol will be analyzed at 80 total nanograms of each compound injected.

2.4.2.4 Preparation (Method) Blank Analysis

A method blank is a volume of deionized, distilled laboratory water for water samples, or a purified solid matrix (sodium sulfate) for soil/sediment samples carried through the entire analytical scheme

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(extraction, concentration, and analysis). The method blank volume or weight must be approximately equal to the sample volumes or sample weights being processed. The method blank analysis must be performed at the following frequency:

- o For the analysis of volatile HSL compounds, a method blank analysis must be performed every 12 hours, once per sample set, or with every 20 samples of similar concentration and/or sample matrix, whichever is more frequent, on each GC/MS system used to analyze samples.
- o For the analysis of semivolatile or pesticide HSL compounds, a method blank analysis must be performed once each sample set, with every 20 samples of similar concentration and/or sample matrix or whenever samples are extracted by the same procedure (separatory funnel or continuous extraction), whichever is more frequent. The method blank associated with a specific set or group of samples must be analyzed on each GC/MS or GC system used to analyze that specific group or set of samples.
- o It is the laboratory's responsibility to minimize method interference caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in gas chromatographs.
- o For the purposes of this protocol, an acceptable laboratory method blank should meet the following criteria:
 - A method blank for volatile analysis must contain no greater than five times the contract-required detection limit (Table 1-2) of common laboratory solvents (common laboratory solvents are: methylene chloride, acetone, and toluene).
 - A method blank for semivolatile analysis must contain no greater than five times the contract-required detection limit (Table 1-2) of common phthalate esters.

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- For all other HSL compounds not listed above, the method blank must contain less than the contract-required detection limit of any single HSL compound.

If a laboratory method blank exceeds criteria, the laboratory must consider the analytical system out of control. The source of the contamination investigated and appropriate corrective measures must be taken and documented before further sample analysis proceeds. All samples processed with a method blank that is out of control (i.e., contaminated) must be re-extracted/re-purged and reanalyzed. Method blank results are to be reported on Form I, Appendix A for Form I and Form IV in Appendix B.

2.4.2.5 Surrogate Standard Spike Analysis

Surrogate standard determinations are performed on all samples and blanks. All samples and blanks are fortified with surrogate spiking compounds before purging or extraction in order to monitor preparation and analysis of samples.

Each sample (including matrix spike and matrix spike duplicate) and blank are spiked with surrogate compounds prior to purging or extraction. The surrogate spiking compounds shown on Form II (Appendix B) are used to fortify each sample or blank with the proper concentrations. Performance-based criteria are generated from laboratory results. Therefore, deviations from spiking protocol will not be permitted.

Surrogate spike recovery must be evaluated for acceptance by determining whether or not the concentration (measured as percent recovery) falls inside the contract-required recovery limits presented on Form II (Appendix B).

Method Blank Surrogate Spike Recovery - The laboratory must take corrective action if any one of the following conditions exist:

- o Recovery of any one surrogate compound in the volatile fraction is outside the required surrogate spike recovery limits; and

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- o Recovery of any one surrogate compound in either the base-neutral or acid fraction is outside surrogate spike recovery limits.

Corrective action will include the following:

- o Check calculations so there are no errors; check internal standard and surrogate spiking solutions for degradation, contamination, etc.; also, check instrument performance.
- o Recalculate or re-inject/re-purge the blank or extract if the above corrective actions fail to solve the problem.
- o Re-extract and reanalyze the blank.

Sample Surrogate Spike Recovery - The laboratory must take corrective action if any of the following conditions exist:

- o Recovery of any one surrogate compound in volatile fraction is outside the contract surrogate spike recovery limits;
- o Recovery of any one surrogate compound in either base-neutral or acid fraction is below 10 percent; or
- o Recoveries of two surrogate compounds in either acid or base neutral fractions are outside surrogate spike recovery limits.

Corrective action will include the following:

- o Check calculations so there are no errors; check internal standard and surrogate spiking solutions for degradation, contamination, etc.; and check instrument performance.
- o Recalculate or reanalyze the sample or extract if the above corrective action fails to solve the problem.
- o Re-extract and reanalyze the sample if none of the above present a problem.

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2.4.2.6 Matrix Spike/Matrix Spike Duplicate Analysis (MS/MSD)

In order to evaluate the matrix effect of the sample upon the analytical methodology, the compounds listed on Form III (Appendix B) are designated to be used for matrix spike and matrix spike duplicate analysis. These compounds are subject to change depending upon availability and suitability for use as matrix spikes.

An MS/MSD must be performed once for every sample set or with every 20 samples of similar sample matrix, whichever is greater. The analytical protocols require that a uniform amount of matrix spiking solution be added to the sample aliquots prior to extraction. Samples requiring dilutions and chosen as the matrix spike/matrix duplicate samples, must be analyzed at the same dilution as the original unspiked sample.

Matrix Spike Percent Recovery - Individual component recoveries of the matrix spike are calculated using the following equation from the CLP method in WA-87-K236:

$$\text{Matrix Spike Percent Recovery} = \frac{\text{SSR} - \text{SR}}{\text{SA}} \times 100$$

Where:

SSR = spike sample results
SR = sample result
SA = spike added from spiking mix

Relative Percent Difference (RPD) - The relative percent difference for each component is calculated using the following equation from the CLP method in WA-87-K236:

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

Where:

D₁ = first sample value
D₂ = second sample value (duplicate)

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The results for the nonspiked HSL compounds in the matrix spike and matrix spike duplicate will be reported on Form I (Appendix B). The percent recovery and relative percent difference results will be reported on Form III (Appendix B).

2.4.2.7 Pesticides and PCB QC Requirements

The following minimum QC requirements must be met for validation of pesticide and PCB analytical results:

- o Preparation (method) blanks must be performed as described in Section 2.4.2.4.
- o Matrix spike/matrix spike duplicate analyses must be performed as described in Section 2.4.2.6.
- o Spike all standards, samples, blanks, matrix spike, and matrix spike duplicate samples with dibutylchlorendate as described in Section 2.4.2.5.
- o Before performing any sample analyses, the laboratory is required to determine the retention time window for each pesticide/PCB compound listed in Table 402 and the surrogate spike compound dibutylchlorendate. These retention time windows are used to make tentative identification of pesticides/PCBs during sample analysis. The following procedure is used to establish retention time windows:
 - Prior to establishing retention time windows, the GC operating conditions (oven temperature and flow rate) must be adjusted such that 4,4'-DDT has a retention time of >12 minutes on packed GC columns.
 - Make three injections of all single-component pesticide mixtures, multiresponse pesticides, and PCBs throughout the course of a 24-hour period.

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- Verify the retention time shift for dibutylchlorodate in each standard. The retention time shift between the initial and subsequent standards must be less than a two percent difference for packed columns (less than 0.3 percent for capillary column). If this criterion is not met, continue injecting replicate standards to meet criteria.
 - Calculate the standard deviation of the three absolute retention times for each single-component pesticide. For multiresponse pesticides or PCBs, choose one major peak from the envelope and calculate the standard deviation of the three retention times for that peak.
 - Plus or minus three times the standard deviation of the absolute retention times for each pesticide/PCB will be used to define the retention time window; however, the experience of the analyst should weight heavily on the interpretation of chromatograms. For multiresponse pesticide/ PCBs, the analyst should utilize the retention time window, but should primarily rely on pattern recognition.
 - In those cases where the standard deviation for a particular pesticide/PCB is zero, the laboratory may substitute the standard deviation of a close eluting, similar compound to develop a valid retention time window.
 - The laboratory must calculate retention time windows for each pesticide/PCB on each GC column used at the beginning of the program and whenever a new GC column is installed. The data must be retained by the laboratory and made available during any on-site laboratory evaluation.
 - Report results on Form IX (Appendix B).
- o The external standard quantification procedure must be used to quantitate all pesticides and PCBs. Prior to performing any sample analyses, the laboratory must demonstrate the linear response range for each pesticide and PCB by the following procedures:

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- Prepare calibration standards at a minimum of three concentration levels for each parameter of interest by adding volumes of one or more stock standards to a volumetric flask and diluting to volume with hexane. One of the external standards should be at a concentration near, but above, the MDL and the other concentrations should correspond to the expected range of concentrations found in real samples or should define the working range of the detector.
 - Using injections of two to five microliters of each calibration standard, tabulate peak height or area responses against the mass injected. The results can be used to prepare a calibration curve for each compound.
 - The three-point calibration should be done on each quantitation column and each instrument at the beginning of the project and each time a new column is installed. The data must be retained by the laboratory and made available for inspection during on-site evaluations.
- o Prior to sample analysis, perform an evaluation check for linearity by the following procedure:
- Prepare Evaluation Standards A, B, and C (aldrin, endrin, 4,4'-DDT, and dibutylchlorendate) at the three concentration levels described in Exhibit D of WA-87-K236.
 - Analyze the three evaluation standards sequentially at the beginning of each 72-hour period and calculate the calibration factor for each compound in evaluation standards using the following equation from the CLP method in WA-87-K236:
- Calibration Factor = $\frac{\text{Total Areas of Peak}}{\text{Mass Injected (in nanograms)}}$
- Using the calibration factors, calculate the percent relative standard deviation for each compound at the three concentration levels using the following equation:

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$$\text{Percent RSD} = \frac{\text{SD}}{\bar{x}} \times 100$$

Where:

SD = the standard deviation

$\bar{x}$ = the mean of the three calibration factors
 for the compound of interest

The percent relative standard deviation for aldrin, endrin, and dibutylchlorendate must be ≤ 10 percent. The 10 percent RSD linearity criteria pertain only to columns being used for pesticide/PCB quantitation. If a column is used only for surrogate quantitation, the 10 percent RSD is only required for dibutylchlorendate.

Report results on Form VIII (Appendix B).

- o From the analysis of the Evaluation B standard described above, determine the percent breakdown for 4,4'-DDT and endrin by the following equations from the CLP method in WA-87-K236:

% Breakdown

$$\text{for 4,4'-DDT} = \frac{\text{Total DDT Degradation Peak Area (DDE+DDD)}}{\text{Total DDT Peak Area (DDT+DDE+DDD)}} \times 100$$

Percent Breakdown for Endrin =

$$\frac{\text{Total Endrin Degradation Peak Areas (Endrin Aldehyde+Endrin Ketone)}}{\text{Total Endrin Peak Area (Endrin+Endrin Aldehyde+Endrin Ketone)}}$$

The percent breakdown for endrin or 4,4'-DDT must not exceed 20 percent, or corrective action must be taken before analysis continues. Evaluate endrin and 4,4'-DDT breakdown each time the Evaluation B standard is analyzed (Table 2-3). Report the percent endrin and 4,4'-DDT breakdown results on Form VIII (Appendix B).

- o Prepare individual standard mixtures A and B containing all of the single-component pesticides. The single-component pesticides are divided into two groups to prevent overlap of compounds during packed GC column analysis.

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Analyze individual standard mixture A and B and all multiresponse pesticide/PCBs at the beginning of each 72-hour period (Table 2-3) and analyze individual standard mixture A or B intermittently throughout the analysis and whenever sample analysis is completed.

Calculate the calibration factor for each single component compound in individual standard mixtures A and B. Calculate the percent difference by the following equation from the CLP method in WA-87-K236:

$$\text{Percent Difference} = \frac{R_1 - R_2}{R_1} \times 100$$

Where:

R_1 = calibration factor from first analysis
 R_2 = Calibration factor from second analysis

The percent difference between calibration factors for each single-component compound must not exceed 15 percent for a quantitation run nor exceed 20 percent for a confirmation run during the 12-hour period. If the above criteria are exceeded, the affected samples have to be reanalyzed. Report results on Form IX (Appendix B).

TABLE 2-3
PESTICIDE AND PCB
72-HOUR ANALYTICAL SEQUENCE

1. Evaluation Standard Mix A
2. Evaluation Standard Mix B
3. Evaluation Standard Mix C
4. Individual Standard Mix A(a)
5. Individual Standard Mix A(a)
6. Toxaphene
7. Aroclors 1016/1260
8. Aroclor 1221(b)
9. Aroclor 1232(b)
10. Aroclor 1242
11. Aroclor 1248
12. Aroclor 1254
13. 5 samples
14. Evaluation Standard Mix B
15. 5 samples
16. Individual Standard Mix A or B
17. 5 samples
18. Evaluation Standard Mix B
19. 5 samples
20. Individual Standard Mix A and B (whichever not run in Step 16)
21. 5 samples
22. Repeat the above sequence starting with Evaluation Standard Mix B (Step 14 above)
23. Pesticide/PCB analysis sequence must end with Individual Standard Mix A or B regardless of the number of samples analyzed

(a) These standards may be combined into one mixture.

(b) Aroclors 1221 and 1232 must be analyzed once every 30 days on each instrument and each column. Copies of these chromatograms must be submitted with the results for each sample set for all instruments and columns used to quantitate samples in that set.

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- o The retention time shift for dibutylchlorendate must be evaluated after the analysis of each sample. The retention time shift may not exceed a two percent difference for packed GC columns between the initial standard analysis and any sample analyzed during the 72-hour period.

Calculate the retention time shift using the following equation from the CLP method in WA-87-K236:

$$\text{Percent Difference} = \frac{RT_I - RT_S}{RT_I} \times 100$$

Where:

RT_I = absolute retention time of dibutylchlorendate in the initial standard (Evaluation Standard Mix A)

RT_S = absolute retention time of dibutylchlorendate in the sample.

Report the retention time shift for all standards, blanks, and samples on Form VIII (Appendix B).

- o All pesticides or PCBs tentatively identified during the primary analysis must be confirmed by analysis on the second GC column. All of the QC requirements described above apply except that only standards for the compounds to be confirmed are analyzed.

2.4.3 Radiological Laboratory Analysis Quality Control

The radiological analysis laboratory QC will provide that the required analysis, QC sample checks, and verification of the results are performed and that the acceptability of the results is known and verifiable. Any deficiencies in the testing program will be identified so proper corrective action can be taken. A more detailed discussion of radiological QC requirements is included in the IT/RSL Radioanalytical Methodology and Procedures Manual and the IT/RSL QA Manual.

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2.4.3.1 Duplicate Sample Analysis

One duplicate sample will be run for every 10 to 15 samples. The results of these analyses will be used to determine the percent relative standard deviation (percent RDS), which will be recorded on radiological analysis quality control forms (e.g., control charts) for the parameters being tested. If the results of the percent relative standard deviation are excessive (i.e., outside the control limits) for the materials analyzed and method used, the samples will be reanalyzed.

2.4.3.2 Matrix Spike Analysis

One sample out of every 10 to 15 will be spiked prior to analysis with the parameters of interest to determine the percent bias.

The percent bias will be recorded on radiological analysis QC forms (e.g., control charts). If the results of the percent bias determinations fall outside appropriate values (i.e., control limits) for the material analyzed and method used, the samples will be reanalyzed and the values recorded.

2.4.3.3 Method and Field Blank Analyses

At least one method blank for each group of samples will be analyzed for the pertinent radiological parameters. The method blanks will consist of a distilled or deionized water sample.

Field blanks will be analyzed to monitor for possible sample contamination during storage and shipment. Field blanks will be prepared by filling two sample containers with distilled water and shipping the blanks to the lab with the sample bottles. The field blanks accompany the sample bottles through collection and shipment to the laboratory and are stored with the samples. If the field blanks indicate possible contamination of the samples, the laboratory manager and site manager will be notified immediately and, depending upon the nature and extent of the contamination, the sample results may be corrected for the field blank concentration or the sources resampled. Results of method and field blank analyses will be filed with the corresponding sample analytical data.

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2.5 Field Quality Control

Field activities are the responsibility of the site manager. prior to initiating field work, the site manager will discuss the scope of work, contractual and regulatory requirements, and applicable QA/QC procedures with assigned personnel. At the request of the site manager, this may be done by the QA officer or senior members of the project staff.

Once in the field, field personnel are responsible for all daily QC activities. Included in this responsibility will be the supervision of subcontractors.

2.5.1 Performance Documentation

To provide evidence of satisfactory work performance and the basis for subsequent activities and information transmitted external to WMCO, the results of field investigations and sampling will be completely documented. Whenever possible, information will be recorded on a standardized form. Documentation will include the project log book, test and survey data forms, monitoring/sampling equipment installation records, photographs, and field collection and sampling custody forms.

Members of the project staff working in field operations will keep a project log book. Each page of the project log will be signed by the person preparing the log. Items to be included in the daily log, as appropriate, are:

- o Field activity subject;
- o General work activity;
- o Unusual events;
- o Changes to plans and specifications;
- o Subcontractor progress or problems;
- o Weather conditions; and
- o Personnel on site.

The Project Logbook will be reviewed on a weekly basis by the task manager. After review of the logbook, copies should be routed to other members of the sampling team as needed.

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2.5.2 Verification of Data Reduction

The numerical reduction of field data will be formally checked. Checking will be performed prior to the presentation of results. If it becomes necessary to present or use unchecked results, transmittals or subsequent calculations will be marked "preliminary" until such time that the results are checked and determined to be correct.

All data reduction and resulting tables and graphs will be checked. This includes computer input, if reduction is performed by computer. Data sheets will be complete, with all requested information addressed.

The verification of field data reduction is the responsibility of project personnel.

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ATTACHMENT 3

3.0 PREVENTIVE MAINTENANCE

Preventive maintenance is an organized program of actions (such as equipment cleaning, lubricating, reconditioning, adjustment, and/or testing) taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use. An adequate preventive maintenance program increases reliability of a measurement system. A preventive maintenance program considers the following:

- o Instruments, equipment, and parts thereof that are subject to wear, deterioration, or other change in operational characteristics without periodic maintenance;
- o Spare parts that should be available within the laboratory to minimize downtime; and
- o Frequency that maintenance is required.

The implementation of a preventive maintenance program is dependent upon the specific instruments and equipment used within a laboratory or a field program; therefore, this section does not designate specific practices for instruments and equipment. The laboratories and field program will maintain a preventive maintenance program which meets the guidelines presented in this section.

Within a laboratory, the laboratory manager is responsible for preparation and documentation of the program. Group leaders shall implement the program and the QC Coordinator shall review implementation to verify compliance. The appropriate task leader, as part of the field program, is responsible for preparation, implementation, and documentation of the program within his task.

The preventive maintenance program shall include the following:

- o A listing of the instruments and equipment that are included in the program;

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- o The frequency of maintenance considering manufacturer's recommendations and/or previous experience with equipment. The listing and maintenance frequency should be provided on a schedule. Frequency should be stated in terms of monthly, quarterly, etc.;
- o For each instrument in the program, provide:
 - A list of spare parts maintained by the laboratory or field program;
 - External service contracts; and
 - Items to be checked and/or serviced during maintenance and directions for performing maintenance (if external service is not provided or if not stated in manufacturer's instrument manuals).

Preventive maintenance should be documented as discussed below and the records stored in accordance with Section 12.1 of the IT Analytical Services QA Manual and Site Procedure FMPC 407. The master schedule should be kept at the beginning of the maintenance records. Behind the schedule, a separate file should be maintained for each instrument. The instrument file should include:

- o Spare parts list;
- o External service contracts;
- o Checklist of items to be serviced and directions for maintenance or manufacturer's instrument manuals; and
- o Record of periodic maintenance.

The record of maintenance is documented in ink in bound notebooks which are kept with the corresponding laboratory instrument or on site with the field program. Attachment 4 lists laboratory and field equipment and their related preventive maintenance programs.

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ATTACHMENT 4

4.0 EQUIPMENT CALIBRATION/MAINTENANCE

Measuring and test equipment used in the field and laboratory shall be controlled by a formal calibration program (e.g., Site Procedure FMPC-407, Section 6.1 of the IT Analytical Services QA Manual, Section 7 of the IT/RSL QA Manual, and in Laboratory-Specific Attachments for the Mixed Waste, Middlebrook Pike, and Geotechnical Laboratories). The program shall provide equipment of the proper type, range, accuracy, and precision to provide data that are compatible with the specified requirements and desired results. Calibration of measuring and test equipment may be performed internally using in-house reference standards traceable to the National Bureau of Standards (NBS) or some other nationally reliable recognized standard, or externally by agencies or manufacturers.

4.1 Responsibilities

The responsibility for the calibration of laboratory equipment rests with the applicable laboratory manager. The task manager is responsible for the calibration of field equipment and for field equipment provided by subcontractors.

4.2 Calibration Procedures

Documented and approved procedures shall be used for calibrating measuring and test equipment. Whenever possible, widely accepted procedures (such as those published by ASTM or EPA) or procedures provided by manufacturers in equipment manuals shall be adopted. Procedures for laboratory measuring and test equipment routinely calibrated are discussed in the IT Analytical Services QA Manual and IT/RSL QA Manual, IT/RSL Radioanalytical Methodology and QA Procedures Manual, and in the Laboratory-Specific Attachments for the Mixed Waste, Middlebrook Pike, and Geotechnical Laboratories. Procedures for the calibration of major equipment that may be used for this project are presented in Tables 1 through 3.

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Calibrated equipment shall be uniquely identified by using either the manufacturer's serial number, a calibration system (FMPC-407 and Section 5.5.7 of the IT Engineering Services QA Manual for laboratory equipment) identification number, or other identifier(s). A calibration sticker will be attached to the appropriate equipment, or a record noted in the calibration log so that project personnel can recognize the most recent date of calibration and/or when the next calibration is due.

It is the responsibility of all personnel to check calibration status prior to using the equipment.

Measuring and test equipment shall be calibrated at prescribed intervals and/or as part of operational use. Frequency shall be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience (Tables 1 through 3). Equipment shall be calibrated, whenever possible, using reference standards having known relationships to nationally recognized standards (e.g., NBS) or accepted values of natural physical constants. If national standards do not exist, the basis for calibration shall be documented.

Reference standards (physical, radiological, and chemical) shall be used only for calibration. Physical standards shall be stored separately from working measuring and test equipment. Equipment that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use, or shall be tagged to indicate it is out of calibration. Such equipment shall be repaired and satisfactorily recalibrated to the satisfaction of the laboratory manager or site manager, as applicable. Equipment that cannot be repaired shall be replaced.

Records shall be prepared and maintained for each piece of calibrated measuring and test equipment to indicate that established calibration procedures have been followed. Records for equipment controlled by the IT calibration system (Section 6.0 of the IT Analytical Services QA Manual, Section RS12.0 of the IT/RSL QA Manual, and Mixed Waste, Middlebrook Pike, and Geotechnical Laboratory-Specific Attachments) shall be maintained by the appropriate IT laboratory.

TABLE 4-1

ENVIRONMENTAL LABORATORY AND FIELD EQUIPMENT
CALIBRATION AND MAINTENANCE PROCEDURES
PEED MATERIALS PRODUCTION CENTER
PERNOLD, OHIO

INSTRUMENT/EQUIPMENT	CALIBRATION METHOD/PROCEDURE	REFERENCE	CALIBRATION FREQUENCY	MAINTENANCE SCHEDULE
<u>INORGANIC ANALYSIS</u>				
Atomic Adsorption Spectrophotometer (AA)	Metals(a) 206.2 CLP-M, 239.2 CLP-M, 245.1 CLP-M, 245.2 CLP-M, 270.2 CLP-M	(1)	Daily or with each use	Complete routine preventive maintenance program exists with daily, weekly, monthly, quarterly, semiannual, and annual activities.
Inductively Coupled Argon Plasma Emission Spectrometer (ICP)	200.7 CLP-M	(1)	Daily or with each use	Equipment tuneup conducted annually involving replacement of worn-out parts, calibration for optimum response, and performance.
UV/VIS Spectrophotometer	Cyanide and Nitrate(a) 335.2 CLP-M, 352.1	(1,2)	Daily or with each use	Routine preventive maintenance program, annual visit by service personnel for tuneup.
Specific Ion Meter/Microprocessor	pH and Fluoride(b) 150.1 and 340.2	(2)	Daily or with each use	Routine preventive maintenance program, annual visit by service personnel for tuneup.
Analytical and Top-Loading Balances	Section 5.1(c)	(3)	Three months	Routine preventive maintenance program, semiannual visit by service personnel for calibration.

See footnotes at end of table.

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TABLE 4-1
(Continued)

INSTRUMENT/EQUIPMENT	CALIBRATION METHOD/PROCEDURE	REFERENCE	CALIBRATION FREQUENCY	MAINTENANCE SCHEDULE
Thermometer	Section 5.2(c)	(3)	Six months	Traceable to National Bureau of Standards
Conductivity Meter	Conductivity(d) 120.1	(2)	Daily or with each use	Routine preventive maintenance program, annual visit by service personnel for tuneup.
Exotox 50 Portable Gas Monitor	Standard calibration gases Chapter 6 of users manual	Neotronics Exotox 50 Portable Gas Monitor User Manual, 1986	Once/year at factory	Performance test every three months. Recharge battery after each use.
Draeger Multi- Gas Detector	Leak test per page 16 of instructions	Draeger Multi-Gas Detector, Instructions for Use	Before each use	Operational check before each use.
SKC Model 224-PCXR7 Sample Pump	Use flowmeter per page 13 of instructions	Operation Instructions for Universal Flow Sample Pump Model 224-PCXR7 SKC Inc.	Before each use	Recharge batteries after each use.
Dissolved Oxygen Meter	Probe in calibration chamber, switch instrument to CALIB O ₂ and adjust CALIB until meter indicates local altitude	YSI Model 51B Dissolved Oxygen Meter Instruction Manual	Daily or before each use	Replace batteries after 1,000 hours or if full scale adjustment can not be made. Membrane replacement 2-4 weeks. Store probe in humid environment.
Water Level Indicator	Section 4.5(c)	(3)	Six months	Serviced after each field use.

See footnotes at end of table.

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TABLE 4-1
 (Continued)

INSTRUMENT/EQUIPMENT	CALIBRATION METHOD/PROCEDURE	REFERENCE	CALIBRATION FREQUENCY	MAINTENANCE SCHEDULE
ORGANIC ANALYSIS				
Gas Chromatograph/Mass Spectrometer (GC/MS)	Exhibit D(e)	(4)	Daily or with each use	Complete routine preventive maintenance program exists with daily, weekly, monthly, quarterly, semiannual, and annual activities.
	Exhibit D(e)	(4)	Daily or with each use	Equipment tuneup conducted semi-annually involving replacement of worn-out parts and calibration for optimum response and performance.
Gas Chromatograph (GC)	Exhibit D(f)	(4)	Daily or with each use	Complete routine preventive maintenance program exists with manufacturer service contract support.
Total Organic Carbon Analyzer	9060	(5)	Daily or with each use	Complete routine preventive maintenance program exists with daily, weekly, monthly, quarterly, semiannual, and annual activities.
Total Organic Halide Analyzer	9020	(5)	Daily or with each use	Complete routine preventive maintenance program exists with daily, weekly, monthly, quarterly, semiannual, and annual activities.
HNu Photoionization Detector	Calibrate with Isobutylene	HNu Systems, Inc. Instruction Manual for Model P1101 Photoionization Analyzer, 1975	Routine Calibration once/10 days Factory Calibration once/year	Monthly cleaning of UV light source window and ion chamber. Recharge battery after each use.

See footnotes at end of table.

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TABLE 4-1
(Continued)

References

- (1) U.S. Environmental Protection Agency (EPA), 1985, "Chemical Analytical Services for Multi-Media Multi-Concentration Metals and Inorganics," WA-87-K236, Washington, D.C.
- (2) U.S. Environmental Protection Agency (EPA), 1983, "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-070, Cincinnati, Ohio.
- (3) IT Engineering Services Quality Assurance Manual, Chapters 4.0 and 5.0.
- (4) U.S. Environmental Protection Agency (EPA), 1985, "Chemical Analytical Services for Multi-Media Multi-Concentration Organics, GC/MS Techniques," WA-87-K026, Washington, D.C.
- (5) U.S. Environmental Protection Agency (EPA), 1986, 3rd ed., "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846

NOTES

(a) Generally, the calibration procedure consists of constructing a four-point standard curve consisting of a blank and three calibration standards within the instrument's working range. After the ICP or AA systems have been initially calibrated, the accuracy of the initial calibration is verified and documented for each metal by analysis of an initial calibration verification solution prepared from a source different from the calibration standards. Continuing calibration verification is performed every 10 samples or two hours, whichever is more frequent, as well as at the beginning and end of a sample run. The initial and continuing calibration verification solution (standard) must read within 90 to 110 percent of its true value. A calibration blank is analyzed each time the instrument is calibrated, at the beginning and the end of the run, and at a frequency of 10 percent during the run. The calibration blank must be below the analytical method detection limit. Calibration of the UV/VIS spectrophotometer follows the same procedure as described for AA.

(b) pH calibration consists of standardizing the meter using National Bureau of Standards (NBS) traceable buffer solutions at pH 4.01, 7.00, and 10.00. The procedure consists of constructing a four-point standard curve consisting of one standard at the method detection limit and three calibration standards within the working range of the specific ion electrode. Initial and continuing calibration verification solutions are analyzed as described for metals above.

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TABLE 4-1
 (Continued)

NOTES (Continued)

- (c) Analytical balances are checked for calibration within the laboratory on a quarterly basis in accordance with the IT Engineering Services Quality Assurance Manual, Chapter 5.0 and are recalibrated at least every six months by outside service personnel. The indicated sections referenced for thermometers and water level indicators are in the IT Engineering Services Quality Assurance Manual, Chapters 4.0 and 5.0.
- (d) The specific conductivity meter is calibrated with standard potassium chloride (KCl) solutions over the range of the sample readings. The KCl solutions used for calibration shall bracket the sample readings.
- (e) Initial calibration of the GC/MS consists of a five-point standard curve at Contract Laboratory Program (CLP) prescribed concentration levels. The minimum average response factor and the percent relative standard deviation of the response factors must be within acceptance criteria. Continuing calibration must be performed every 12 hours using a single standard, and acceptance criteria must be met or the five-point standard calibration must be repeated.
- (f) Initial calibration of the GC consists of a four-point linearity check curve consisting of a blank and three evaluation standards at CLP-prescribed concentration levels for aldrin, endrin, 4,4'-DDT and dibutylchlorodane. Single-point calibration standard mixtures are used to calibrate the GC for all pesticides and PCBs following the evaluation standards. During the sample analyses, the midpoint evaluation standard is alternated with the single-component pesticides calibration standard every five samples. The pesticide/PCB analysis sequence must end with the single-component pesticides calibration standard.

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TABLE 4-2

GEOTECHNICAL LABORATORY EQUIPMENT
CALIBRATION PROCEDURES^a
FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

<u>INSTRUMENT</u>	<u>PROCEDURE</u>	<u>FREQUENCY</u>
Balance	Section 5.1	3 Months
Oven	Section 5.3	3 Months
No. 200 Sieve	Section 5.7	6 Months
Thermometer	Section 5.2	1 Year
Timing Device	Section 5.5	1 Year
Pressure Transducer	Section 5.21	6 Months
Caliper	Section 5.9	6 Months
Liquid Limit Device	Section 5.4	6 Months
Hydrometer	Section 5.6	1 Year
Pycnometer	Section 5.20	1 Year
Consolidometer	Section 5.11	1 Year
Extensometer	Section 5.10	1 Year
Proving Ring	Section 5.12	1 Year
Unconfined Compression Machine	Section 5.14	1 Year
Field Vane Shear	Section 4.13	b

^aManuals of Practice associated with the IT Engineering Services Quality Assurance Manual.

^bPrior to use on project.

TABLE 4-3

RADIOLOGICAL LABORATORY AND FIELD EQUIPMENT
CALIBRATION PROCEDURES
FEED MATERIALS PRODUCTION CENTER
PERNAID, OHIO

INSTRUMENT/EQUIPMENT	MANUFACTURER	CALIBRATION REFERENCE	CALIBRATION FREQUENCY
Low Background Alpha/Beta Counting System	Tennelec	1,2,3,4,5,6,7,8	Daily(a)
Scaler Scintillation Counter	Ludlum	1,2,3,4,5,6,7,8	Daily
Alpha Spectrometer	Tennelec, Canberra	2,3,4,5	Daily
Computer Based Gamma Spectrometer, (Data System Only)	Nuclear Data, Model ND9900	2,3,4,5	Monthly as a single unit
Liquid Scintillation Spectrometer	Packard	9	Daily
Intrinsic Germanium Detectors	EG&G ORTEC	1	Daily
Field Instrument for the Detection of Low Energy Radiation (FIDLER)	Bicron/Ludlum	Section 5.1.1.1 of QAPP	Weekly
Pressurized Ion Chamber (PIC)	Reuter - Stokes	Instrument Manual	Annually by Manufacturer
Large-Volume Scintillation Detector (SPA-3/ESP-1)	Eberline/Eberline	Instrument Manual	Weekly

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See footnotes at end of table.

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TABLE 4-3
(Continued)

INSTRUMENT/EQUIPMENT	MANUFACTURER	CALIBRATION REFERENCE	CALIBRATION FREQUENCY
Ludlum Model 19 Micro R Meter	Per Section 5 Ludlum Instruction Manual	Ludlum Model 19 Micro R Meter Instruction Manual	Once/3 months(b)
Ludlum Model 12 Portable Survey Meter with 44-9 Pancake GM detector or 43-5 alpha scintillation detector	Per Section 5 Ludlum Instruction Manual	Ludlum Model 12 Survey Meter Instruction Manual	Once/3 months(b)
Eberline BC-4 Beta Counter	Known Beta-Gamma Source, Section IV-D of Instruction Manual	Eberline BC-4 Beta Counter Instruction Manual	Daily or before each use(b)
Eberline SAC-4 Scintillation Alpha Counter	Known Alpha Source Section IV-D of Instruction Manual	Eberline SAC-4 Scintillation Alpha Counter Instruction Manual	Daily or before each use(b)

(a) Each day samples are analyzed.
(b) Operational check before each use.

TABLE 4-3

(Continued)

REFERENCES

- (1) Krieger, H. L. and E. L. Whittaker, August 1980, "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032 (1980 Update), U.S. Environmental Protection Agency (U.S. EPA).
- (2) Kraus, K. A. and G. E. Moore, 1955, "The Separation of Pa (V) and Fe (III) with HCl Mixtures," Journal of American Chemical Society 77, 1383.
- (3) Wish, Leon, March 1959, "Quantitative Radiochemical Analysis by Ion Exchange," Analytical Chemistry 31, 326-329.
- (4) Campbell, E. E. and W. D. Moss, October 10-11, 1963, "Determination of Plutonium in Urine by Ion Exchange," Proceedings of the Ninth Annual Conference on Bioassay and Analytical Chemistry, San Diego, California.
- (5) Henley, L. C., May 1978, Radiochemical Procedures of the Industrial Safety and Applied Health Physics Division, Oak Ridge National Laboratory, ORNL/TM-6372.
- (6) Hume, D. N., N. E. Ballou, and L. E. Gendenin, June 1945, CN-2815, 23-26
- (7) Swift, E. H., 1940, A System of Chemical Analysis, Prentice-Hall, New York, 376.
- (8) Willard, H. H. and E. W. Goodspeed, 1936, "Separation of Strontium, Barium, and Lead from Calcium and Other Metals," Ind. Eng. Chem., Anal. Ed., 8, 414.
- (9) Anders, Ed, November 1960, The Radiochemistry of Technetium, National Academy of Sciences - National Research Council.

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ATTACHMENT 5

5.0 DOCUMENT CONTROL

Change from original documents, procedures, and specifications must be expected. Change does not imply a nonconformance with the work, but simply means that original plans must be altered because of information or events that occur during the work.

Change must be documented, evaluated, and reported as necessary. It is necessary to manage change so that the actual course of the project, not the original plan, can be demonstrated and justified. Changes must be documented so that the actual course of work is known and the effect of the change upon the course of work can be evaluated.

The effect of the change on the project should be evaluated by the task manager, task leader, OS&H (if safety or health related) and QA (if quality related) prior to implementation. Review and written approval for changes which affect the project activities should be provided by the task manager. Following the review and approval process, notification and training of the change should be made to appropriate personnel and affected documents revised as necessary to reflect the work as actually performed.

Project documents and drawings as discussed below must be reviewed, approved, distributed, and revised as necessary. This control will provide approved, up-to-date information and drawings.

5.1 Review and Approval of Documents and Drawings

Before use, the following documents and drawings must be reviewed and approved by the personnel identified:

- o Quality Assurance Plan
 - WMCO QA Officer
 - WMCO Task Manager
- o Project-specific documents (such as work plans or sampling protocols)
 - WMCO QA Officer
 - WMCO Task Manager

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- o Drawings
 - WMCO QA Officer (if appropriate)
 - WMCO Task Manager

Approval of the above documents and drawings shall be denoted by a signature and date which indicates the above approval.

5.2 Distribution

Documents and drawings will be distributed to all K-65 sampling team personnel Figure 9.2. When a document or drawing is no longer needed, it shall be destroyed or returned to Impact Assessment. The Task Manager shall control distribution of all documents and drawings.

5.3 Revision of Documents and Drawings

Whenever the K-65 Implementation Plan is revised, review and approval of the revision shall be in accordance with the requirements of the original document or drawing.

Revisions shall be issued to all holders of the original document or drawing. Each copyholder will sign a revision receipt verifying that the revision has been received and properly placed in the document. The receipt will be returned to Impact Assessment.

Revisions to documents shall, as a minimum, be denoted by including the consecutive revision number and revision date on the document title page, revised signature page, and each page that has been revised. Revisions to design drawings shall, as a minimum, be denoted by including the consecutive revision number and revision date in the appropriate block on the drawing and revised signature block.

5.4 Document Status

To prevent the inadvertent use of obsolete or superseded project-related information, all members of the project team are responsible for reporting changed documents and drawing status to the Task Manager. In turn, the Task Manager (or designee) shall notify affected personnel of the resulting status change in the project documents and drawings.

To purge outdated material from use, notification of personnel by the Task Manager (or designee) should be in

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writing and should indicate the means for removal from use. In general, drawings and other documents shall be marked "void". The Task Manager may request that obsolete copies be destroyed. The Task Manager will decide if one copy of a voided document or drawing be maintained for record purposes. This copy will have the reasons for and date of voiding clearly indicated.

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ATTACHMENT 6

6.0 CHAIN-OF-CUSTODY PROCEDURES

6.1 Field Sampling

The following will be used in the chain-of-custody process for sample tracking and field activities:

- o Sample identification and labeling;
- o Sample chain-of-custody form;
- o Sample collection log; and
- o Laboratory request for analysis form.

6.1.1 Sample Identification and Labeling

All samples will be adequately marked for identification from the time of collection and packaging through shipping and storage. Marking will generally be made on the sample container (jar, bottle, etc.) but may be applied directly to the sample, or on a tag or label attached to the sample or container, depending on the type of sample and its intended use. Sample identification will include, as appropriate:

- o Project name and number;
- o Sample number;
- o Sample location (Silo # and Manway Location)
- o Sample date and time;
- o The initials of the individual(s) performing the sampling; and
- o Sample preservative used.

An example of the sample label is illustrated in Figure 6-1. A sample numbering system will be established for the purpose of identifying the samples according to location and type.

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IT CORPORATION	
Project Name _____	Project No. _____
Sample Location _____	Number _____
Boring/Well No. _____	Date _____
Collector's Name _____	Time _____
Sample Type: _____ Ground Water _____ Surface Water	
_____ Soil	_____ Sludge/Waste
Parameters _____	Preservative _____
Bottle _____	Filtered _____ Nonfiltered _____

FIGURE 6-1
EXAMPLE SAMPLE LABEL

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6.1.2 Chain-of-Custody Record

Documentation of the sample chain-of-custody is provided by the use of a chain-of-custody record that includes the sampling location, the type and amount of samples collected, the date and time of sample collection, the name(s) of the person(s) responsible for sample collection, the date and time of all custody transfers, the signature of the person relinquishing and accepting sample custody, and other pertinent information.

Chain-of-custody procedures document sample possession from the time of collection to disposal. A sample is considered in custody if it is:

- o In one's physical possession;
- o In view, after being in physical possession;
- o Locked so that no one can tamper with it, after having been in physical custody; and/or
- o In a secured area, restricted to authorized personnel.

A chain-of-custody record will be initiated in the field and will accompany each group of samples during shipment to the laboratory. Each time custody of the sample changes, the new custodian will sign the record and indicate the dates of transfer. An example of the chain-of-custody record is included in Figure 6-2.

If the samples are shipped to the laboratory by commercial carrier, the original chain-of-custody form shall be sealed in a watertight container, placed in the shipping container, and the shipping container sealed prior to giving it to the carrier.

If the samples are directly transported to the laboratory, the original chain-of-custody form shall be kept in possession of the person delivering the samples.

For samples shipped by commercial carrier, the waybill shall serve as an extension of the chain-of-custody record between the final field custodian and receipt in the laboratory. (The carrier and waybill number will be written on the chain-of-custody form. If the original chain-of-custody form is sealed in the shipping

CHAIN-OF-CUSTODY RECORD

R/A Control No.

C/C Control No.

PROJECT NAME/NUMBER

LAB DESTINATION

SAMPLE TEAM MEMBERS

CARRIER/WAYBILL NO.

[illegible]

Special Instructions:

Possible Sample Hazards:

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By:

Received By: -

3. Relinquished By:

Received by:

2. Relinquished By:

Received By:

4. Relinquished By: _____

Received By:-

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WHITE - To accompany samples
YELLOW - Field copy

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container before the waybill number is received, then this number will be written on the copy of the chain-of-custody form.)

Upon receipt in the laboratory, the Quality Control Coordinator, or representative, shall open the shipping containers, compare the contents with the chain-of-custody record, and sign and date the record. The Quality Control Coordinator will also record the carrier and waybill number on the original chain-of-custody form, if it is not already present.

All original chain-of-custody records, analytical data, and other project documentation will be maintained in a project file. Project files will be stored in Impact Assessment.

A legible copy of the field chain-of-custody record will be maintained in the WMC0 project file. Once samples are received in the laboratory, chain-of-custody records will be signed by a designated representative of the laboratory and copies of the signed chain-of-custody records will be submitted to the WMC0 Task Manager or other designated representative.

6.1.3 Sample Collection Log

A sample collection log is prepared for each sample to record information pertaining to the location and collection of a sample. The following information is required on the sample collection log, as appropriate:

- o Unique sample number;
- o Sample location;
- o Collector initials;
- o Date and time sample collected;
- o Sample coordinates (Ohio State Planar System);
and
- o Sample identification (type, media, sequence, blank, spike, duplicate, split).

An example of a sample collection log is provided in Figure 6-3.

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6.1.4 Laboratory Request for Analysis Form

The laboratory request for analysis form is prepared to indicate the testing program required for the collected samples. The following information is recorded on the laboratory request for analysis form:

- o Project name and number;
- o Date samples shipped;
- o Required report date and turnaround times for analysis;
- o Contact with telephone number for receipt of the analytical report and billing invoices;
- o Sample identification numbers; and
- o Sample volume collected and appropriate preservatives.

An example of the laboratory request for analysis form is provided in Figure 6-4.

6.2 Analytical Laboratory

6.2.1 Laboratory Sample Receipt

Upon sample receipt, the QA coordinator or designee shall:

- o Examine all samples and determine if proper temperature has been maintained during shipment. The receiving temperature will be recorded on the chain-of-custody record. If samples have been damaged during shipment, the remaining samples shall be carefully examined to determine whether they were affected. Any samples suspected of being affected shall also be considered damaged. It will be noted on the chain-of-custody record what specific samples were damaged and that the samples were removed from the sampling program. WMCO laboratory supervisor will be notified in writing as soon as possible of an estimate of the cause of damage, that samples were damaged and that they must be resampled, or the testing program changed.

SAMPLE COLLECTION LOG

[illegible]

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Figure 6-3:

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REQUEST FOR ANALYSIS

R/A Control No.

PROJECT NAME

DATE SAMPLES SHIPPED

PROJECT NUMBER

LAB DESTINATION

PROJECT MANAGER

LABORATORY CONTACT

BILL TO

SEND LAB REPORT TO

PURCHASE ORDER NO.:

DATE REPORT REQUIRED

PROJECT CONTACT

PROJECT CONTACT PHONE NO.

[illegible]

TURNAROUND TIME REQUIRED: (Rush must be approved by the Project Manager.)

Normal _____

Rush _____

(Subject to rush surcharge)

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances)

Nonhazard _____

Flammable _____

Skin irritant

Highly Toxic

Other _____ (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, and disposal.)

Return to Client _____

Disposal by Lab _____

FOR LAB USE ONLY

Received By _____

Date/Time:

WHITE - Original, to accompany samples
YELLOW - Field copy

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- o Compare samples received against those listed on the chain-of-custody record.
- o Verify that sample holding times have not been exceeded. If the sample holding time has been exceeded, the QC coordinator, or designee, will notify in writing to the WMCO laboratory supervisor that this has occurred and will prepare a laboratory Nonconformance Report.
- o Sign and date the chain-of-custody record and attach the waybill to the chain-of-custody record.
- o Place the samples in adequate laboratory storage.
- o Enter the samples in the laboratory sample log-in book which contains the following information:
 - Project identification number;
 - Sample numbers;
 - Type of samples; and
 - Date received in laboratory.
- o Notify the laboratory manager or group leaders of sample arrival;
- o Place the completed chain-of-custody records in the project file.

If samples collected arrive without chain-of-custody or with incorrect chain-of-custody records, the following actions shall be undertaken by the QC coordinator:

- o If the chain-of-custody record is incorrect, a memorandum to the project director and field personnel is prepared stating the deviations. The memorandum must be signed and dated by the person originating the chain-of-custody and by the QC coordinator. The memorandum will serve as an amendment to the chain-of-custody. If the information on the chain-of-custody record cannot be corrected by the QC coordinator or the field personnel, the samples affected shall be removed from the sampling program.

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- o If the chain-of-custody record is not shipped with the samples, the field personnel shall be contacted and a memorandum prepared which lists the persons involved in collecting, shipping, and receiving the samples and the times, dates, and events. Each person involved must sign and date this memorandum. The completed memorandum will be maintained in lieu of the chain-of-custody record.

6.2.2 Laboratory Storage of Samples

The primary considerations for sample storage are:

- o Maintaining the prescribed temperature, if required, which is typically 4 degrees Celsius; and
- o Extracting and/or analyzing samples within the prescribed holding time for the parameters of interest.

The requirements of Tables 6-1 and 6-2 for temperatures and holding times shall be used. Placing of samples in the proper storage environment is the responsibility of the QC coordinator or designee, who should notify the laboratory manager or group leaders if there are any samples which must be analyzed immediately because of holding time requirements.

6.2.3 Initiation of Testing Program

As stated in Section 6.1.4, a request for analysis form shall be submitted with the samples to the laboratory. If the analytical program is not defined with the sample shipment, the QC coordinator shall immediately notify the manager responsible for the work for definition of the analysis program.

The laboratory manager and group leaders are responsible for prioritizing samples on the basis of holding time and of the required time needed to include the samples into the laboratory sample stream.

6.2.4 Sample Disposal

The chain-of-custody for the sample is completed as part of sample disposal. There are several possibilities for sample disposition:

TABLE 6-1
SAMPLING AND PRESERVATION REQUIREMENTS
FOR WATER SAMPLES
FEED MATERIALS PRODUCTION CENTER
PERNAID, OHIO

PARAMETER	CONTAINER(a)	VOLUME REQUIRED (ml)	PRESERVATION(b)	MAXIMUM HOLDING TIMES(c)
<u>Inorganics</u>				
o Alkalinity	P,G	50	Cool 4°C	14 days
o Ammonia	P,G	100	Cool 4°C, H ₂ SO ₄ to pH <2	28 days
o Chloride	P,G	50	None required	28 days
o Cyanide (Total)	P,G	1,000	Cool 4°C, NaOH to pH >12, 0.6g Ascorbic Acid(d)	14 days (e)
o Fluoride	P	300	None required	28 days
o Redox Potential (Eh)	P,G	100	None required	Analyze immediately
o Hydrogen Ion (pH)	P,G	100	None required	Analyze immediately
o Hexavalent Chromium	P,G	50	Cool 4°C	24 hours
o Mercury(f)	P,G	100	HNO ₃ to pH <2	28 days
o Metals, Except Hexavalent Chromium and Mercury(f)	P,G	200	HNO ₃ to pH <2	6 months
o Nitrate	P,G	100	Cool 4°C	48 hours
o Organic Carbon (Total) (TOC)	G	25	Cool 4°C, HCl or H ₂ SO ₄ to pH <2	28 days
o Organic Halogen (Total) (TOX)	G	100	Cool 4°C, H ₂ SO ₄ to pH <2	14 days
o Organic Nitrogen (Total)	P,G	500	Cool 4°C, H ₂ SO ₄ to pH <2	28 days

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See footnotes at end of table.

TABLE 6-1
 (Continued)

PARAMETER	CONTAINER(a)	VOLUME REQUIRED (ml)	PRESERVATION(b)	MAXIMUM HOLDING TIMES(c)
o Oxygen, Dissolved	G bottle and top	300	None required	Analyze immediately
o Phenols (Total)	G	500	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction
o Phosphorus (Total)	P, G	50	Cool 4°C, H ₂ SO ₄ to pH <2	28 days
o Residue, Filterable (TDS)	P, G	100	Cool 4°C	7 days
o Specific Conductance	P, G	100	Cool 4°C	28 days
o Sulfate	P, G	100	Cool 4°C	28 days
o Sulfide	P, G	500	Cool 4°C, add zinc acetate plus sodium hydroxide to pH >9	7 days
o Temperature	P, G	1,000	None required	Analyze immediately
<u>Organic Compounds(g)</u>				
o Volatiles	G, Teflon-lined septum	40	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days(i)
o PCBs	G, Teflon-lined cap	1,000	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction
o Pesticides	G, Teflon-lined cap	1,000	Cool 4°C, NaOH or HCl to pH 5-9(h), 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction
o Acid/Base Neutral Extractables	G, Teflon-lined cap	1,000 each	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction
o Polychlorinated dibenzo-P- dioxins and Polychlorinated Dibenzofurans	G, Teflon-lined cap	1,000	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction

TABLE 6-1
(Continued)

PARAMETER	CONTAINER (a)	VOLUME REQUIRED (ml)	PRESERVATION (b)	MAXIMUM HOLDING TIMES (c)
<u>Radiochemical Samples</u>				
o Gross Alpha	P, G	1,000	INO ₃ to pH <2	6 months
o Gross Beta	P, G	1,000	INO ₃ to pH <2	6 months
o Radium-226	P, G	1,000	INO ₃ to pH <2	6 months
o Radium-228	P, G	1,000	INO ₃ to pH <2	6 months
o Strontium-90	P, G	1,000	INO ₃ to pH <2	6 months
o Technetium-99	P, G	1,000	INO ₃ to pH <2	6 months
o Cesium-137, Gamma Spec	P, G	1,000	INO ₃ to pH <2	6 months
o Ruthenium-106	P, G	1,000	INO ₃ to pH <2	6 months
o Plutonium, Isotopic	P, G	1,000	INO ₃ to pH <2	6 months
o Neptunium-237	P, G	1,000	INO ₃ to pH <2	6 months
o Thorium, Total	P, G	1,000	INO ₃ to pH <2	6 months
o Thorium, Isotopic	P, G	1,000	INO ₃ to pH <2	6 months
o Uranium, Total	P, G	1,000	INO ₃ to pH <2	6 months
o Uranium, Isotopic	P, G	1,000	INO ₃ to pH <2	6 months

See footnotes at end of table.

TABLE 6-1
(Continued)

- a) Polyethylene (P) or glass (G).
- b) Sample preservation will be performed immediately upon sample collection.
- c) Samples will be analyzed as soon as possible after collection. The times listed are maximum times that samples should be held in the laboratory before analysis.
- d) Will only be used in the presence of residual chlorine. Sodium thiosulfate is only proposed as a sample preservative for HSL organics when residual free chlorine is known to be present. Sodium thiosulfate will be omitted in all other cases.
- e) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustment to determine if sulfide is present.
- f) Samples will be filtered immediately following collection on site before adding preservatives for dissolved metals.
- g) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
- h) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $\text{Na}_2\text{S}_2\text{O}_3$.
- i) If acid preservation (HCl to pH<2) is used, the maximum holding time can be extended from 7 days to 14 days.
- Reference: This table includes the requirements of the U.S. Environmental Protection Agency, as published in the Code of Federal Regulations, Vol. 49, No. 209, 40 CFR 136, October 26, 1984, pg. 43260. HSL organic compound requirements are promulgated in "Chemical Analytical Services for Multi-Media Multi-Concentration Organics, GC/MS techniques," WA-87-K236, U.S. Environmental Protection Agency, Washington, D.C., 1987.

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TABLE 6-2
 SAMPLING AND PRESERVATION REQUIREMENTS
 FOR SEDIMENT AND SOIL SAMPLES
 PEED MATERIALS PRODUCTION CENTER
 FERNALD, OHIO

PARAMETER	CONTAINER	SAMPLE WEIGHT REQUIRED (gm)	PRESERVATIVE	REFERENCE	MAXIMUM HOLDING TIMES(a)
Radionuclides	Plastic	100(b)	None	1	Indefinite
Inorganics	Plastic, Glass	500(c)	Cool, 4°C	2,3,4,5	Indefinite
Volatile Organics	Glass, Teflon- lined septum(d)	40	Cool, 4°C	6	10 days
Semivolatile Organics(e)	Glass, Teflon- lined cap	400	Cool, 4°C	6	10 days until extraction, 40 days after extraction
Pesticides/PCBs	Glass, Teflon- lined cap	400	Cool, 4°C	6	5 days until extraction 40 days after extraction
Cation Exchange Capacity (Total)	Plastic, Glass	400	Cool, 4°C	4	Indefinite

(a) Samples will be analyzed as soon as possible after collection. The times listed are maximum times that samples should be held before analysis.

(b) Check with laboratory for the volume of samples required for different radionuclide analyses.

(c) The collected sample can be divided for wet chemistry, metals, etc.

(d) 40-ml VOA vial.

(e) Semivolatile organics include acid and base-neutral extractables and pesticides/polychlorinated biphenyls.

TABLR 6-2
(Continued)

REFERENCES:

- (1) U.S. Environmental Protection Agency (EPA), September 1982, "Handbook for Sampling and Sample Preservation of Water and Wastewater," EPA-600/4-82-029.
- (2) U.S. Environmental Protection Agency (EPA), April 1984, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 2nd ed.
- (3) U.S. Environmental Protection Agency (EPA), 1984, "Proposed Sampling and Analytical Methodologies for Addition to Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," PA85-101026.
- (4) U.S. Environmental Protection Agency (EPA), 1978, "Field and Laboratory Methods Applicable to Overburdens and Mine Soil," EPA-600/2-80-054.
- (5) U.S. Environmental Protection Agency (EPA), 1987, "Chemical Analytical Services for Multi-Media Multi-Concentration Metals and Inorganics," WA-87-K026, U.S. EPA, Washington, D.C.
- (6) U.S. Environmental Protection Agency (EPA), 1987, "Chemical Analytical Services for Multi-Media Multi-Concentration Organics, GC/MS Techniques," WA-87-K236, U.S. EPA, Washington, D.C.

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- o The sample may be completely consumed during analysis.
- o Samples may be returned to WMCO for disposal.
- o The samples may be stored after analysis. Proper environmental control and holding time must be observed if re-analysis is anticipated. If re-analysis is not anticipated, environmental conditions for storage will not be observed.

The laboratory manager shall determine disposition of samples if not specified on the request for analysis form (Figure 6-4).

In general, IT laboratories will not maintain samples and extracts longer than six months beyond completion of analysis, unless otherwise specified.

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ATTACHMENT 7

7.0 DATA REDUCTION, VALIDATION, AND REPORTING

Procedures used by the laboratory and engineering groups for data reduction, validation, and reporting will be documented and subjected to review by the K-65 Sampling Team. Records will be legible and complete enough to permit reconstruction of the work by a qualified individual other than the originator. Laboratory-specific data reduction information is presented in Sections 3.6 and 10.2 of the IT Analytical Services QA Manual.

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ATTACHMENT 8

8.0 SAMPLE COLLECTION PROCEDURES

The following considerations form the basis for the sampling program:

- o Frequency of sampling;
- o Location and number of locations to be sampled;
- o Methods of sampling to be employed;
- o Media to be sampled;
- o Number of samples to be collected;
- o Volume of samples to be collected;
- o Type and kind of analyses to be performed in the field;
- o Type and kind of analyses to be performed at the laboratories;
- o Procedures and precautions to be followed during sampling; and
- o Methods of preservation and shipment.

Methods of sampling employed shall preserve the integrity of material parameters.

The following guidelines are applicable to the implementation of a field sampling program:

- o Review the sample collection program to become familiar with the overall scope of the study and also sampling procedures and equipment, sample handling procedures, and shipping requirements.
- o Determine the characteristics of the material to be sampled, become familiar with the safety precautions and practices, and obtain the necessary safety equipment.

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- o Obtain equipment and materials necessary to perform field sampling and analyses.
- o Review manufacturer's instructions on equipment calibration and sensitivity.
- o Calibrate all field equipment prior to field work according to manufacturer's instructions and calibration procedures.

NOTE: Certain equipment may require calibration in the field before each measurement.

- o Fill out the appropriate sample field collection reports (Sample Collection Log, Figure 6-3 in Attachment 6) completely prior to leaving the field location.
- o Label all sample containers with appropriate information. This includes project number and name, sample number, location, sampling date and time, preservatives added, and sampler's initials.
- o Complete chain-of-custody records and laboratory request for analysis forms which will accompany all samples during shipment.

The following guidelines are applicable for sample packaging to avoid breakage or cross contamination:

- o Sample container lids are never to be mixed. Sample lids will stay on the original container until time of sampling (only open sample container at the time of sampling). The original sample containers will arrive in the field in packages with custody tape affixed at the appropriate access points. When sample container packages are received in the field, the chain-of-custody form for shipping the empty containers to the field will be appropriately marked to state if the custody seal was affixed when the package arrived.
- o After a sample is placed in a plastic/glass container, the sample container will be

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secured with a custody seal and placed in a plastic bag to minimize the potential for contamination from vermiculite or other packing material. Sample containers may be placed between cardboard inserts and will not need to be placed in plastic bags (e.g., subsurface soil sample jars are placed back in their original shipping container, a cardboard box with cardboard inserts).

- o Upon arrival at the laboratory, the QC coordinator, or designee will examine the contents of the shipping container and document on the chain-of-custody record if any sample containers do not have the custody tape affixed.
- o Shipping coolers with plastic/glass containers will be filled initially with approximately three inches of vermiculite or suitable substitute (non-combustible, absorbent packing material). Under no circumstances will locally obtained material (sawdust, sand, etc.) be used. Do not use earth or ice as packing materials.
- o The secured sample containers will be placed in the cooler in such a way so they do not touch one another. Use additional container protection (e.g., new, unused paint cans), if necessary. (Keep cooler closed except when placing sample in cooler).
- o Commercially available artificial icing material will be used. If unavoidable, ice may be used, provided that it is placed in a plastic bag. Ice is not to be used as a substitute for packing materials.

Samples will be properly packaged and labeled for shipment and dispatched to the appropriate laboratory for analysis. Separate chain-of-custody and request-for-analysis records will be prepared for each laboratory. The following requirements for shipping containers will be followed:

- o United States Department of Transportation (DOT) regulations covering the transport of hazardous materials are contained in the Code

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of Federal Regulations (CFR) Title 49, Parts 170-179. Field personnel should acquaint themselves with the general provisions of these requirements.

- o Shipping containers are to be padlocked or custody-sealed for shipment, as appropriate. The packing custody seal should consist of filament tape wrapped around the container, with a custody seal affixed at appropriate access points. In this way, access to the container can be gained only by cutting the filament tape and breaking the seal.
- o Shipping cooler containers will be secured by field personnel with a proper custody seal, marked with indelible pen or ink, and addressed to the appropriate laboratory.
- o Field personnel will make arrangements for transportation of samples. When custody is relinquished to a shipper, field personnel will telephone the receiving laboratory custodian to report the expected time of arrival of the sample shipment and the existing time constraints (holding times) for sample analysis.

8.1 Field Storage and Shipment of Samples

Samples will be stored in a cool place away from direct sunlight. As soon as samples are collected, filtered (if necessary), and preserved, they should be stored in an ice chest packed with plenty of blue ice. Field personnel should make sure that sample container lids are tight and secure before storing them in an ice chest. Samples must be promptly shipped to the appropriate laboratory so that sample holding times are not exceeded.

Samples collected during sampling operations will have to be transported to IT laboratories in Tennessee for analysis. Transportation of sample must be accomplished not only in a manner designed to protect the integrity of the sample, but also to prevent any detrimental effects from the potentially hazardous nature of the samples. Regulations for packaging, marking, labeling, and shipping of hazardous materials, substances and wastes are promulgated by the U.S. Department of

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Transportation (DOT) and described in 49 CFR 171 through 177 (in particular, 172.402h, Packages Containing Samples). In general, these regulations were not intended to cover the shipment of samples collected at hazardous waste sites. However, the U.S. EPA has deemed it prudent to package, mark, label, and ship samples observing these DOT procedures. The information contained in this section is for general guidance and, although factual, should not be misconstrued as identical to DOT regulations for transportation of hazardous materials. Samples collected shall be classified as hazardous substance (or waste) samples. Special precautions, procedures, and secondary containment areas within laboratories will be used.

8.1.1 Hazardous Substance Samples

All Samples will be considered hazardous substance samples and transported according to the following requirements. If the material in the sample is known or can be identified, then it should be packaged, marked, labeled, and shipped according to the specific instructions for that material if listed in the DOT Hazardous Materials Table, 49 CFR 172.101. For those samples of hazardous substances where the contents are unknown, the selection of the appropriate transportation category will be based upon the DOT Hazardous Material Classification, a prioritized system of transportation categories. This system is presented in Table 8-1. For purposes of packaging safety, liquid and solid samples will be classified no lower than "flammable" as per Table 8-1.

The selection of the correct category for an unknown sample is through the process of elimination utilizing the DOT classification system. Unless known or demonstrated otherwise (through the use of radiation survey instruments), the sample will be considered radioactive and appropriate shipping regulations for radioactive material will be followed. If radioactive material is eliminated, the sample will be considered to contain Poison "A" materials, the next material on the list. Poison "A" is defined by DOT as extremely dangerous poisonous gases or liquids of such a nature that a very small amount of gas, or vapor of the liquid, mixed with air, is dangerous to life. The class "A" poisons listed in 49 CFR 172.101 and their physical state at normal temperatures are presented in Table 8-2.

Table 8-1

DOT HAZARDOUS MATERIALS CLASSIFICATION

1. Radioactive Material	12. Combustible liquid (in
2. Poison "A"	containers having ca-
3. Flammable Gas	capacity exceeding 110
4. Non-Flammable Gas	gallons)
5. Flammable Liquid	13. ORM-B
6. Oxidizer 13. ORM-B	14. ORM-A
7. Flammable Solid	15. Combustible liquids (in
8. Corrosive Materials (liquid)	containers having ca-
9. Poison B	capacity of 100 gallons
10. Corrosive Material (solid)	or less)
11. Irritating Materials	16. ORM-E

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TABLE 8-2

CLASS "A" POISONS AND THEIR PHYSICAL STATE
 AT ROOM TEMPERATURES

<u>Compound</u>	<u>Physical State</u>
arsine	gas
bromoacetone	liquid
chloropicrin & methyl chloride mixture	gas
chloropicrin & non-flammable, non- liquified compressed gas mixture	gas
cyanogen chloride containing less than 0.9% water	gas
cyanogen gas	gas
gas identification set	gas
gelatin dynamite (H.E. Germaine)	gas
grenade (with poison "A" gas charge)	gas
hexaethyl tetraphosphate & com- pressed gas mixture	gas
hydrocyanic acid (prussic solution)	liquid
hydrocyanic acid, liquified	gas
insecticide liquified gas, containing poison "A" or poison "B" materials	gas
methyldichloroarsine	liquid
nitric oxide	gas
nitrogen dioxide	liquid
nitrogen peroxide	liquid
nitrogen tetroxide	liquid
organic phosphate	gas
parathion & compressed gas mixture	gas
phosgene (diphosgene)	gas
phosphine	gas
poisonous liquid or gas n.o.s.	liquid or gas
tetraethyl dithiopyrophosphate	gas
tetraethyl pyrophosphate	gas

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If poison "A" is eliminated as a shipment category, the next two classifications are "flammable" and "non-flammable" gases. Since few gas samples will be collected, flammable liquids would be the next category. The elimination of the classification of radioactive, Poison "A", flammable gas, and non-flammable has which require more stringent shipping procedures, permits the sample to be classified as a flammable liquid (or solid) and shipped accordingly. The shipping requirements for flammable liquids would also suffice for shipping any other samples classified below flammable liquids on the DOT classification schedule. For samples containing unknown materials, other categories listed below flammable liquids/solids on the table will not be considered.

8.1.2 Samples Classified as Radioactive

Federal regulations governing the transport of radioactive sample material are extremely complex and reflect overlapping jurisdiction of many federal agencies. The important features of the DOT regulations (49 CFR 173, dated 1 November 1983) are summarized with their application to samples contaminated with uranium and associated daughter radionuclides.

The following definitions are summarized from those presented in 49 CFR 173.403:

- o Natural Thorium - Thorium characterized by the naturally occurring distribution of thorium isotopes (essentially 100 weight-percent thorium-232);
- o Natural Uranium - Uranium characterized by the naturally occurring distribution of uranium isotopes (approximately 0.711 weight-percent uranium-235 and the remainder essentially uranium-238);
- o Specific Activity - In reference to a radionuclide; the activity of the nuclide per unit mass of the nuclide. The specific activity of a material in which a radionuclide is uniformly distributed is expressed as the activity per unit mass of the material;

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- o Radioactive Material - Any material having a specific activity greater than 0.002 microcurie per gram;
- o Special Form Radioactive Material - Radioactive material that is either a single, solid piece or is obtained in a sealed capsule;
- o Normal Form Radioactive Material - Radioactive material that is not "Special Form Radioactive Material"; and
- o Transport Index - The dimensionless number (rounded up to the first decimal place) marked on the label of a package to designate the degree of control to be exercised by the carrier during transport. Generally, the transport index is the number expressing the maximum radiation level, in millirem per hour, occurring at distance of 1 meter (3.3 feet) from the external surface of the package. Other considerations may apply to certain fissile materials.

8.1.2.1 Quantities of Radioactivity in Packages

The regulations impose limits on the total activity (i.e., specific activity times the weight of the package) contained within a package of radioactive material. With respect to Type A packages, the limits are expressed as two quantities, A1 and A2, which refer to the maximum permissible activity for radionuclides in Special Form and Normal Form radioactive materials, respectively. Since the samples from FMPC fall into the latter category, and A2 value sets the activity limits for packages of such samples. In those cases where contaminated material shipments are designated Low Specific Activity or Limited Quantity, some fraction of the A2 value will normally apply.

Table 8-3 lists the A1 and A2 values cited in 49 CFR 173.435 for radionuclides of the uranium decay series. Values for radionuclides not listed in the regulations (e.g., lead-214, bismuth-214, polonium-214) have been assigned in accordance with the specifications set forth in 49 CFR 173.433 (a)(2).

TABLE 8-3

 A₁ AND A₂ QUANTITIES FOR RADIONUCLIDES
 OF THE URANIUM DECAY SERIES

Isotope	Atomic Number	Decay	Half-Life ^a	Quantity in Curies	
				A ₁	A ₂
U-238	92	Alpha	4.5x10 ⁹ y	Unlimited	Unlimited
Th-234	90	Beta	24 d	10	10
U-234	92	Alpha	2.5x10 ⁵ y	100	0.1
Th-230	90	Alpha	7.5x10 ⁴ y	3	0.003
Ra-226	88	Alpha	1622 y	10	0.05
Rn-222	86	Alpha	3.8 d	10	2.0
Pb-210	82	Beta	22 y	100	0.2
Bi-210	83	Beta	5 d	100	4.0
Po-210	84	Alpha	138 d	200	0.2

^aAbbreviations: y = years; d = days; m = minutes; s = seconds

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Determination of permissible quantities for samples that are contaminated with FMPC waste is more complicated than simple reference to the A2 values, since such material contains a mixture of radionuclides. For such mixtures, two rules apply. A mixture of radionuclides from a single decay chain is considered to be a single radionuclide if the following criteria are met: (1) the parent and daughters are present in their naturally occurring proportions (for example, in secular equilibrium); (2) no daughter has a half-life longer than 10 days; and (3) no daughter has a half-life longer than the parent radionuclide. For such a mixture, the A2 quantity to be applied is that of the parent radionuclide [49 CFR 173.433(b)(2)]. For those mixtures in which the identity and activity of radionuclides is known, the permissible quantity for each radionuclide must be such that the following equation is true:

$$F_1 + F_2 + \dots + F_k \dots F_n \leq 1$$

where F_k is the ratio of the total activity of the k^{th} radionuclide to its A1 or A2 quantity [49 CFR 173.433(b)(3)].

8.1.2.2 Low Specific Activity Materials

Low Specific Activity (LSA) materials include uranium and thorium ores, physical and chemical concentrates of these ores (e.g., yellow cake), unirradiated natural or depleted uranium or thorium, nonradioactive material externally contaminated with radioactivity that is not readily dispersible, and material in which the radioactivity is essentially uniformly distributed and does not exceed certain prescribed concentration limits. These limits for radionuclides of the uranium decay series, beginning with thorium-230, are listed in Table 8-4. In general, these concentrations will not be exceeded in FMPC samples.

Details for shipping LSA materials are described in 49 CFR 173.425. The chief advantage of shipping under the LSA category arises when the shipment is consigned Exclusive Use, the shipment is exempt from specification packaging, labeling and marking. Requirements that must be met include the following [49 CFR 173.425(b)]:

TABLE 8-4

LOW SPECIFIC ACTIVITY (LSA) CONCENTRATION LIMITS FOR RADIONUCLIDES
OF THE URANIUM DECAY SERIES
[FROM 49 CFR 173.403(N)(4)]

Nuclide	A2 Value (curies)	Estimated Average Concentration	
		<u>Microcuries/Gram</u>	<u>Curies/Kilogram</u>
Th-230	0.003	0.1	0.0001
Ra-226	0.05	0.1	0.0001
Rn-222	2.0	300	0.3
Pb-210	0.2	5.0	0.005
Bi-210	4.0	300	0.3
Po-210	0.2	5.0	0.005

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- o The shipment must be consigned Exclusive Use, unloaded from the conveyance in which it was originally loaded, and accompanied by written instructions for the maintenance of Exclusive Use shipping controls. LSA materials cannot be shipped by air.
- o The material must be packaged in strong, tight packages that will not leak under normal conditions of transport, and each package must be marked "Radioactive - LSA".
- o The package does not exceed the limits for removable radioactive contamination and radiation level.
- o The transport vehicle must be appropriately placarded, unless the shipment consists solely of unconcentrated uranium and thorium ores.

8.1.2.3 Limited Quantities of Radioactive Material

Limited quantity shipments of radioactive material must meet the requirements specified in 49 CFR 173.421 and 173.423. If the activity per package does not exceed 10^{-3} A2 quantity of the radionuclide, then it is exempt from specification packaging and from the associated shipping-paper, marking, and labeling requirements. Instead, the package need only comply with the following requirements:

- o The material must be packaged in strong, tight packages that will not leak under normal conditions of transport. The outside of the inner packaging, or the outside of the packaging itself when there is no inner packaging, must be marked "Radioactive."
- o The package does not exceed the limits for removable radioactive contamination and radiation level.
- o The package must be certified as being acceptable for transport by having a notice enclosed in or attached to the package, stating the name of the consignor and including this statement: "This package conforms to conditions and limitations specified in 49 CFR 173.421 for excepted

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radioactive material, limited quantity,
n.o.s., UN2910."

One advantage of limited quantity shipments is that there are no restrictions on air transport. [Guidelines specified in the International Civil Aviation Organization (ICAO) regulations should be consulted for air shipments of radioactive materials.] The major disadvantage is the low concentrations and quantity weights permissible for mixtures of different radionuclides.

8.1.3 Radiation and Contamination Control

Measurements of radiation level (does rate) and of nonfixed (removable) radioactive contamination are conducted on radioactive-material shipments to control exposure to radioactivity. Inspectors of such shipments can readily determine whether the packages comply with the regulations summarized below.

8.1.3.1 Radiation Limits

Radiation level is the radiation dose-equivalent rate expressed in millirem per hour (mrem/h) [49 CFR 173.403(v)]. Permissible radiation levels for various shipping categories are described below:

- o Limited Quantity Packages - The radiation level at any point on the external surface of the package may not exceed 0.5 mrem/h [49 CFR 173.421(b)].
- o LSA Packages - The radiation level of the LSA packages transported as Exclusive Use shipments shall not at any time during transport exceed any of the following limits [49 CFR 173.441(b)]:
 - 200 mrem/h on the accessible external surface of the package; or 1,000 mrem/h if the following criteria are met: the shipment is made in a closed transport vehicle, the package is secured so that its position remains fixed during transport, and no unloading/loading operations occur between the beginning and end of transport;

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- 10 mrem/h at any point on the outer surface of the transport vehicle;
 - 10 mrem/h at any point 2 meters (6.6 feet) from the outer surfaces of the transport vehicle; and
 - 2 mrem/h at any normally occupied position in the transport vehicle. This provision does not apply to private motor carriers when personnel operate under a radiation protection program.
- o Other Packages - The radiation level must not exceed 200 mrem/h at any point on the external surface of the package, and the transport index must not exceed 10.

8.1.3.2 Contamination Control

Nonfixed (removable) radioactive contamination is defined as radioactive contamination that is easily removed from the surface by wiping with an absorbent material [49 CFR 173.403(r)]. The maximum permissible limits for removable radioactive contamination, as set forth in 49 CFR 173.443(a), are summarized below; these limits apply to any are of 300 square centimeters.

- o 10^{-5} micro Ci/cm² or 22 disintegrations per minute (dpm)/cm², for beta/gamma-emitting radionuclides, all radionuclides with half-lives less than 10 days, natural uranium, natural thorium, uranium-235, uranium-238, thorium-232, and thorium-228 and thorium-230 when contained in ore and physical concentrates; and
- o 10^{-6} micro Ci/cm² or 2.2 dpm/cm², for all other alpha-emitting radionuclides.

Exclusive use consignments of radioactive material may not exceed these limits at the beginning of transport, and may not exceed 10 times the limits at any time during transport (49 CFR 173.443).

8.1.4 Samples Classified as Poison "A"

8.1.4.1 Packaging

Collect samples in a polyethylene or glass container which is of an outer diameter narrower than the valve hole in a DOT Spec. #3A1800 or #3A1800 metal cylinder. Fill sample container allowing sufficient ullage (approximately 10 percent by volume) so it will not be liquid-full at 130°F. Seal sample container. Attach a properly completed identification tag to the sample container. With a string or flexible wire attached to the neck of the sample container, lower it into a metal cylinder which has been partially filled with incombustible, absorbent loose packaging material (vermiculite or diatomaceous earth). Allow sufficient absorbing material between the bottom and sides of the container and the metal cylinder to prevent breakage and absorb leakage. After the cylinder is filled with cushioning material, drop the ends of the string or wire into the cylinder valve hole. Only one sample may be placed in a metal cylinder.

Replace valve, torque to 250 feet/pound (for one-inch opening) and replace valve protector on metal cylinder, using teflon tape. One or more cylinders may be placed in a DOT-approved outside container.

8.1.4.2 Marking and Labeling

Abbreviations will be used only when specified. The following formation will be placed on the side of the cylinder, or on a tag wired to the cylinder valve protector, either hand printed or in label form: "Poisonous Liquid, n.o.s." or "Poisonous Gas, n.o.s. NA9035," laboratory name and address. Place the following DOT label on the cylinder: "Poisonous Gas" (even if the sample is liquid).

If the metal cylinders are placed in an outside container, both the container and cylinders inside will have the same markings and labels as above. In addition, "Laboratory Sample" and "Inside Packages Comply With the Prescribed Specifications" will be marked on the top and/or front side of the outside container. "THIS SIDE UP" marking will be placed on the topside of the container, with upward point arrows on all four sides.

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8.1.4.3 Shipping Papers

The bill of lading will be completed and the certification statement signed (if the carrier does not provide a certification statement, a standard industry form will be used) with the following information in the order listed. One form may be used for more than one exterior container. Abbreviations will be used only as specified: "Poisonous Liquid, n.o.s. NA9035, "Limited Quantity" or "Ltd. Qty.", net weight or net volume. The net weight or net volume must be placed just before or just after the "Poisonous Liquid, n.o.s" marking. A chain-of-custody record will also be properly executed and included in the container or with the cylinder, if legal use of samples is required or anticipated.

Using the work "poisonous" does not convey the certain knowledge that a sample is in fact poisonous, or to what degree it may be poisonous; however, it is intended to describe the class of packaging in order to comply with DOT regulations.

8.1.4.4 Transportation

Poison "A" categorized packages may not be transported by Federal Express Corporation (air cargo) or other common carrier aircraft, or by rental, non-government aircraft. Samples may be shipped by ground transport or government-owned aircraft.

8.1.5 Samples Classified as Flammable Liquids or Flammable Solids Procedures

8.1.5.1 Packaging

Samples will be collected in a glass container with non-metallic, Teflon-lined screw cap allowing sufficient ullage (approximately 10 percent by volume) so that the container is not liquid full at 130°F. If an air space in the innermost container cannot be tolerated in order to maintain sample integrity, the sample will be placed within a second container to provide the required ullage. A properly completed sample identification tag will be attached to the sample container.

The sample container closure will be sealed and the sample placed in a two-millimeter-thick (or thicker) polyethylene bag, one sample per bag. The sample

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identification tags will be positioned to enable it to be read through the bag.

The sealed bag will be placed inside an appropriate size metal can with enough incombustible, absorbent, cushioning matter (e.g., vermiculite, diatomaceous earth) to prevent breakage and absorb liquid; one bag per can. The can will be pressure closed using clips, tape, or other positive means to hold the lid securely, tightly, and effectively.

One or more metal cans will be placed (or single one-gallon bottle) surrounded with incombustible, absorbing packaging material for stability during transport into a strong outside container, such as a cooler or inside an approved fiberboard box.

8.1.5.2 Marking and Labeling

Abbreviations will be used only when specified. The following information will be placed on the metal can (or 1-gallon bottle), either hand printed or in label form: laboratory name and address, "Flammable Liquid n.o.s. UN1993" or "Flammable Solid n.o.s. UN1325." Not otherwise specified (n.o.s.) is not used if the flammable liquid or solid is identified. In that case, the name of the specific material is used and listed before the category (e.g., "Flammable Liquid").

The following DOT labels will be placed on the outside of the can (or bottle): "Flammable Liquid" or "Flammable Solid". The "Dangerous When Wet" label will be used with the "Flammable Solid" label if the material meets the definition of a water reactive material. The "Cargo Aircraft Only" label will be used if the net quantity of the sample in each package is greater than one quart (for "Flammable Liquid," n.o.s.) or 25 pounds (for "Flammable Solid" n.o.s.). [49 CFR 172.402, 172.101].

If the cans are placed in an exterior container, both that container and inside can (or bottle) will have the same markings and labels as above.

The words, "This End Up" or "This Side Up," will be clearly printed on the top of the outer package. Upward pointing arrows will be placed on the side the package. The words, "Laboratory Samples," will also be printed on the top of the package.

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8.1.5.3 Shipping Papers

Abbreviations will be used only when specified: "Flammable Liquid n.o.s. UN1993" or "Flammable Solid n.o.s. UN1324"; Limited Quantity (or Ltd. Qty.); net weight or net volume (abbreviations or weight or volume are acceptable). Further descriptions such as "Laboratory Samples" or "Cargo Aircraft Only" (if applicable) are allowed if they do not contradict the required information. The net weight or net volume will be placed just before or just after the "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s." description. The bill of lading will be completed and the certification statement signed (if the carrier does not provide, a standard industry form will be used) with the following information in the order listed. One form may be used for more than one exterior container.

A chain-of-custody record, properly executed, will be included in the exterior container.

8.1.5.4 Transportation

Unknown hazardous substances classified as flammable liquids may be transported by rented or common carrier truck, bus, railroad, or by Federal Express Corporation, but they should not be transported by any other common carrier air transport, even "cargo only" aircraft. (DOT regulations permit "cargo only" aircraft such as TWA, United, etc.; however, difficulties with regular airline transportation suggest avoiding these types of transportation.)

These procedures are designed to enable air cargo shipment by entities such as Federal Express; however, they should not be construed as an endorsement of a particular commercial carrier.

If samples are transported by any type of government-owned vehicle, including aircraft, DOT regulations are not applicable. However, personnel will use the packaging procedures described. The bill of lading with a certification is an exception and does not have to be executed.

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8.2 Sample Bottle Preparation and Sample Preservation

Sample containers and appropriate preservatives are presented in Tables 8-5 and 8-6 for specific chemical and radiological parameters. Sample bottle containing premeasured amounts of the appropriate chemical preservatives are prepared in the laboratory and are shipped to the field. Sample bottles are either purchased precleaned in accordance with U.S. EPA specifications or are cleaned in the laboratory to U.S. EPA specifications. Volatile organic analysis (VOA) vials are purchased precleaned. Glass containers for other organic analyses are washed with a nonphosphate detergent, rinsed with tap water, rinsed with methanol, rinsed with deionized water, and allowed to air dry. Plastic containers for metals analyses are washed with a nonphosphate detergent, rinsed with tap water and deionized water, and then rinsed with dilute nitric acid. Plastic containers for other general chemistry and radiological procedures are washed with a nonphosphate detergent and rinsed with tap water and deionized water.

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TABLE 8-5

SAMPLING AND PRESERVATION REQUIREMENTS
FOR WATER SAMPLES
FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

PARAMETER	CONTAINER(a)	VOLUME REQUIRED (ml)	PRESERVATION(b)	MAXIMUM HOLDING TIMES(c)
<u>Inorganics</u>				
o Alkalinity	P,G	50	Cool 4°C	14 days
o Ammonia	P,G	100	Cool 4°C, H ₂ SO ₄ to pH <2	28 days
o Chloride	P,G	50	None required	28 days
o Cyanide (Total)	P,G	1,000	Cool 4°C, NaOH to pH >12, 0.6g Ascorbic Acid(d)	14 days(e)
o Fluoride	P	300	None required	28 days
o Redox Potential (Eh)	P,G	100	None required	Analyze immediately
o Hydrogen Ion (pH)	P,G	100	None required	Analyze immediately
o Hexavalent Chromium	P,G	50	Cool 4°C	24 hours
o Mercury(f)	P,G	100	HNO ₃ to pH <2	28 days
o Metals, Except Hexavalent Chromium and Mercury(f)	P,G	200	HNO ₃ to pH <2	6 months
o Nitrate	P,G	100	Cool 4°C	48 hours
o Organic Carbon (Total) (TOC)	G	25	Cool 4°C, HCl or H ₂ SO ₄ to pH <2	28 days
o Organic Halogen (Total) (TOX)	G	100	Cool 4°C, H ₂ SO ₄ to pH <2	14 days
o Organic Nitrogen (Total)	P,G	500	Cool 4°C, H ₂ SO ₄ to pH <2	28 days

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See footnotes at end of table.

TABLE 8-5
(Continued)

PARAMETER	CONTAINER(a)	VOLUME REQUIRED (ml)	PRESERVATION(b)	MAXIMUM HOLDING TIMES(c)
o Oxygen, Dissolved	G bottle and top	300	None required	Analyze immediately
o Phenols (Total)	G	500	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction
o Phosphorus (Total)	P, G	50	Cool 4°C, H ₂ SO ₄ to pH <2	28 days
o Residue, Filterable (TDS)	P, G	100	Cool 4°C	7 days
o Specific Conductance	P, G	100	Cool 4°C	28 days
o Sulfate	P, G	100	Cool 4°C	28 days
o Sulfide	P, G	500	Cool 4°C, add zinc acetate plus sodium hydroxide to pH >9	7 days
o Temperature	P, G	1,000	None required	Analyze immediately
<u>MSL Organic Compounds(g)</u>				
o Volatiles	G, Teflon-lined septum	40	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days(i)
o PCBs	G, Teflon-lined cap	1,000	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction
o Pesticides	G, Teflon-lined cap	1,000	Cool 4°C, NaOH or HCl to pH 5-9(h), 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction
o Acid/Base Neutral Extractables	G, Teflon-lined cap	1,000 each	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction
o Polychlorinated dibenzo-P- Dioxins and Polychlorinated Dibenzofurans	G, Teflon-lined cap	1,000	Cool 4°C, 0.008X Na ₂ S ₂ O ₃ (d)	7 days until extraction, 40 days after extraction

TABLE 8-5
(Continued)

PARAMETER	CONTAINER(a)	VOLUME REQUIRED (ml)	PRESERVATION(b)	MAXIMUM HOLDING TIMES(c)
<u>Radiological Samples</u>				
o Gross Alpha	P,G	1,000	HNO ₃ to pH <2	6 months
o Gross Beta	P,G	1,000	HNO ₃ to pH <2	6 months
o Radium-226	P,G	1,000	HNO ₃ to pH <2	6 months
o Radium-228	P,G	1,000	HNO ₃ to pH <2	6 months
o Strontium-90	P,G	1,000	HNO ₃ to pH <2	6 months
o Technetium-99	P,G	1,000	HNO ₃ to pH <2	6 months
o Cesium-137, Gamma Spec	P,G	1,000	HNO ₃ to pH <2	6 months
o Ruthenium-106	P,G	1,000	HNO ₃ to pH <2	6 months
o Plutonium, Isotopic	P,G	1,000	HNO ₃ to pH <2	6 months
o Neptunium-237	P,G	1,000	HNO ₃ to pH <2	6 months
o Thorium, Total	P,G	1,000	HNO ₃ to pH <2	6 months
o Thorium, Isotopic	P,G	1,000	HNO ₃ to pH <2	6 months
o Uranium, Total	P,G	1,000	HNO ₃ to pH <2	6 months
o Uranium, Isotopic	P,G	1,000	HNO ₃ to pH <2	6 months

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See footnotes at end of table.

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TABLE 8-5
(Continued)

- (a) Polyethylene (P) or glass (G).
- (b) Sample preservation will be performed immediately upon sample collection.
- (c) Samples will be analyzed as soon as possible after collection. The times listed are maximum times that samples should be held in the laboratory before analysis.
- (d) Will only be used in the presence of residual chlorine. Sodium thiosulfate is only proposed as a sample preservative for HSL organics when residual free chlorine is known to be present. Sodium thiosulfate will be omitted in all other cases.
- (e) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustment to determine if sulfide is present.
- (f) Samples will be filtered immediately following collection on site before adding preservatives for dissolved metals.
- (g) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
- (h) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $\text{Na}_2\text{S}_2\text{O}_3$.
- (i) If acid preservation (HCl to pH < 2) is used, the maximum holding time can be extended from 7 days to 14 days.

Reference: This table includes the requirements of the U.S. Environmental Protection Agency, as published in the Code of Federal Regulations, Vol. 49, No. 209, 40 CFR 136, October 26, 1984, pg. 43260. HSL organic compound requirements are promulgated in "Chemical Analytical Services for Multi-Media Multi-Concentration Organics, GC/MS Techniques," WA-87-K236, U.S. Environmental Protection Agency, Washington, D.C., 1987.

TABLE 8-6

**SAMPLING AND PRESERVATION REQUIREMENTS
FOR SEDIMENT AND SOIL SAMPLES
FEED MATERIALS PRODUCTION CENTER
PERNOLD, OHIO**

PARAMETER	CONTAINER	SAMPLE WEIGHT REQUIRED (gm)	PRESERVATIVE	REFERENCE	MAXIMUM HOLDING TIMES(a)
Radionuclides	Plastic	100(b)	None	1	Indefinite
Inorganics	Plastic, Glass	500(c)	Cool, 4°C	2,3,4,5	Indefinite
Volatile Organics	Glass, Teflon- lined septum(d)	40	Cool, 4°C	6	10 days
Semivolatile Organics(e)	Glass, Teflon- lined cap	400	Cool, 4°C	6	10 days until extraction, 40 days after extraction
Pesticides/PCBs	Glass, Teflon- lined cap	400	Cool, 4°C	6	5 days until extraction 40 days after extraction
Cation Exchange Capacity (Total)	Plastic, Glass	400	Cool, 4°C	4	Indefinite

(a) Samples will be analyzed as soon as possible after collection. The times listed are maximum times that samples should be held before analysis.

(b) Check with laboratory for the volume of samples required for different radionuclide analyses.

(c) The collected sample can be divided for wet chemistry, metals, etc.

(d) 40-ml VOA vial.

(e) Semivolatile organics include acid and base-neutral extractables and pesticides/polychlorinated biphenyls.

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TABLE 8-6
(Continued)

REFERENCES:

- (1) U.S. Environmental Protection Agency (EPA), September 1982, "Handbook for Sampling and Sample Preservation of Water and Wastewater," EPA-600/4-82-029.
- (2) U.S. Environmental Protection Agency (EPA), April 1984, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 2nd ed.
- (3) U.S. Environmental Protection Agency (EPA), 1984, "Proposed Sampling and Analytical Methodologies for Addition to Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," PB85-103026.
- (4) U.S. Environmental Protection Agency (EPA), 1978, "Field and Laboratory Methods Applicable to Overburdens and Mine Soil," EPA-600/2-80-054.
- (5) U.S. Environmental Protection Agency (EPA), 1987, "Chemical Analytical Services for Multi-Media Multi-Concentration Metals and Inorganics," WA-87-K026, U.S. EPA, Washington, D.C.
- (6) U.S. Environmental Protection Agency (EPA), 1987, "Chemical Analytical Services for Multi-Media Multi-Concentration Organics, GC/MS Techniques," WA-87-K236, U.S. EPA, Washington, D.C.

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ATTACHMENT 9

9.0 LABORATORY TESTING PROGRAM INITIATION

9.1 Radiological Screening

Samples from the Fernald RI/FS will undergo a radiological screening at IT/RSL to classify the samples into one of three hazard categories. All samples are counted for gross alpha and gross beta activity. In addition, samples that contain or are suspected of containing low energy beta emitters are analyzed by liquid scintillation counting. The purpose of the screening is three-fold: (1) to determine whether or not the samples can be shipped to other nonlicensed IT laboratories; (2) to verify that the radioactivity content is below the IT/RSL license limit, and (3) to evaluate the radiological hazard associated with the sample preparation and analysis procedure. A description of the three hazard categories is given below.

- o Category I - There are no radiological hazards associated with these samples. Category I samples may be shipped to other laboratories.
- o Category II - Category II samples must be analyzed at IT/RSL. Standard safe laboratory procedures are sufficient to protect the health of laboratory personnel.
- o Category III - Category III samples must be analyzed at IT/RSL. Screening results are reviewed on a case-by-case basis in order to specify handling and monitoring requirements and to verify that the radionuclide content of the sample does not exceed the license limit.

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9.2 Receipt of Samples

Upon receipt of the samples, the laboratory QC coordinator will:

- o Examine all samples and determine whether or not proper temperature has been maintained during shipment. If samples have been damaged during shipment, the remaining samples will be carefully examined visually to determine whether or not they were affected. Any samples affected will be also considered damaged. It will be noted on the chain-of-custody record that specific samples were damaged and that the samples were removed from the sampling program. Field personnel will be notified as soon as possible that samples were damaged and that they must be resampled or the testing program changed to avoid such damage in the future.
- o Compare samples received against those listed on the chain-of-custody record.
- o Verify that sample holding times have not been exceeded.
- o Sign and date the chain-of-custody record and attach any waybill to the chain-of-custody.
- o Place the samples in appropriate laboratory storage.
- o Enter the samples in the laboratory sample log-in book, which contains the following information:
 - Project identification number
 - Sample numbers
 - Type of samples
 - Date received in laboratory
- o Notify the laboratory manager of sample arrival.
- o Place the chain-of-custody records in the laboratory project file.

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ATTACHMENT 10

10.0 RADIATION SURVEY WITH FIDLER DETECTOR (FIELD)

10.1 Field Radiation Survey With Fidler Detector

This procedure describes the methods by which a field instrument for the detection of low energy radiation (FIDLER) is used to monitor ground surface deposits of uranium.

Included in the procedure are instructions for:

- o Initial instrument set-up;
- o Daily instrument standardization using a sealed "check source";
- o Determination of the instrument's response to terrestrial background radiation;
- o Establishment of field calibration factors;
- o Radiation survey measurements of ground surface areas; and
- o Use of the instrument to estimate the uranium concentration in the surface soil.

Method references for the above techniques are presented in:

- o UMTRA Procedure 10.17.3, In-Situ Ra-225 Measurement Using the Shielded Delta Procedure;
- o Tinney, J. F. and J. J. Koch, An X-Ray Screening Meter for Plutonium Contamination, UCRL-5000-67-3, 1967; and
- o Instrument manufacturer's instructions.

The FIDLER was developed in the 1960s as a portable instrument to monitor ground surfaces contaminated with plutonium. A five-inch diameter thin sodium iodide (NaI) crystal serves as the detector. It is optically coupled to a quartz light pipe and installed in a standard five-inch probe housing that has an entrance window of beryllium. The principal use of this detector

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is for photons with energies less than about 75 KeV. Uranium is an alpha emitter; however, the radiation from its daughter products include low-energy photons, principally L x-rays from thorium. In the case of U-238, by far the predominant uranium isotope at the FMPC, there are two low-energy photons from Th-234 that can be detected by the FIDLER. These are 63 KeV (3.5 percent abundant) and 93 KeV (four percent abundant). If significant concentrations of natural thorium are present, radiation from Ac-228 will create interference in detecting the 93 KeV photon from Th-234. For this reason, the instrument will be adjusted for maximum response from the 63 KeV photon from Th-234.

10.2 Initial Instrument Set-up

Before this instrument can be used to monitor low-energy radiation in the field, it is necessary to determine the maximum response for contamination by the uranium daughter, Th-234. This is done by using a source of Am-241 (60 KeV) (whose intensity is several times greater than background radiation levels), as follows:

- o Inspect the FIDLER, ratemeter/scaler (RM/S), and interconnecting cable for obvious damage. If no damage is observed, connect the FIDLER and RM/S, and adjust the High Voltage to 50 volts or less.
- o Depress the THRESH button. Turn the THRESH potentiometer clockwise until "0049" displays.
- o With the WINDOW IN/OUT switch IN, depress the WINDOW button. Turn the WINDOW potentiometer until 0020 appears on the display.
- o Switch the WINDOW IN/OUT to OUT.
- o Connect the probe and expose the Am 241 source.
- o Increase HV (if the HV potentiometer is at a minimum, it will take approximately three turns before any change is indicated). While increasing the HV, observe the log scale of the ratemeter. Increase HV until ratemeter indication occurs.
- o Switch the WINDOW IN/OUT to IN.

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- o Turn the HV control until the maximum reading occurs on the log scale. Increase HV until the reading starts to drop off, then decrease the HV for maximum reading.
- o Turn the RANGE selector switch to the KIK position.
- o Press the ZERO button. If meter does not read, switch to a lower range until a reading occurs.
- o Carefully adjust the HV potentiometer until the maximum reading is achieved on the range scale. The instrument is now peaked for daughters of uranium-238 on both the LOG and RANGE scales.

10.3 Daily Instrument Standardization

Following completion of the instrument set-up procedure, establish a fixed source-detector geometry so that the source-to-detector distance is a matter of record and reproducible from one day to the next. Standardize the FIDLER as follows:

- o Make five one-minute counts with the Am-241 source in its check position. Record each count on the "Instrument Checks" form (Figure 11-2).
- o Determine the standard deviation of the five one-minute counts. Record this value (σ) and three times the value (3σ) in the project logbook.

$$\text{Standard Deviation} = \frac{(\sum x^2) - (\sum x)^2}{n(n-1)} \quad 0.5$$

- o A control chart will be prepared using information from the previous two steps. This chart will be prepared at the beginning of the site characterization and will be used each day to record the FIDLER's response to the Am-241 source. On a piece of linear graph paper, place consecutive calendar dates on the x-axis. Define a range along the y-axis which includes the average FIDLER source count ± 3 times the standard deviation. Draw three horizontal lines that intersect the y-axis at these three points.
- o On a daily basis, repeat the five-point standardization procedure before the FIDLER is used for field measurements.

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TITLE: Walk-Over Surveys Using a Large Volume Scintillation Detector	NO: RSL-2003
	REVISION: 1

INSTRUMENT CHECK PROCEDURE RSL-2003

Detector Model _____ Serial No. _____

[illegible]

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Determine the average count rate and plot this value on the control chart for that day. If the average count rate falls within the boundary as defined above, the FIDLER may be used for field measurements. However, if the average count rate is not within the boundary, corrective action must be taken according to the following procedure.

- o Repeat the procedure "Initial Instrument Set-up."
- o Turn off the ratemeter and disconnect the cable to FIDLER. Clean the cable and chassis connectors with ethyl alcohol and let them dry.
- o Reconnect the cable and turn on the ratemeter; check the voltage setting.
- o Check the source-to-detector distance; make necessary corrections.
- o Confirm the proper window setting.
- o Repeat the five-point standardization procedure. If the FIDLER response is within the average count rate ± 3 , the unit may be used. If the average count rate is still outside of the control boundary, turn off the ratemeter and use a substitute ratemeter. Repeat the five-point standardization procedure. If problems still exist, repeat the initial instrument set-up. Repeated failures will require the attention of a manufacturer-certified service technician.

10.4 Determination of Instrument Response to Background Radiation

As part of the site characterization, several background locations will be selected in the vicinity of the FMPC. Each instrument, while having the same discriminator settings, responds differently to radiation. It is important that all instruments be checked at the same time to document the differences in responses. The FIDLER response to radioactivity in the soil at each of these background locations will be determined as follows:

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- o At each background station, establish an area where measurements can be made with the FIDLER probe in contact with the surface. Mark the location so that additional (or repeat) measurements can be made at later dates.
- o In a project logbook, describe the area chosen for background measurements and list specific features (soil is sandy, rocky, damp, wet, etc.). Also, record climatic conditions at the time measurements are made. Make five one-minute counts and record them in the field logbook or Field Activity Daily Log.
- o When all background location measurements have been completed, compare the average count rate at each station with the concentration of uranium in the soil samples collected at that point.

10.5 Establishment of Field Calibration

The response of a FIDLER to radioactivity in the soil is site-specific and is governed by several parameters, such as the presence of radioactivity other than uranium, a layer of clean soil between a subsurface deposit of uranium and the ground surface, nearby radioactive sources such as radon in the air or a waste storage pit, etc. Therefore, the field calibration factors determined in this instruction can only be considered estimates. Use of this calibration serves as an indicator for the need to perform soil sample analyses.

Several areas within the FMPC site where surface radioactivity is evident will be chosen as test areas. These should range from near-background radiation levels to the highest expected level on the site. Readings will be taken at the designated test areas as follows:

- o Perform five one-minute measurements with the FIDLER in contact with the ground surface and record the count rate in a field logbook or the Field Activity Daily Log.

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- o Collect a sample of surface soil (zero to two inches); submit it to the analytical laboratory for a gamma-ray spectral and total uranium analysis. Soil sample collection procedure and chain-of-custody requirements are described in detail in Attachments 6 and 8.
- o Following completion of the analysis of soil samples, compare the data from the five one-minute measurements to the soil concentration of uranium and prepare a table of values.

Based on the information above, using a least square fit, establish a calibration factor. Record this factor in the project logbook.

10.6 Radiation Survey Measurements of Ground Surface Areas

Surface scanning (whether on the ground, on equipment, or on building surfaces) with portable radiation detectors is normally carried out to determine the location of anomalous areas (radiation levels in excess of guideline values) within a measurement grid block or the average radiation level within a measurement grid block. The scan of ground surfaces at the FMPC will be carried out to determine the average estimated soil concentration of uranium within small areas that have been staked by a licensed surveyor. This will be accomplished by moving the FIDLER probe in a serpentine pattern over the area to be surveyed. During this scan, the detector will be held approximately two inches above the surface. Although the beryllium window is protected by Lucite, care must be taken to protect the window during this operation. Radiation survey measurements will be performed according to the following procedure:

- o Determine by checking the daily instrument standardization documentation that the FIDLER system has been checked and is ready for field measurements.
- o Receive instructions from the Radiation Measurements task leader. These instructions should be specific in the following ways:

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- The transit survey has been completed and 100-foot grids have been established;
 - The number of people required (one technical to monitor and one to record data);
 - Time requirements; and
 - Special instructions.
- o Areas to be scanned should be subdivided into square grid blocks approximately 100 feet by 100 feet.
 - o Grid block squares should be further subdivided into smaller square or rectangular grids, the total area of which can be scanned in several minutes. Areas 25 feet by 25 feet can be scanned in three minutes. The grids will be measured with a tape measure.
 - o Drainage paths will have been staked at 100-foot intervals. Scanning these areas with a FIDLER can only be done if the area is free of standing or flowing water. If the area meets these criteria, place a grid stake at 25-foot intervals between the 100-foot stakes.
 - o Attach a Surface Measurements Field Logbook Form (Figure 11-3) to a clipboard or other suitable writing surface; mark the grid block coordinates in the boxes along the left and top margins of the form.
 - o Scan measurements will be recorded as integral counts over the area to be scanned; that is, pulses from the FIDLER will be summed for the three-minute intervals necessary to scan each 25-foot by 25-foot area.
 - o Scans will begin at one corner of a grid block and will progress in a serpentine pattern over the entire block, ending at the diagonally opposite corner of the block. Push the count button as the scan begins. With practice, the timed count will end upon reaching the opposite corner. During the scan, the technician must listen to the audible signal. This may be achieved by using headphones. Although scanning speed should not be slowed when

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DATE:				
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FERNALD
 RI/FS

Surface Measurements Field Logbook Form

Site: _____ Surveyors: _____
 Area: _____ Recorded By: _____
 Date: _____ Count Time: _____ Background: _____ CPM
 _____ CPM
 (-Z)W—Coordinates—E(+X)

(-Y)S Coordinates.....N(+Y)

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Comments: _____ Scaler Model _____ Serial No. _____
 _____ Probe Model _____ Serial No. _____
 _____ Scaler Model _____ Serial No. _____
 _____ Probe Model _____ Serial No. _____
 _____ PIC Serial No. _____

FIGURE II-3

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increased audible signals are heard, the presence of apparent "hot spots" should be noted when the integrated count for the scan is recorded.

- o Upon completion of the scan for an individual grid block, record the integrated count in its respective position on the Surface Measurements Field Logbook Form.
- o Return to the locations that were identified as having a "hot spot" and conduct a one-minute count over the area indicated as having the highest concentration. Record the count on the Surface Measurements Field Logbook Form.
- o Repeat the survey of at least two subgrids (approximately 10 percent) for each 100-foot by 100-foot grid. The subgrid yielding the highest count, as well as a subgrid selected randomly. Should be recounted. A calculator generating random numbers may be used to select the specific subgrid. Record the repeated data in the appropriate box on the Surface Measurements Field Logbook form, under the first data point.
- o When all grid blocks for each assignment have been completed, return the signed Surface Measurement Field Logbook Forms to the task leader and return the FIDLER system to its storage area. The task leader will transfer the surface Measurement Field Logbook Form to the project logbook.

10.7 Use of the FIDLER to Estimate Soil Uranium Concentration

The determination of uranium contamination in soil is based on the laboratory analysis of soil samples to identify isotopes of uranium. The FIDLER serves to identify areas that have "elevated" readings and provides a systematic approach to a biased soil sampling program by collecting samples in areas where the instrument response is consistently higher. It is possible to develop a correlation between the FIDLER response and degrees of soil contamination by comparing instrument response and the laboratory results of soil samples.

The correlation is determined by first collecting soil samples from grids that exhibited elevated readings. A survey with the FIDLER is repeated for the 25-foot by

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25-foot subgrid as described in Section 11.6, as well as for the specific location where the sample is to be collected. The FIDLER is placed directly on the soil over the sample location and the integral count recorded. The soil sample is then collected at several depths to determine the concentration on the surface versus the subsurface. The instrument response is plotted with the concentrations of uranium, and a correlation is calculated using a linear regression method.

The soil sampling program collects samples from areas previously surveyed during the radiation measurements task, especially those identified to have elevated readings. The FIDLER is used to survey each sample location to provide additional data concerning instrument response to soil contamination.

10.8 Walk-Over Surveys Using the Large-Volume Scintillation Detector

The purpose of this instruction is to provide uniform measurement techniques when using a large-volume scintillation detector and to provide uniform interpretation of the results from such measurements.

The most sensitive gamma-ray survey instrument is the large-volume, sodium iodide scintillation detector (e.g., the Eberline Model SPA-3 or equivalent). It is commonly used for locating gamma-ray sources in low background areas and for measurements of low-level exposure rates.

This procedure is referenced in the manufacturer's operation manual. Various other manufacturer's instructions for operation of the large-volume scintillation detector may be used.

Large-Volume Scintillation Detector Operational and Field Measurement Procedure - Set up the detector and perform the field measurement according to the following instructions:

- o Check proper operation of the detector and its associated ratemeter/scaler according to the manufacturer's instructions.

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- o Perform daily source checks using a 0.1 uCi Cesium-137 check source and record the response in the project logbook.
- o For walkover surveys, proceed to the assigned grid area and reset the scaler on the ratemeter/scaler.
- o Subdivide the 100-foot by 100-foot grid into 16 squares, each 25 feet by 25 feet.
- o At one corner of the grid, start the scaler and timer and walk at a steady rate (approximately two feet per second) over the subgrid, beginning along one side and covering the entire grid in a rectilinear fashion until all areas have been surveyed.
- o The scintillation detector should be suspended by a rope or strap and swung from side to side in a serpentine fashion. Each 25-foot by 25-foot subgrid should be surveyed in approximately two minutes.
- o During the walkover, the survey meter count rate may be monitored with earphones, if necessary. Any location with an elevated count rate (indicated by a higher pitch in the earphones) in localized areas will be marked by dropping a weighted flag, and the survey will continue at the same pace.
- o After the walkover of the grid is completed, the scaler and timer are stopped and the following items are recorded on the Surface Measurements Field Logbook Form (Figure 11-3): (1) grid ID number; (2) the total count; and (3) the elapsed time.
- o Return to each location that has been flagged within the grid and perform a systematic survey beginning at the flag and working outward to determine the areal extent of the elevated reading.
- o Record the highest count rate and the approximate location and areal extent and insert a marker at the location of the highest reading.

ATTACHMENT 11

WMCO SOLID WASTE HANDLING PROCEDURES

SOP 20-C-601*

Pages: 1 - 11

SOP 1-C-602*

Pages: 1 - 13

WMCO-QAP-12.09*

Pages: 1 - 30

*For Reference Only

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PRODUCTION OPERATIONS PROCEDURE	Title: PACKAGING LOW LEVEL RADIOACTIVE WASTE (L-LRW) FOR OFF-SITE DISPOSAL	SOP 20-C-601
		Section: Waste Operations Plant: All
Authorization: R. L. Gardner	Supersedes: None	Issue Date: 07-07-87

1.0 PURPOSE

This procedure establishes the criteria for packaging waste for off-site disposal.

2.0 APPLICABILITY

This procedure shall apply to WMCO organizations or subcontractors under the control of a WMCO organization that generates or requires disposal of materials classified as low level radioactive waste.

3.0 RESPONSIBILITIES

3.1 Transportation/Production Operations shall be responsible to move waste containers as required.

R 3.2 The waste generator shall be responsible for packaging waste in a waste
R container specified for disposal by Waste Operations, labeling packaged
R material in accordance with the FMPC Lot Marking and Color-Coding System,
R and ensuring packaged material meets waste criteria guidelines per
R Figure 1 by interfacing with Waste Certification.

3.3 The supervisor shall be responsible for defining applicable scale check procedures, specifying a standard tare weight of boxes, ensuring packaging materials are available for operators, personnel are trained in this SOP, determining disposition of items as defined in this SOP, and instructing personnel in packaging bulk shipments to meet DOT regulations as identified in this SOP.

3.4 The operator is responsible for packaging waste for off-site disposal per this SOP.

4.0 DEFINITIONS

4.1 L-LRW - Low level radioactive waste.

4.2 ERMT - Environmental & Radiological Monitoring Technician.

4.3 Tare Weight - gross weight minus the weight of the contents.

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WESTINGHOUSE MATERIALS COMPANY OF OHIO - FMPC		Page 1A Page Revision Date: 07-25-88
PRODUCTION OPERATIONS PROCEDURE	Title: PACKAGING LOW LEVEL RADIOACTIVE WASTE (L-LRW) FOR OFF-SITE DISPOSAL	SOP 20-C-601
		Section: Waste Operations Plant: All
Authorization: R. L. Gardner	Supersedes: None	Issue Date: 07-07-87

4.0 DEFINITIONS (cont.)

4.4 Waste Generator - organization (point of generation) at which waste is originated.

4.5 48/55 Drum Package - 48 gallon drum placed inside a 55 gallon DOT approved drum.

4.6 Bulk Shipment - objects of non-radioactive material externally contaminated with radioactive material and shall be in compliance with DOT Regulation 173.425 (c) (1) (iv) as example scrapwood, metal, paper bales, pallets and other such items.

R 4.7 Waste Container - Approved container for waste shipment and disposal.

WESTINGHOUSE MATERIALS COMPANY OF OHIO - FMPC		Page 2 Page Revision Date:
PRODUCTION OPERATIONS PROCEDURE	Title: PACKAGING LOW LEVEL RADIOACTIVE WASTE (L-LRW) FOR OFF-SITE DISPOSAL	SOP 20-C-601
		Section: Waste Operations Plant: All
Authorization: R. L. Gardner	Supersedes: None	Issue Date: 07-07-87

5.0 REFERENCES - SOP 1-C-101

6.0 INDUSTRIAL HEALTH AND SAFETY REQUIREMENTS

DEFINED SAFETY SYSTEM INVOLVED: _____ YES ☒ NO

- 6.1 Safety glasses with side shields shall be worn unless other eye protection is specified.
- 6.2 Proper respiratory protection shall be worn when dusty conditions exist as specified by the ERMT for radioactive contaminants or by IH&S personnel for chemical air contaminants.
- 6.3 Leather-palm gloves shall be worn to protect the hands from rough material and contamination.
- 6.4 HEPA type filter vacuum cleaners or a vacuum system approved by ES&H shall be used.
- 6.5 Any circumstance which could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption shall immediately be reported to a supervisor. The involved employees shall report to the Medical Department at the end of their shift to submit a urine sample and again report at the start of their next shift to submit another urine sample. Each involved employee shall complete an Incident Investigation Report, Form No. FMPC-ES&H-1458 while at Medical. The supervisor shall inform the Environmental and Radiological Monitoring Technician of the circumstance immediately and file a Minor Event Report, (Form FMPC-QA-2689) before the end of the shift during which the circumstance happened.

7.0 PROCEDURE

7.1 Packaging 48 gallon drum in 55 gallon drum (48/55 drum package).

- 7.1.1 Perform scale check per applicable SOP in area of packaging operation.
- 7.1.2 Visually inspect drums for significant rust, dents or damage. Do not use drums having significant rust, dents, or damage. Notify supervisor for disposition. Move rejected drums to designated area.
- 7.1.3 Remove lids of the 48 & 55 gallon drums.
- 7.1.4 Place 48 gallon drum inside the 55 gallon drum.

PRODUCTION OPERATIONS PROCEDURE	Title: PACKAGING LOW LEVEL RADIOACTIVE WASTE (L-LRW) FOR OFF-SITE DISPOSAL	SOP 20-C-601
		Section: Waste Operations Plant: All
Authorization: R. L. Gardner	Supersedes: None	Issue Date: 07-07-87

7.0 PROCEDURE (cont.)

7.1.5 Record the standard tare weight (72 lbs) for 48/55 gallon drum package on Form No. FMPC-AC-1945 (See Figure 2).

R 7.1.6 Complete form FMPC-ES&H-1945-XX (See Figure 2).

R NOTE: Return completed form FMPC-ES&H-1945-XX to supervisor at the end
R of each shift.

7.1.7 Place filling collar on the 48/55 gallon drum package.

7.1.8 Position new drum package, coded with lot numbers and tare weight in the drumming station.

7.1.9 Fill the 48 gallon drum with specified material within 3 inches of drum top.

7.1.10 Remove filled drum package from the drumming station and vacuum loose material from the top surface of the filling collar.

NOTE: Remove the filling collar carefully to prevent material from spilling into the void between the 48 and 55 gallon drums.

7.1.11 Using a 4 ounce scoop, collect samples from the center surface of contents per SOP 1-C-101.

7.1.12 Hold for inspection by waste technician.

7.1.13 Cover the 48 gallon drum with lid and secure with a vertical lever ring.

7.1.14 Install a wire seal in the lever ring of drum.

7.1.15 Cover the 55 gallon drum with a lid and bolt type ring.

7.1.16 Secure the bolt ring by placing the locking nut in a neutral position.

7.1.17 Using a torque wrench, torque the bolt to 45-55 lb-ft.

7.1.18 Tighten the locking nut snugly against the threaded flange (right side) of the bolt ring.

7.1.19 Place filled drum on scale and print weigh the drum, complete the weight ticket and stencil the gross and net weights on the side of the drum. Record drum information on Form FMPC-AC-1945 (See Figure 2).

PRODUCTION
OPERATIONS
PROCEDURE

Title: PACKAGING LOW LEVEL RADIOACTIVE
WASTE (L-LRW) FOR OFF-SITE
DISPOSAL

SOP 20-C-601

Section: Waste Operations
Plant: All

Authorization: R. L. Gardner

Supersedes:

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7.0 PROCEDURE (cont.)

7.1.20 Place three drums on a pallet with drum bolt rings facing outward. Strap drums together using straps. Stage in designated storage area awaiting transfer to Waste Operations staging area.

R 7.1.21 Notify supervisor for Transportation to move palletized drums to Waste Operations staging area.

7.2 PACKAGING WOOD BOXES (4FT X 4FT X 7FT) OR (2FT X 4FT X 7FT).

R 7.2.1 Tare weigh each twentieth box. Record the weight on a "Box Tare Weight Check", Form FMPC-PRO-2867 (See Figure 3).

7.2.2 Place wooden box in loading area and remove lid.

R 7.2.3 Complete form FMPC-ES&H-1945-XX (See Figure 2).

R 7.2.4 Line the box with a sheet of 0.006 inch plastic that is approximately 14 feet X 16 feet, or a performed liner if the box is to be filled with loose material such as scrap wood or metal.

R 7.2.5 Add Polypropylene/Pulp super absorbent sheets or one bag of uncalcined diatomaceous earth spread evenly in the bottom of the box.

R NOTE: DELETED

R 7.2.6 Load loose material into the box as tightly as possible. If the box contains soil, add wet-strength polypropylene/pulp superabsorbent fabric, or one bag of uncalcined diatomaceous earth over the soil when the box is full.

R CAUTION: DELETED

R NOTE: DELETED

7.2.7 When box is full, fold plastic over contents and place lid on box.

7.2.8 Perform scale check per applicable SOP in area of packaging operation.

7.2.9 Weigh box and stencil or mark the gross weight, FMPC Lot number or content description, and tare weight (use standard tare weight specified by supervisor) in 1 inch (minimum) block or legible letters with black waterproof ink on the side of box.

NOTE: When filling box with drums, obtain shipment number and box number prior to loading drums.

CAUTION: DO NOT EXCEED A MAXIMUM GROSS WEIGHT OF 5000 LBS.

PRODUCTION
OPERATIONS
PROCEDURE

Title: PACKAGING LOW LEVEL RADIOACTIVE
WASTE (L-LRW) FOR OFF-SITE
DISPOSAL

SOP 20-C-601

Section: Waste Operations
Plant: All

Authorization: R. L. Gardner

Supersedes: None

Issue
Date: 07-07-87

7.0 PROCEDURE (cont.)

7.2.10 Close lever/rings on drums before loading. Place wire seal in lever rings.

7.2.11 Place barrel grab over drum.

7.2.12 Attach the clam shell hook or other lifting device (as specified by supervisor) on each side of the drum lid ring.

7.2.13 Raise drum into air and position over top of box.

WARNING: A second operator, using a remote pole, shall steady drum while in the air.

7.2.14 Lower drum into box and remove lifting device.

R 7.2.15 Add one bag of uncalcined diatomaceous earth in the box if
R condensation/frost is present or could develop on exterior of drums.

7.2.16 Place lid on box.

7.2.17 Obtain tabulated weight of box and contents from Waste Technician stencil or mark gross weight, shipment log number and identification number in 1 inch (minimum) block or legible letters with black waterproof ink on the side of box.

7.3 PACKAGING METAL BOXES

R 7.3.1 Tare weigh each twentieth box. Record the weight on a "Box Tare Weight
R Check", Form FMPC-PRO-2867 (See Figure 3).

7.3.2 Place metal box in staging area and remove banding and cardboard packing material.

7.3.3 Remove lid and slowly lower lid to prevent damage.

R 7.3.4 Complete form FMPC-ES&H-1945-XX (See Figure 2).

7.3.5 Obtain from supervisor a shipment log number and box identification number for drums to be loaded into metal box.

7.3.6 Seal drum lever/rings on drums. Install wire seal on lever rings.

7.3.7 Complete steps 7.2.10 thru 7.2.13 of this procedure to load drums into metal box.

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Title: PACKAGING LOW LEVEL RADIOACTIVE
WASTE (L-LRW) FOR OFF-SITE
DISPOSAL

SOP 20-C-601

Section: Waste Operation
Plant: All

Authorization: R. L. Gardner

Supersedes: None

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7.0 PROCEDURE (cont.)

R 7.3.8 When box is filled, add one bag of uncalcined diatomaceous earth in the
R box if condensation/frost is present or could develop on exterior of
R drums.

7.3.9 Close and secure box lid for interplant transfer.

7.3.10 Obtain tabulated weight of box and contents, mark gross weight, shipment
log number and box identification number in 1 inch (minimum) block or
legible letters with black waterproof ink on side of box.

R 7.3.11 When loading loose material in metal boxes, perform items 7.2.5 and
R 7.2.8. When loading asbestos, perform items 7.2.4, 7.2.5, 7.2.7, and
R 7.2.8.

R CAUTION: MAXIMUM GROSS WEIGHT OF METAL BOXES IS 6,000 LBS.

R NOTE: Soil and masonry can be mixed. Scrap wood and metal shall be
R packaged separately.

7.4 PACKAGING BULK SHIPMENTS

7.4.1 Notify supervisor of bulk packaging requirement.

7.4.2 Package material or item per posted instructions of supervisor.

R 7.4.3 Complete form FMPC-ES&H-1945-XX (See Figure 2).

R 7.5 PACKAGING SEA/LAND CONTAINERS

R 7.5.1 Inspect the exterior of the container. Do not use containers having
R significant rust, dents, or damage. Notify supervisor for disposition
R instruction. Move reject containers to the designated area.

R 7.5.2 Check that container tare weight is identified on the container. Notify
R the supervisor if the tare weight is not located on a side of the
R container.

R 7.5.3 Inform the supervisor that container survey is required.

R NOTE: The supervisor shall request an ERMT to perform the container
R survey.

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7.0 PROCEDURE (cont.)

- R 7.5.4 Inspect the interior of the container. If significant rust, dents,
R and/or damage is found, notify the supervisor. Do not use the
R container. Move the reject container to a storage area designated by
R the supervisor.
- R 7.5.5 Complete a "Residue Production - Transfer and Identification", Form
R FMPC-ES&H-1945-XX (See Figure 2).
- R 7.5.6 Apply a continuous bead of GE RTV SILICONE RUBBER ADHESIVE SEALANT, or
R equivalent, on all seams and corners of the container interior.
- R NOTE: The bead of sealant shall be a minimum of 1/4-inch.
- R 7.5.7 Line the container floors with a 0.006 inch thick plastic sheet that
R extends at least 36 inches up each side of the container.
- R 7.5.8 Cover the plastic sheet with wet-strength polypropylene/pulp
R superabsorbent fabric.
- R 7.5.9 Place plywood on the container floor and up to approximately four feet
R in height on all sides.
- R 7.5.10 Attach a prohibited materials list (See Figure 1) to the container, in a
R conspicuous location.
- R 7.5.11 Load the container. Use all the space in the container.
- R CAUTION: WHEN A UNSEALED CONTAINER IS NOT ATTENDED, LOCK THE CONTAINER.
- R 7.5.12 After the container has been filled, clean the back ledge of the
R container.
- R 7.5.13 Line the lid/door opening with 0.006-inch thick plastic, or equivalent,
R to a height of 18 inches.
- R 7.5.14 Using plywood and 2 inch x 4 inch wood, or other similar type
R materials, secure the load inside the container.
- R 7.5.15 Seal the door/lid seam with a 1/4-inch minimum bead of GE RTV SILICONE
R RUBBER ADHESIVE SEALANT, or equivalent.
- R 7.5.16 Close one door, apply GE RTV SILICON RUBBER ADHESIVE SEALANT, or
R equivalent, around the crack, and then close the other door.

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		Section: Waste Operations Plant: All	
Authorization: R. L. Gardner		Supersedes: None	Issue Date: 07-07-87

8.0 APPLICABLE FORMS

- R 8.1 FMPC-ES&H-1945-XX, Item Production/Certification/Identification"
- R 8.2 FMPC-PRO-2867, "Box Tare Weight Check"
- R 8.3 DELETED

PRODUCTION
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PROCEDURE

Title: PACKAGING LOW LEVEL RADIOACTIVE
WASTE (L-LRW) FOR OFF-SITE
DISPOSAL

SOP 20-C-601

Section: Waste Operations
Plant: All

Authorization: R. L. Gardner

Supersedes: None

Issue
Date: 07-07-87

PACKAGING GUIDELINES FOR WASTE GENERATOR

R

R

R

R

PACKAGE HAS BEEN PROPERLY PREPARED FOR CLOSING:

R

NO LIQUIDS OF ANY KIND HAVE BEEN PLACED IN CONTAINER

R

HEAVY/BULKY ITEMS HAVE BEEN SECURED WITHIN CONTAINER

R

ALL AVAILABLE SPACE HAS BEEN UTILIZED EFFICIENTLY

R

PROHIBITED MATERIALS HAVE BEEN EXCLUDED (SEE BELOW)

R

PACKAGING HAS NOT BEEN DAMAGED DURING LOADING

R

LINER IS IN PLACE AND PROPERLY LAPPED AND SEALED

R

PROHIBITED MATERIALS

R

COMPRESSED GASES

R

(UNPUNCTURED AEROSOL CANS INCLUDED)

R

EXPLOSIVES

R

FREE LIQUIDS

R

FINE PARTICULATES (RESPIRABLE FINES)

R

HAZARDOUS WASTE

R

CORROSIVE MATERIALS

WASTE CRITERIA GUIDELINES
Figure 1

000412

R - MATERIAL REVISED, ADDED, OR DELETED.

WESTINGHOUSE MATERIALS
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1807

PRODUCTION
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PROCEDURE

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DISPOSAL

SOP 20-C-601

Section: Waste Operations
Plant: All

Authorization: R. L. Gardner

Supersedes: None

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CARD XX ITEM PRODUCTION/CERTIFICATION/IDENTIFICATION 102144

P. O. NO.	SOURCE	CLASS	MATERIAL TYPE	LOT SEQUENCE NO.	DATE			SHIFT	BADGE NO.	DRUM NO.
					MO	DAY	YEAR			
SEAL NUMBER		SEAL DATE			PACKAGE PHYSICAL CERTIFICATION			PLANT	PROD. MBA	GROSS WEIGHT
		MONTH	DAY	YEAR	YES NO					
					EMPTY DRUM AT START					
					RUST HOLES OR DENTS					
WASTE DESCRIPTION AND COMMENTS					MATERIAL IS AS CODED			PLANT TO	MBA TO	TARE WEIGHT
					PROHIBITED MATERIALS					
PACKAGE TYPE					LIQUIDS IN CONTAINER					
PACKAGE SIZE					LINER SEALED					
					OVERPACK SECURED					NET WEIGHT

102144

GENERATOR SIGNATURE
FMPC-ES&H-1945-XX (REV. 8/12/87)

SUPERVISOR SIGNATURE

DATE

ITEM PRODUCTION/CERTIFICATION/IDENTIFICATION
FORM NO. FMPC-ES&H-1945-XX
Figure 2

R - MATERIAL REVISED, ADDED, OR DELETED.

000413

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BOX TARE WEIGHT CHECK

BOX NO.	DATE	TARE WEIGHT (LBS.)	BADGE NO.

FMPC-PRO-2867

BOX TARE WEIGHT CHECK
FORM FMPC-PRO-2867
Figure 3

000414

R - MATERIAL REVISED, ADDED, OR DELETED.

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R

Figure 4 - DELETED

R - MATERIAL REVISED, ADDED, OR DELETED.

000415

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RECORD OF ISSUE/REVISIONS

<u>PAGE</u>	<u>DATE</u>	<u>DESCRIPTION AND AUTHORITY</u>
1 thru 11	07-07-87	Procedure requirement for packaging waste for off-site disposal per Request No. P87-151, initiated by K. J. Dunbar.
1, 3 thru 7, 9	12-21-87	Revised procedure to incorporate audit recommendations per Request No. P87-229, initiated by J. E. Harmon.
1 thru 1A, 3 thru 5, 6 thru 6B, 7 thru 11	07-25-88	Revised to incorporate CIOs C88-081, C88-097, C88-098, C88-099, C88-100, and C88-101 per Request Nos. P88-162, P88-171, P88-172, P88-173, P88-174, and P88-175.

LIST OF EFFECTIVE PAGES

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Authorization: R. L. Gardner <i>[Signature]</i>	Supersedes: None	Issue Date: 07-07-87	

1.0 PURPOSE

This procedure establishes the criteria for low level radioactive waste shipment preparation.

2.0 APPLICABILITY

This procedure shall apply to preparation for shipment of material designated as low level radioactive waste for shipment off-site.

3.0 RESPONSIBILITIES

- 3.1 The Waste Operations supervisor shall be responsible for coordinating and notifying supporting organizations of assistance as required per this SOP, determining disposition of items as defined in this SOP, ensuring packaging materials are available for operators, designating area for rejected containers, and ensuring personnel are trained in this SOP.
- 3.2 The Environmental and Radiological Monitoring Technician (ERMT) shall be responsible for survey of each container classified as low level radioactive waste.
- 3.3 Materials Control and Accountability Section shall coordinate documentation preparation for a waste shipment.
- 3.4 The operator is responsible for shipment preparation per this SOP.

4.0 DEFINITION

- 4.1 ERMT - Environmental, Radiological Monitoring Technician.
- 4.2 Waste Generator - Organization (point of generation) at which waste is originated.
- 4.3 L-LRW - Low Level Radioactive Waste
- 4.4 Transport Index - A dimensionless (rounded up to the first decimal place) number placed on the label of a package to designate the degree of control to be exercised by those handling the package. The number is from the higher of the two following derivations: (1) the maximum radiation level (in m R/h) at one meter from the package; and (2) for fissile Class II and III shipments, an index is calculated for criticality control purposes.

5.0 REFERENCES

SOP-01-105, "Packaging of Contaminated Wood Pallets for Shipment"

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6.0 INDUSTRIAL HEALTH AND SAFETY REQUIREMENTS

- 6.1 Safety glasses with side shields shall be worn unless other eye protection is specified.
- 6.2 Proper respiratory protection shall be worn when dusty conditions exist as specified by the ERMT for radioactive contaminants or by IH&S personnel for chemical air contaminants.
- 6.3 Leather palmed gloves shall be worn to protect the hands from rough material and contamination.
- 6.4 HEPA type filter vacuum cleaners or a vacuum system approved by ES&H shall be used.
- R 6.5 Any circumstance which could have resulted in an intake of radioactive
R materials by inhalation, ingestion or absorption shall immediately be
R reported to a supervisor. The supervisor shall immediately report the
R circumstance of possible radioactive materials intake to Environmental and
R Radiation Monitoring for evaluation. The involved employees shall report
R to Medical Services at the end of their shift to submit a urine sample and
R again report at the start of their next shift to submit another urine
R sample.

7.0 PROCEDURE

7.1 Waste Shipment Arrival At Waste Operations Staging Area

- 7.1.1 Move waste shipment to Waste Operations staging area.
- 7.1.2 Check the container for significant damage such as dents, rust, holes, cracks, and defects. Notify supervisor for disposition. Move rejected containers to designated area.
- R 7.1.3 Check container to ensure that the Waste Certification Specialist's
R sticker is present. Notify supervisor if sticker is missing.
- R 7.1.4 Notify supervisor to request the Waste Certification Specialist to
assign shipment log number and container identification number.

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7.0 PROCEDURE (cont.)

- R 7.1.5 Stencil or mark assigned shipment log number and container identification number in 1 inch (minimum) block or legible letters with black waterproof ink on the top center and/or side of container.
- R 7.1.6 Notify ES&H for an ERMT to survey container.
- R 7.1.7 Affix LSA (Low Specific Activity) or LQ (Limited Quantity) labels to container as specified by the Waste Certification Section of MC&A.

7.2 Drum Shipment Preparation

- 7.2.1 Torque lock ring bolt to 45 ft-lbs.
- 7.2.2 Securely tighten the locking nut against the threaded flange (right flange) (See Figure 1).
- 7.2.3 Dab bolt flange assembly with red paint as a visual code designating that the tightening procedure has been completed.
- R 7.2.4 Thread safety wire through hole in either the bolt head or threaded portion of bolt and around threaded portion of bolt ring and fasten (See Figure 2).
- 7.2.5 Touch-up paint scratches on container.
- 7.2.6 Check drums for moisture. Remove moisture with rag and dispose of rag in designated container.

7.3 Wooden Box Shipment Preparation

- 7.3.1 Band the box vertically with three 1-1/4 inch metal bands. One band on both ends of box and one in the middle (See Figure 3 for Band Location).
- 7.3.2 Check box for moisture. Remove moisture with rag and dispose of rag in designated container.
- 7.3.3 Apply CONTECH PL-500 adhesive, or equivalent, in a continuous bead 1/4 inch minimum to 1/2 inch maximum on top edges of vertical 3/4 inch panel.
- 7.3.4 Fasten top using 10 penny nails on three inch centers and in addition drive two 30 penny galvanized nails through side panel into each 2 inch x 4 inch on top panel (eight places).

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Title: LOW LEVEL RADIOACTIVE WASTE
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SOP 1-C-602

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Authorization: R. L. Gardner

Supersedes: None

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7.0 PROCEDURE (cont.)

7.4 Metal Box Shipment Preparation

7.4.1 Check the box for significant damage such as dents, rust, holes, cracks, and defects. Notify supervisor for disposition. Move rejected boxes to designated area.

R 7.4.2 Check box for drain hole/plug. If a drain hole/plug is present, tighten
R the drain plug. Paint red dot on lower left hand front of box to
R indicated plug has been tightened. If drain hole/plug is not present,
R proceed to 7.4.3.

R WARNING: IF THERE IS A DRAIN HOLE BUT NO PLUG, CONTACT SUPERVISOR.

7.4.3 Band box with two metal bands 1-1/4 inch wide x .044 inch thick mangus P/W (painted/waxed), tensile strength of 7,610 lbs, 5.3 ft/lb, 100 lbs/coil, located equidistance from center.

7.4.4 For box with edge type pins, insert pins through the straps located on the upper perimeter of the box so that the locking notches are below the straps.

7.4.5 For box with bolt type closure, insert self-tap hex-head bolt through flange on lid and the hole on the top of the box.

7.4.6 Tighten hex-head bolts with an impact or socket wrench.

7.4.7 Touch-up paint scratches.

7.4.8 Check box for moisture. Remove moisture with rag and dispose of rag in designated container.

7.5 Pre-Final Container Preparation For All Types of Containers.

7.5.1 Move waste shipment container to designated temporary staging area and cover with tarp or equivalent cover.

7.5.2 Coordinate with Transportation to determine completion of shipment documentation.

7.5.3 After verifying documentation move the shipment to shipping lanes for final preparation.

7.6 Drum Shipment Final Preparation

7.6.1 Check drum for significant damage such as dents, rust, holes, cracks, and defects. Notify supervisor for disposition. Move rejected drums to designated area.

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7.0 PROCEDURE (cont.)

- 7.6.2 Verify the existence and clarity of the shipment log number and container identification number and that they are marked in 1 inch (minimum) letters using black waterproof ink.
- 7.6.3 Verify gross weight is marked on each drum.
- 7.6.4 Verify jam nut is locked to opposite side of bolt head with flat side against ring harness.
- 7.6.5 Check for a red dot on bolt to signify torque has been applied.
- 7.6.6 Verify safety wire installed on bolt.
- 7.6.7 Touch-up paint scratches.
- 7.6.8 Check for moisture on drum. Remove moisture with rag and dispose of rag in designated container.

7.7 Wooden Box Shipment Final Preparation

- 7.7.1 Check box for significant damage such as holes, cracks, or defects. Notify supervisor for disposition. Move rejected box to designated area.
- 7.7.2 Verify the existence and clarity of the shipment log number and container identification number and that they are marked in 1 inch (minimum) letters using waterproof ink.
- 7.7.3 Verify gross weight is marked on each box.
- 7.7.4 Verify that three metal bands are secure and located vertically with one in the center and the remaining two equidistance from the center.
- 7.7.5 Check for moisture on box. Remove moisture with rag and dispose of rag in designated container.

7.8 Metal Box Shipment Final Preparation

- 7.8.1 Check for significant damage such as dents, rust, holes, cracks, and defects. Notify supervisor for disposition. Move container to designated area.
- 7.8.2 Verify drain plug secure by checking for red paint dot on the lower left hand front of box.
- 7.8.3 Verify wedge type pins (if used) are secure.

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Authorization: R. L. Gardner	Supersedes: None	Issue Date: 07-07-87	

7.0 PROCEDURE (cont.)

- 7.8.4 Verify bolt type locking devices (if used) are secure.
- 7.8.5 Verify the existence and clarity of the shipment log number and container identification number and that they are marked in 1 inch (minimum) letters using black waterproof ink.
- 7.8.6 Verify gross weight is marked on box.
- 7.8.7 Verify two bands are located vertically on box, secure, and equidistant from center.
- 7.8.8 Touch-up paint scratches.
- 7.8.9 Check for moisture on box. Remove moisture with rag and dispose of rag in designated area.

7.9 Bulk Shipment Final Preparation

- 7.9.1 Check items or material for visible loose contamination. Notify supervisor of condition.
- 7.9.2 Check parcel or package for containment (Refer to items 7.1.1 thru 7.1.6 for requirements). When packaging wooden pallets, refer to SOP-01-105, "Package of Wooden Pallets."
- 7.9.3 Verify the existence and clarity of markings for gross weight, shipment log number, and package identification number on package.
- 7.9.4 Check that package has no sharp protruding objects which could puncture transport vehicle lining. Notify supervisor of condition. Move rejected package to designated area.
- 7.9.5 Check for moisture on package. Remove moisture with rag and dispose of rag in designated container.

7.10 Final Documentation Prior to Loading

- 7.10.1 The Waste Operations Supervisor shall notify the Materials Control and Accountability Waste Certification Specialist and designated Engineer and together with Waste Operations Supervisor shall authorize the release of each shipment by signing the Waste Shipment Authorization Checklist, Form No. FMPC-PRO-2868 (See Figure 4).

R

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7.0 PROCEDURE (cont.)

7.10.2 Notify Nuclear Materials Control and Accountability Section for a designated individual to affix to each container and authorize by a package signature the certification sticker NV-211.

7.10.3 Notify Transportation that shipment is ready for loading.

8.0 APPLICABLE FORMS

8.1 Form No. FMPC-PRO-2868, "Waste Shipment Final Authorization Checklist"

PRODUCTION
OPERATIONS
PROCEDURE

Title: LOW LEVEL RADIOACTIVE WASTE
(L-LRW) SHIPMENT PREPARATION

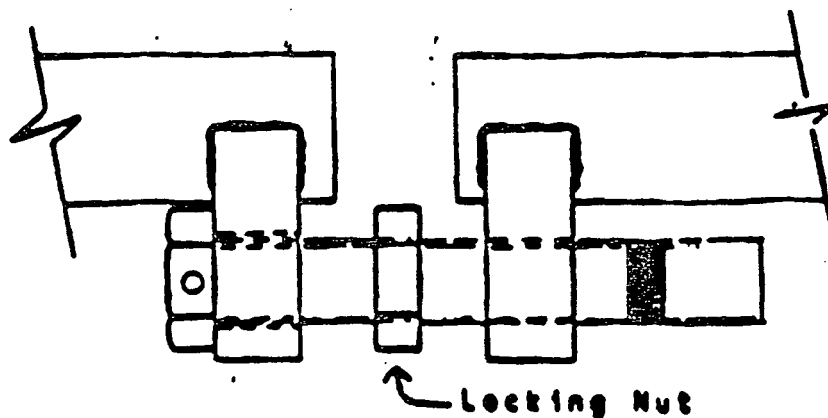
SOP 1-C-602

Section: Waste Operations
Plant: 1

Authorization: R. L. Gardner

Supersedes: None

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LOCK RING BOLT INSTALLATION

Figure 1

000424

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PRODUCTION
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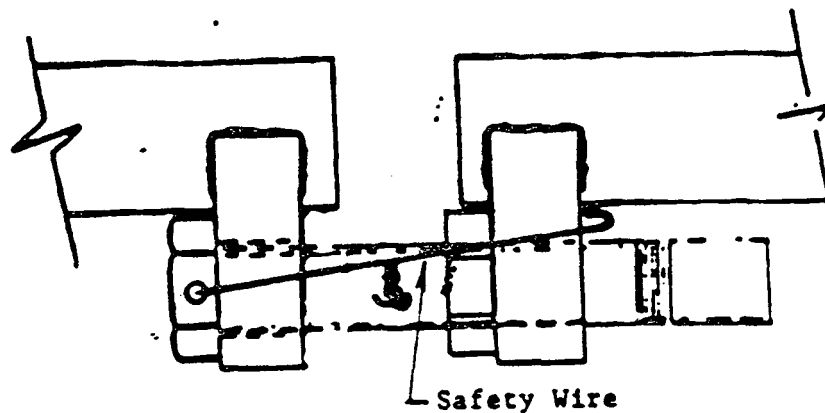
SOP 1-C-602

Section: Waste Operations
Plant: 1

Authorization: R. L. Gardner

Supersedes: None

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LOCK RING PAINT AND SAFETY WIRE INSTALLATION

Figure 2

R - MATERIAL REVISED, ADDED, OR DELETED.

000425

PRODUCTION
OPERATIONS
PROCEDURE

Title: LOW LEVEL RADIOACTIVE WASTE
(L-LRW) SHIPMENT PREPARATION

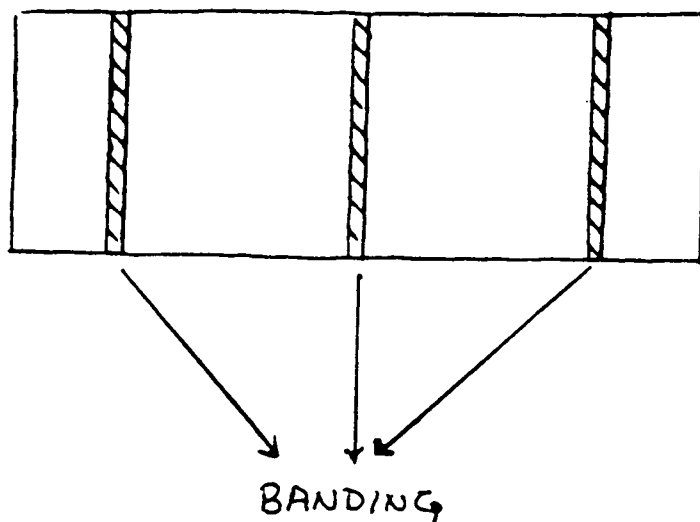
SOP 1-C-602

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BOX BANDING

Figure 3

PRODUCTION
OPERATIONS
PROCEDURE

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SOP 1-C-602

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Authorization: R. L. Gardner

Supersedes: None

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WASTE SHIPMENT FINAL AUTHORIZATION CHECKLIST

Shipment Number _____

Waste Description Code(s) _____

Waste Container Description(s)

Closure	Type	Dimensions	Tare Wt.	Approved	Badge No.
Pin & Gasket	Metal Box	43"Hx53"Wx77"L	629	_____	_____
Pin & Gasket	Metal Box	43"Hx53"Wx77"L	660	_____	_____
Bolt & Gasket	Metal Box	40"Hx53"Wx77"L	632	_____	_____
Nail & Silicone Adhesive	Wood Box	53 1/4"Hx48"Wx84"L	_____	_____	_____
Nail & Silicone Adhesive	Wood Box	29 1/4"Hx48"Wx48"L	_____	_____	_____
Bolt & Gasket	Steel Drum	80 gallon/OP	80	_____	_____
Bolt & Gasket	Steel Drum	55 gallon/OP	50	_____	_____
Steel Band(s)	Bulk	_____	_____	_____	_____
	Nonroutine	_____	_____	_____	_____
1. Exclusion of unauthorized materials.				_____	_____
2. Absence of free liquid, either inside or outside of container.				_____	_____
3. No significant container defects.				_____	_____
4. Proper closure of container lid.				_____	_____
5. Presence of red dot on bolts and drain plugs of container signifying torquing and/or tightening has been performed.				_____	_____
6. Pins are locked as indicated by the position of the locking notch.				_____	_____

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WASTE SHIPMENT FINAL AUTHORIZATION CHECKLIST (Sheet 1 of 2)
Form No. FMPC-PRO-2868
Figure 4

WESTINGHOUSE MATERIALS COMPANY OF OHIO - FMPC		Page 12 Page Revision Date:	6180
PRODUCTION OPERATIONS PROCEDURE	Title: LOW LEVEL RADIOACTIVE WASTE (L-LRW) SHIPMENT PREPARATION		SOP 1-C-602
			Section: Waste Operations Plant: 1
Authorization: R. L. Gardner		Supersedes: None	Issue Date: 07-07-87

Container Stencilled Identification:

Presence of: Shipment Number _____

Gross Weight _____

DOT Radiation Label _____

NV-211 Label _____

All information is stencilled in 1-inch block letters (minimum) and is located on the top center, and/or on side of containers.

LOADING INFORMATION

Shipment Loaded: _____ Time: _____ Date: _____

Comments: _____

I hereby certify that the above checklist has been completed and witness that all items are correct to the best of my knowledge.

Signed: _____ Company: _____
(Certification Officer)

Date: _____ Date: _____

Signed: _____ Signed: _____
(Waste Operations Supervisor) (Engineer)

Copies to: Waste Operations
Waste Certification (MC&A)

WESTINGHOUSE MATERIALS COMPANY OF OHIO - FMPC		Page 13 Page Revision Date: 01-05-88	6180
PRODUCTION OPERATIONS PROCEDURE	Title: LOW LEVEL RADIOACTIVE WASTE (L-LRW) SHIPMENT PREPARATION	SOP 1-C-602	
		Section: Waste Operations Plant: 1	
Authorization: R. L. Gardner		Supersedes: None	Issue Date: 07-07-87

RECORD OF ISSUE/REVISIONS

<u>PAGE</u>	<u>DATE</u>	<u>DESCRIPTION AND AUTHORITY</u>
1 thru 13	07-07-87	Procedure requirement for low level (L-LRW) shipment preparation per Request No. P87-150, initiated by K. J. Dunbar.
2 thru 4, 6	01-05-88	Revised to incorporate recommendations from QA/internal audit per Request No. P87-230, initiated by J. E. Harmon.

LIST OF EFFECTIVE PAGES

<u>PAGE</u>	<u>DATE</u>
1	07-07-87
2 thru 4	01-05-88
5	07-07-87
6	01-05-88
7 thru 12	07-07-87
13	01-05-88

WESTINGHOUSE MATERIALS COMPANY OF OHIO - FMPC		Document Number: WMCO-QAP-12.09
QUALITY ASSURANCE DEPARTMENT PROCEDURE	Subject: PACKAGE INSPECTION, SEALING AND CERTIFICATION	Revision: 0
	Authorized: (Quality Assurance Manager) <i>J. A. Gump</i>	Page <u>1</u> of <u>30</u>
		Effective Date: 3/28/88

This procedure was formerly issued as ESH-P-21-002, Rev. 0 (5/8/87). It has been transferred to a QAP for immediate use without changing the format or content of the procedure. The next revision will incorporate any outstanding change requests and will conform to the format requirements of QAP-2.01.

1.0 POLICY

This procedure outlines the method by which certification of waste materials is performed prior to offsite shipment.

2.0 SCOPE

This procedure applies to Waste Certification Officers.

3.0 DEFINITIONS

3.1 LLWPSS - Low Level Waste Processing Storage and Shipping System.

3.2 Hazardous Waste - Those materials as identified in 40 CFR 261.

4.0 RESPONSIBILITIES

4.1 The Waste Certification Officer shall be responsible for performing their work according to this standard operating procedure.

4.2 The Waste Certification Administrator shall ensure compliance with this standard operating procedure.

5.0 GENERAL

5.1 Designated packages of low-level waste are placed in a selected inspection lane where they are opened and inspected by a Certifying Official in accordance with the LLWPSS Certification Checklist (Table I).

5.2 The inspected load is transported to an assigned load lane in the staging area where, after a final inspection, it is placed on a trailer for shipment.

5.3 The proper protective clothing as well as safety glasses are to be worn at all times.

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- 5.4 Leather-palm gloves shall be worn whenever packages are handled.
- 5.5 Smoking, eating or drinking are not permitted.
- 5.6 A half-mask respirator equipped with purple radionuclide cartridges as specified by the ERM Technician shall be conveniently available for each person working in the inspection area and must be used whenever the possibility of airborne contamination is encountered.
- 5.7 Any circumstance or event which could result in any intake of radioactive materials by inhalation, ingestion or absorption, shall be reported to a supervisor immediately. All involved personnel shall report to the Medical Department and submit a urine sample for analysis, both at the end of the shift during which the event occurred and at the beginning of their next shift. The supervisor shall immediately inform the Environmental and Radiological Monitoring Technician of the situation and file a Minor Event Report before the end of the shift during which the event occurred.

6.0 PROCEDURE

- 6.1 The Certifying Official will inspect each package in accordance with the LLWPSS Certification Checklist (Table I).
- 6.2 Rejected lids, rings and containers shall be handled per conditions listed in Table I Section 6.0 (Rejects) of the LLWPSS Certification Checklist.
- 6.3 For certification of hazardous waste, the following tasks are required:
 - 6.3.1 Waste packages must be certified according to DOT requirements (Table I Section 1.0) and K-25 Waste Acceptance Criteria (See Attachment M).
 - 6.3.2 Verify that a "chain of custody" tamperproof seal (Attachment O) is placed across the bung of the waste package.
 - 6.3.3 Complete the "Hazardous Waste" label (Attachment B) from information provided by the "Compliance Form" (Attachment A). Sign and attach a "Hazardous Waste" label to each waste package.
 - 6.3.4 Labels are assigned to the waste packages according to the criteria in Table I Section 5.0 (Marking).
 - 6.3.5 The container checklist (Attachment C) must be completed for record keeping along with a copy forwarded to the Transportation Department.

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TABLE I

LLWPSS CERTIFICATION CHECKLIST

1.0 PACKAGE

1.1 Drum

1.1.1 General

- 1.1.1.1 If a drum is used as an exterior waste package (Ex. overpack), it must be a drum in good condition. If not, reject the drum.
- 1.1.1.2 Drum color will be identified within the applicable SOP for that waste stream. If the drum color is not correct, reject the drum for redrumming.
- 1.1.1.3 The exterior container for all waste packages shall be white.

1.1.2 Condition

- 1.1.2.1 Examine all surfaces of the drum and reject the drum for redrumming or overpacking, if any of the following conditions is encountered.
 - a) A breach
 - b) A bulge in the drum's surface which causes creasing of the metal.
 - c) A dent causing the painted surface to be scraped or cracked.
 - d) A dent involving the top or bottom side and/or top or bottom rim of the drum.
 - e) A dent extending more than four (4) inches in any direction.
 - f) A significant dent involving the rolling hoops.
 - g) Rust or scraped paint as defined in this section.

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1.0 PACKAGE (Continued)

1.1 Drum (Continued)

1.1.2 Condition (Continued)

1.1.2.2 Scraped Paint and Rust

1.1.2.2.1 With minor scraped paint will be touched up with paint matching the original color.

1.1.2.2.2 With significant scraped paint will be rejected.

1.1.2.2.3 With rust causing exfoliation (scale), reject the drum for redrumming.

1.1.2.3 Top and Bottom rim along with bottom side.

1.1.2.3.1 Reject for redrumming if there is any deformation or out of round condition.

1.2 Drum Lid

1.2.1 Color

1.2.1.1 Lid color will match drum color which will be identified within the applicable SOP for that waste stream. If the lid color is not correct, reject it.

1.2.2 Condition

1.2.2.1 Reject for new lid if there is serious rust, rust causing scaling, dents, holes or tears.

1.2.2.2 Waste containers designated for burial.

1.2.2.2.1 Reject for new lid if it lacks a domed appearance or has any bungs or any deformation of the sealing surface.

1.2.2.3 Waste containers with waste designated for incineration

1.2.2.3.1 Reject for new lid if there are any deformation and if it lacks domed appearance and a bung.

1.2.2.4 Minor dents not involving the rim or sealing surface are acceptable.

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1.0 PACKAGE (Continued)

1.2 Drum Lid (Continued)

1.2.2 Condition (Continued)

1.2.2.5 Reject for new lid if there is significant scraped paint.

1.2.2.5.1 Refer to Table I, paragraph 1.1.

1.3 Closing Ring

1.3.1 Bolt Ring

1.3.1.1 Minimum 5/8 inch bolt diameter.

1.3.1.2 One flange of ring must be threaded.

1.3.1.3 Flanges must be forged and securely welded to the ring.

1.3.1.4 Reject the bolt ring for any deficiencies.

1.3.2 Lever Ring

1.3.2.1 Lever must work freely and provide secure closure of the drum.

1.3.2.2 The ring may not be deformed in any manner which would cause inadequate closure of the drum.

1.3.2.3 Reject the ring for any deficiencies.

1.4 Plywood Boxes

1.4.1 Construction

1.4.1.1 Boxes shall be well constructed of plywood with a heavy wood frame work.

1.4.1.2 Boxes shall be free of all defects and voids between the plywood panels and frame work.

1.4.1.3 Edges of side and end panels must be flush within 1/16 inch of the bottom of the box.

1.4.1.4 The interior of the box must be free of protruding fasteners and split lumber.

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1.C PACKAGE (Continued)

1.4 Plywood Boxes (Continued)

1.4.1 Construction (Continued)

1.4.1.5 Each box shall be labeled, on opposite sides, with the manufacturer's name and shipping box serial number.

1.4.1.6 The interior of the box must be free of moisture prior to filling.

1.4.1.7 Lids shall fit snugly into the top recesses of the box and must be free of all warping and voids.

1.4.1.8 Before filling, each box shall have three (3) metal straps (1 1/2" width, 16 Gauge) secured horizontally around the perimeter with equidistant spacing.

1.4.2 If any criterion in Section 1.4.1 is not met, reject the box.

1.5 Six-Pack Steel Boxes

1.5.1 Construction

1.5.1.1 Each box shall be well constructed of steel with all seams adequately welded.

1.5.1.2 The boxes shall be free of holes, dents or other defects.

1.5.1.3 A secure sealing, locking lid shall be used on each box.

1.5.1.4 The exterior container for all waste packages shall be white.

1.5.1.5 Drain plug if present shall be tightened. A red dot on the lower left hand front of box shall indicate this has been done.

1.5.2 If any criterion in Section 1.5.1 is not met, reject the box.

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2.0 PAPERWORK

- 2.1 The Certification Officer assigns a shipment number and package number to each waste package and records this information on the LLWPSS Shipping Report Form #FMPC-WM-497 (Attachment D).
- 2.2 The total truck load weight shall not exceed 42,000 pounds. The Certification Officer will verify with the Production Operations Plant 1 shift supervisor on the allowable capacity for each waste container.
- 2.3 All paperwork is forwarded to the Waste Shipment Data Entry Clerk for preparation of form RE0166/0167 (Attachment E).
- 2.4 Once paperwork is processed by the data entry clerk, a copy of the LLWPSS Shipping Report (Attachment D) is sent back to the Certification Officer.
- 2.5 The Certification Officer will verify that drum labeling is consistent with the LLWPSS Shipping Report (Attachment D) information provided by the Waste Certification Administrator.

3.0 CONTENTS

3.1 Drums

- 3.1.1 Each drum is to be opened and visually inspected to verify the contents are in agreement with the labeling (material type coding) on the drum. Drum contents will also be visually inspected to verify there are no free liquids present. Drum probing criteria are outlined in paragraphs 3.1.2 thru 3.1.8.
- 3.1.2 Each waste stream will be evaluated by MC&A prior to the initial certification to determine the extend of probing required to verify material consistency and moisture content (i.e., presence of free liquid).
- 3.1.3 MC&A will maintain written justification for those waste streams which have been determined not to require probing.
- 3.1.4 Probing may also be used at any time for further examination of questionable drums (e.g., inconsistency in color or texture).
- 3.1.5 All probing conducted will be documented on the LLWPSS Probing Documentation (Attachment F) and the record be maintained by Waste Operations and MC&A.

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3.0 CONTENTS (Continued)

3.1 Drum (Continued)

3.1.6 Initial and Sample Probing

3.1.6.1 The first 200 drums of the waste stream (material type) that require probing will be probed a minimum of five (5) times.

3.1.6.2 After the first 200 drums are probed, additional probing (minimum 5 times) will be done per LLWPSS Probing Schedule (Attachment G).

3.1.7 Rejected drums will be marked per paragraph 6.1 (Table I). Should a small amount of free-liquid be present on the surface of an otherwise acceptable drum of waste, the drum will be sent to Plant 8 where the waste material will be dried and repackaged. In some cases an appropriate amount of diatomaceous earth (or similar absorbent) may be added to ensure any remaining free liquid is absorbed.

3.1.8 Any special handling or treatment applied to waste drums will be identified on the LLWPSS Nonconformance Report (Attachment L). This report shall be maintained by Waste Certification.

3.2 Wooden Boxes

3.2.1 Each box is to have a plywood insert in the bottom to act as a cushion for the rubble. A plastic liner must be placed in each box prior to filling.

3.2.2 Depending upon the moisture content of the soil being shipped, two (2) or three (3) bags of diatomaceous earth (i.e., Diacalite) are placed in the bottom of the box.

3.2.3 Approximately three (3) inches of contaminated soil are placed in the box.

3.2.4 Contaminated concrete pieces are then placed in the box with the smoothest side down.

3.2.5 Contaminated soil shall be added to fill voids and cushion the concrete pieces.

3.2.6 Boxes should be filled to a maximum weight of 3,500 pounds.

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3.0 CONTENTS (Continued)

3.3 Six-Pack Steel Boxes

- 3.3.1 Steel boxes are used as overpack containers for previously inspected drums; therefore, no further inspection of the contents is required.
- 3.3.2 The gross weight is calculated using the sum of the gross weights of the contained drums and the tare weight of the box; this gross weight should not exceed 6,000 lbs.

4.0 CLOSURE

- 4.1 The Certification Officer shall verify the following tasks are performed for drum closure:

- 4.1.1 If a plastic liner is present it must be folded in such a manner as to cover the surface of the material in an inner drum.
- 4.1.2 A foam rubber gasket must be placed on the sealing surface of the lid on the outer drum.
- 4.1.3 The lid is carefully placed on the drum.
- 4.1.4 For interior (overpacked) drums, a lever ring shall be used for closure.
- 4.1.5 A wire tamperproof seal shall be applied to the lever ring in such a manner that the ring may not be opened without breaking the seal. The Certification Officer shall record the seal number on the LLWPSS Shipment Report Form #FMPC-WM-497 (Attachment D).
- 4.1.6 For exterior (overpack) drums a bolt ring shall be secured for closure. The bolt ring shall be secured using the following steps (see Attachment H).
 - 4.1.6.1 The locking nut is placed in a neutral position.
 - 4.1.6.2 A torque wrench is used to torque the bolt to between 45 and 55 ft-lbs.
 - 4.1.6.3 The locking nut is tightened snugly against the bolt head side of the bolt ring.
 - 4.1.6.4 The bolt and bolt head are paint brushed (in red) to indicate that the bolt ring has been properly torqued and locked.

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4.0 CLOSURE (Continued)

4.2 The Certification Officer shall verify the following tasks are performed for wooden box closure:

- 4.2.1 The plastic liner is closed in such a manner as to dispel any trapped air; twist the liner and seal with plastic tape.
- 4.2.2 A silicone adhesive compound is applied to the sealing surface of the lid.
- 4.2.3 The lid is placed carefully on the box.
- 4.2.4 The lid is nailed in place.
- 4.2.5 Two (2), equidistantly spaced, metal straps are secured around the box vertically.

4.3 The Certification Officer shall verify the following tasks are performed for six-pack boxes:

4.3.1 Pin Type Box

- 4.3.1.1 A foam rubber gasket must be placed on the sealing surface of the lid.
- 4.3.1.2 The lid is carefully placed on the box.
- 4.3.1.3 The pins must be inserted through the welds located on the upper perimeter of the box so that the locking notches are below the welds. Locking notches must not be flush with the welds.
- 4.3.1.4 If for any reason the box must be reopened, it cannot be reused for shipment.

4.3.2 Bolt Type Box

- 4.3.2.1 A foam rubber gasket must be placed on the sealing surface of the lid.
- 4.3.2.2 The lid is carefully placed on the box.
- 4.3.2.3 The self tap hex-head bolt must be inserted through the flange on the lid and the hole on the top of the box.
- 4.3.2.4 The hex-head bolts must be tightened with an impact wrench.

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5.0 MARKING

- 5.1 Each acceptable package shall have a "Radioactive - L.S.A" label (Attachment I), if the surface dose rate exceeds 0.5 mR/hr.
- 5.2 Each acceptable package shall have a "Radioactive - LIMITED QUANTITY" label FMPC-T-1623-1 (Attachment J) if the surface dose rate is less than 0.5 mR/hr.
- 5.3 Each "Radioactive Limited Quantity" package must have a DOT required Package Certification Label FMPC-PRO-1623-2 (Attachment J).
- 5.4 Each acceptable package must have a required "Packaging Certification" label, NV-211 (Attachment K).
- 5.5 Each acceptable package will have "FMPC", the shipment number, package number, and gross weights properly marked on the outside.
- 5.6 Any marking deficiencies must be corrected or the package rejected. Rejected packages shall be handled per conditions listed in Table I Section 6.0 (Rejects) of the LLWPSS Certification Checklist SOP.
- 5.7 It is the responsibility of the Certification Officer to verify all required labels are correct and in place on an acceptable package before that package is loaded for shipment.

6.0 REJECTS

- 6.1 Any drums rejected due to condition will be sent to the drum reconditioning area.
- 6.2 Any waste packages other than drums rejected due to condition shall be handled as directed by the Waste Operations Plant 1 shift supervisor.
- 6.3 Any lids, bolt rings or lever rings rejected for defects shall be disposed of as scrap.
- 6.4 Any waste package rejected due to non-acceptable or non-authorized contents shall have a laminated tag attached to it as identification. These rejected packages are recorded on the LLWPSS Nonconformance Report Form (Attachment L). These packages will be staged in an area as directed by the Waste Operations Plant 1 shift supervisor to be disposed of by other means.
- 6.5 Any waste package rejected due to improper labeling or identification shall have a laminated tag attached to it as identification. These rejected packages are recorded on the LLWPSS Nonconformance Report Form (Attachment L). These packages will be staged in a holding zone as directed by the Production supervisor until corrections can be made. Once corrections are completed, these waste packages may be shipped offsite.

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7.0 LOADING

- 7.1 Once paperwork is processed by Materials Control and Accountability (MC&A), a copy of the LLWPSS Shipping Report (Attachment D) is sent back to the Certification Officer. At this time the Certification Officer assigns labels to the waste packages according to the criteria in Table I Section 5.0 (Markings) of the LLWPSS Certification Checklist.
- 7.2 The Certification Officer will observe the waste shipment as it is taken from the staging area. The Certification Officer will visually verify continuity of the load between the staging area and the loading area.
- 7.3 The Certification Officer shall verify all markings and stickers on the shipment (i.e., weight, shipment number, container number, NV-211, LSA, etc.).
- 7.4 The Certification Officer shall complete the Waste Shipment Final Authorization Checklist (Attachment N).
 - 7.4.1 The Waste Shipment Final Authorization Checklist is submitted to Waste Operation Supervisor for signature.
 - 7.4.2 The Waste Operation Supervisor will submit the completed form to the Waste Certification Administrator.
- 7.5 The Transportation Section will assume responsibility for a shipment when it is loaded on to a trailer.
 - 7.5.1 The Transportation Section will verify the shipment with the information on forms RE0166/0167.
 - 7.5.2 The Transportation Section shall inspect the shoring and bracing of the shipment to ensure no movement during transit.
 - 7.5.3 The Transportation Section will complete the Offsite Loading-Tie Down Inspection-Vehicle Inspection form NLO-PUR-2495 (Attachment P) to ensure compliance with DOT requirements in Title 49, Code of Federal Regulations.

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8.0 FORMS USED

Compliance Form	Attachment A
EPA-DOT Label	Attachment B
Container Checklist	Attachment C
LLWPSS Shipping Report, FMPC-WM-497	Attachment D
RE0166/0167	Attachment E
LLWPSS Probing Documentation	Attachment F
LLWPSS Probing Schedule	Attachment G
Bolt Ring Diagram	Attachment H
Radioactive LSA Label, M-206	Attachment I
Radioactive Limited Quantity/DOT Label, FMPC-T-1623-1	Attachment J
Certification Label, FMPC-WM-2334	Attachment K
LLWPSS Nonconformance Report	Attachment L
K-25 Waste Acceptance Criteria	Attachment M
Waste Shipment Final Authorization Checklist	Attachment N
"Chain of Custody" tamperproof seal	Attachment O
Offsite Loading - Tie Down Inspection Vehicle Inspection, NLO-FUR-2495	Attachment P

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ATTACHMENT A

APPROXIMATELY N _____ DRUMS LOCATED _____

ANALYSIS IS ATTACHED _____ NOT REQUIRED _____

EPA ID N SHIPPING DESCRIPTION HAZARD CLASS UN OR NA N

WASTE MANAGEMENT

REQUIREMENTS: _____

RC/A

SURVEY RESULTS

LSA _____ LD & Dot _____

NEED CLEANING NOT ACCEPTABLE _____

MULTI-USE ONLY

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ATTACHMENT B

EPA-DOT LABEL

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR
PUBLIC SAFETY AUTHORITY, OR THE
U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPER D.O.T.

SHIPPING NAME _____ UN OR NA# _____

GENERATOR INFORMATION:

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

EPA ID NO. _____ EPA WASTE NO. _____

ACCUMULATION START DATE _____ MANIFEST DOCUMENT NO. _____

HANDLE WITH CARE!
CONTAINS HAZARDOUS OR TOXIC WASTES

STYLE WM-4

© LABELMASTER, CHICAGO, IL 60676

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ATTACHMENT C

CONTAINER CHECKLIST

Name _____ Date _____ Manifest # _____

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THE LIBRARY OF THE

LLWPSS SHIPPING REPORT

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ATTACHMENT E

PFC-100 ASD

Beverly's Start-Up and Engineering Co., Inc.
Beverly's Start-Up and Engineering Co., Inc.
Beverly's Start-Up and Engineering Co., Inc.04/16/87
12:00:10SUBJECT: Construction Report
Construction ReportProject of: *Chalk*
Site: *Chalk*
Date: *4/16/87*
By: *Chalk*
For: *Chalk*

SECTION 1									
NO.	DESCRIPTION	QTY	UNIT	PRICE	TOTAL	QTY	UNIT	PRICE	TOTAL
1	Excavate	100	cu yd	1.00	100.00	100	cu yd	1.00	100.00
2	Backfill	100	cu yd	1.00	100.00	100	cu yd	1.00	100.00
3	Gravel	100	cu yd	1.00	100.00	100	cu yd	1.00	100.00
4	Asphalt	100	sq yd	1.00	100.00	100	sq yd	1.00	100.00
5	Concrete	100	cu yd	1.00	100.00	100	cu yd	1.00	100.00
6	Rebar	100	lb	1.00	100.00	100	lb	1.00	100.00
7	Formwork	100	sq ft	1.00	100.00	100	sq ft	1.00	100.00
8	Paint	100	gal	1.00	100.00	100	gal	1.00	100.00
9	Lighting	100	ft	1.00	100.00	100	ft	1.00	100.00
10	Signage	100	sq ft	1.00	100.00	100	sq ft	1.00	100.00

SECTION 2									
NO.	DESCRIPTION	QTY	UNIT	PRICE	TOTAL	NO.	DESCRIPTION	QTY	UNIT
1	Excavate	100	cu yd	1.00	100.00	1	Excavate	100	cu yd
2	Backfill	100	cu yd	1.00	100.00	2	Backfill	100	cu yd
3	Gravel	100	cu yd	1.00	100.00	3	Gravel	100	cu yd
4	Asphalt	100	sq yd	1.00	100.00	4	Asphalt	100	sq yd
5	Concrete	100	cu yd	1.00	100.00	5	Concrete	100	cu yd
6	Rebar	100	lb	1.00	100.00	6	Rebar	100	lb
7	Formwork	100	sq ft	1.00	100.00	7	Formwork	100	sq ft
8	Paint	100	gal	1.00	100.00	8	Paint	100	gal
9	Lighting	100	ft	1.00	100.00	9	Lighting	100	ft
10	Signage	100	sq ft	1.00	100.00	10	Signage	100	sq ft

SECTION 3									
NO.	DESCRIPTION	QTY	UNIT	PRICE	TOTAL	NO.	DESCRIPTION	QTY	UNIT
1	Excavate	100	cu yd	1.00	100.00	1	Excavate	100	cu yd
2	Backfill	100	cu yd	1.00	100.00	2	Backfill	100	cu yd
3	Gravel	100	cu yd	1.00	100.00	3	Gravel	100	cu yd
4	Asphalt	100	sq yd	1.00	100.00	4	Asphalt	100	sq yd
5	Concrete	100	cu yd	1.00	100.00	5	Concrete	100	cu yd
6	Rebar	100	lb	1.00	100.00	6	Rebar	100	lb
7	Formwork	100	sq ft	1.00	100.00	7	Formwork	100	sq ft
8	Paint	100	gal	1.00	100.00	8	Paint	100	gal
9	Lighting	100	ft	1.00	100.00	9	Lighting	100	ft
10	Signage	100	sq ft	1.00	100.00	10	Signage	100	sq ft

SECTION 4									
NO.	DESCRIPTION	QTY	UNIT	PRICE	TOTAL	NO.	DESCRIPTION	QTY	UNIT
1	Excavate	100	cu yd	1.00	100.00	1	Excavate	100	cu yd
2	Backfill	100	cu yd	1.00	100.00	2	Backfill	100	cu yd
3	Gravel	100	cu yd	1.00	100.00	3	Gravel	100	cu yd
4	Asphalt	100	sq yd	1.00	100.00	4	Asphalt	100	sq yd
5	Concrete	100	cu yd	1.00	100.00	5	Concrete	100	cu yd
6	Rebar	100	lb	1.00	100.00	6	Rebar	100	lb
7	Formwork	100	sq ft	1.00	100.00	7	Formwork	100	sq ft
8	Paint	100	gal	1.00	100.00	8	Paint	100	gal
9	Lighting	100	ft	1.00	100.00	9	Lighting	100	ft
10	Signage	100	sq ft	1.00	100.00	10	Signage	100	sq ft

No: WMCO-QAP-12.09	Rev: 0	Date: 3/28/88	Page: 19 of 30

ATTACHMENT F

LLWPSS PROBING DOCUMENTATION

INDEX NO.: _____ ISSUE DATE: _____ REVISION DATE: _____ PAGE: _____

WASTE STREAM PROBING DOCUMENTATION

WASTE STREAM _____

LOT NUMBER _____

DRUM NO.	DATE	REMARKS

WASTE STREAM ONLY

No: WMCO-QAP-12.09

Rev: 0

Date: 3/28/88

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ATTACHMENT G

LLWPSS PROBING SCHEDULE

HDCN NO : 21-C-105 ISSUE DATE: 2/17/07 REVISION DATE: PAGE:

WASTE STREAM PROBING SCHEDULE

CODE: A - NONE REQUIRED

B - INITIAL PROBING ONLY *

C - SCHEDULE FOR PROBING REQUIRED

*After first 200 drums Certification Officer will inspect each drum to determine if further probing is required.

WASTE STREAM	CODE	SCHEDULE

MULTI-MATERIAL ONLY

No:
WMCO-QAP-12.09

Rev:
0

Date:
3/28/88

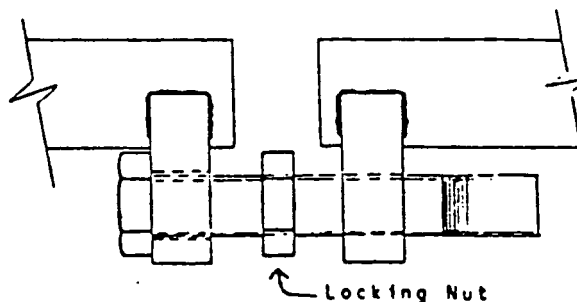
Page:
21 of 30

ATTACHMENT H

BOLT RING DIAGRAM

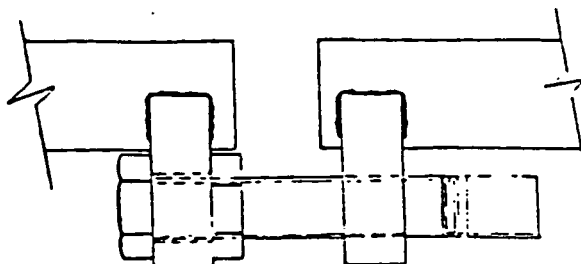
LLWPSS PACKAGE INSPECTION, SEALING AND CERTIFICATION

Install a bolt in the ring. Torque bolts to 45 lbs. to 55 lbs. minimum. Ensure that the "locking" nut is not in contact with either flange during this operation. It must be free to turn. (See figure 1.)



(figure 1)

Tighten locking nut against the flange upon which the bolt head is seated. (Left flange.) (See figure 2.)



(figure 2)

Dab bolt flange assembly with red paint as a visual code that tightening procedure has been completed.

No:
WMCO-QAP-12.09

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0

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ATTACHMENT I

RADIOACTIVE LSA LABEL, M-206

RADIOACTIVE MATERIAL
LSA, N.O.S.
UN2912

M-206 (REV 8/11/83)

No: WMCO-QAP-12.09	Rev: 0	Date: 3/28/88	Page: 23 of 30

ATTACHMENT J

RADIOACTIVE LIMITED QUANTITY LABEL
DOT PACKAGE CERTIFICATION LABEL

RADIOACTIVE MATERIAL LIMITED QUANTITY, NOS UN2910

FMPC 7-1102-1 (7/21/88)

FROM: FMPC

**This package conforms to the conditions
and limitations specified in 49 CFR 173.421
for excepted radioactive material, limited
quantity, n.o.s., UN-2910."**

FMPC PRO 1423-2 (12/18/88)

No: WMCO-QAP-12.09

Rev: 0

Date: 3/28/88

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ATTACHMENT K

CERTIFICATION LABEL, FMPC-WM-234

NV-211

PACKAGING CERTIFICATION

THIS CERTIFIES THAT THIS PACKAGE AND ITS
CONTENTS ARE IN ACCEPTABLE CONDITION FOR
TRANSPORTATION ACCORDING TO DOT & DOE/NV
REQUIREMENTS.

DATE: _____

CERTIFIED BY: _____

TITLE: _____ CERTIFICATION OFFICER

ORGANIZATION: _____ FMPC

FMPC-WM-234 (12/9/85)

No:	Rev:	Date:	Page:
WMCO-QAP-12.09	0	3/28/88	25 of 30

ATTACHMENT L

LLWPSS NONCONFORMANCE REPORT

LLMPSS NONCONFORMANCE REPORT

Waste Certification Location _____

[illegible]

No: WMCO-QAP-12.09

Rev: 0

Date: 3/28/88

Page: 26 of 30

ATTACHMENT M

K-1435 WASTE ACCEPTANCE CRITERIA

Date: October 1, 1986
Revision No.: 0

For routinely received wastes, the existing information on file will be reviewed and used to determine waste acceptance. If a process change has occurred, then complete predisposal waste analysis of the affected waste streams must be submitted by the generator and reviewed by the review team.

2.3 WASTE ACCEPTANCE CRITERIA

The review team will also determine if a waste can be accepted for disposal in the E-25 incinerator. Waste acceptance is determined by evaluating and then comparing the waste characterization data and shipment inspection results to waste acceptance criteria. The waste acceptance criteria are described below:

- All transport containers must comply with the Department of Transportation (DOT) Shipping Regulations (49 CFR) and DOE Order 5820.2, Radioactive Waste Management
- All material shall be packaged, labeled, and shipped per DOT, RCRA, and TSCA regulations
- A material safety data sheet must be supplied by the generator upon the request by ORCDP
- Chain-of-custody seals must be present on all containers and/or tanker truck valve ports upon receipt at ORCDP
- Individual shipping containers must not exceed the following health physics requirements:

Surface	10 $\mu\text{rem/hr}$
At two feet	2 $\mu\text{rem/hr}$
Transferrable contamination	1,000 dpm/100 cm^2 (beta, gamma)
	200 dpm/100 cm^2 (alpha)
- Uranium contaminated material with less than 1 percent ^{235}U must not exceed 0.06 curies per container. For materials containing enriched Uranium (^{235}U concentration greater than 1 percent of total isotope presence), U_2O_8 concentration cannot exceed 5 ppm of the waste.
- Waste must not exceed the values specified on Table 2-1, maximum acceptance levels
- Radionuclides not listed on Table 2-1 will be evaluated on a case-by-case basis
- Variances from the limits in Table 2-1 will be reviewed and considered on a case-by-case basis

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ATTACHMENT N
PAGE 1 OF 2

WASTE SHIPMENT FINAL AUTHORIZATION CHECKLIST

Shipment Number _____

Waste Description Code(s) _____

Waste Container Description(s)

Closure	Type	Dimensions	Tare Wt.	Approved	Badge #
Pin & Gasket	Metal Box	43"Hx53"Wx77"L	629	_____	_____
Pin & Gasket	Metal Box	43"Hx53"Wx77"L	660	_____	_____
Bolt & Gasket	Metal Box	40"Hx53"Wx77"L	632	_____	_____
Nail & Sili- cone Adhesive	Wood Box	53 1/4"Hx48"Wx84"L	_____	_____	_____
Nail & Sili- cone Adhesive	Wood Box	29 1/4"Hx48"Wx84"L	_____	_____	_____
Bolt & Gasket	Steel Drum	80 gallon/OP	80	_____	_____
Bolt & Gasket	Steel Drum	55 gallon/OP	50	_____	_____
Steel Band(s)	Bulk	_____	_____	_____	_____
	Nonroutine	_____	_____	_____	_____

1. Exclusion of unauthorized materials. _____
2. Absence of free liquid, either inside or outside of container. _____
3. No significant container defects. _____
4. Proper closure of container lid. _____
5. Presence of red dot on bolts and drain plugs of container signifying torquing and/or tightening has been performed. _____
6. Pins are locked as indicated by the position of the locking notch. _____

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ATTACHMENT N
PAGE 2 OF 2

Container Stencilled Identification:

Presence of: Shipment Number _____
Gross Weight _____
DOT Radiation Label _____
NV-211 Label _____

All information is stenciled in 1-inch block letters (minimum) and is located on the top center, and/or on side of containers.

LOADING INFORMATION

Shipment Loaded: _____ Time: _____ Date: _____

Comments: _____

I hereby certify that the above checklist has been completed and witness that all items are correct to the best of my knowledge.

Signed: _____ Company: _____
(Certification Officer)

Date: _____

Signed: _____
(Waste Operations Supervisor)

Copies to: Waste Operations
Waste Certification (MC&A)

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ATTACHMENT O

"CHAIN OF CUSTODY" TAMPERPROOF SEAL

Collector. _____		ANALYTICAL LABORATORY SAMPLE SEAL	
Date Collected: _____		Lot No: _____	
Time Collected _____	☐ AM ☐ PM	Drum No. _____	FMFC-ES&M-2774 13/18 '87

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APPENDIX A
U.S. ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
REPORTING FORMS FOR INORGANICS ANALYSIS

000460

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Form I

U.S. EPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 - Alexandria, VA 22313
703/557-2490 FTS: 8-557-2490

EPA Sample No. _____

Date _____

INORGANIC ANALYSIS DATA SHEET

LAB NAME _____

CASE NO. _____

SOW NO. _____

LAB SAMPLE ID. NO. _____

QC REPORT NO. _____

Elements Identified and Measured

Concentration: Low _____ Medium _____
Matrix: Water _____ Soil _____ Sludge _____ Other _____

ug/L or ug/kg dry weight (Circle One)

1. <u>Aluminum</u>	13. <u>Magnesium</u>
2. <u>Antimony</u>	14. <u>Manganese</u>
3. <u>Arsenic</u>	15. <u>Mercury</u>
4. <u>Barium</u>	16. <u>Nickel</u>
5. <u>Beryllium</u>	17. <u>Potassium</u>
6. <u>Cadmium</u>	18. <u>Selenium</u>
7. <u>Calcium</u>	19. <u>Silver</u>
8. <u>Chromium</u>	20. <u>Sodium</u>
9. <u>Cobalt</u>	21. <u>Thallium</u>
10. <u>Copper</u>	22. <u>Vanadium</u>
11. <u>Iron</u>	23. <u>Zinc</u>
12. <u>Lead</u>	Percent Solids (%) _____

Cyanide _____

Footnotes: For reporting results to EPA, standard result qualifiers are used as defined on Cover Page. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit and contained on Cover Page, however.

Comments: _____

Lab Manager _____

Form II

Q. C. Report No. _____

INITIAL AND CONTINUING CALIBRATION VERIFICATION³

LAB NAME _____

CASE NO. _____

SOW NO. _____

DATE _____

UNITS _____

Compound

Initial Calib.¹Continuing Calibration²

Metals:

	True Value	Found	ZR	True Value	Found	ZR	Found	ZR	Method ⁴
1. Aluminum									
2. Antimony									
3. Arsenic									
4. Barium									
5. Beryllium									
6. Cadmium									
7. Calcium									
8. Chromium									
9. Cobalt									
10. Copper									
11. Iron									
12. Lead									
13. Magnesium									
14. Manganese									
15. Mercury									
16. Nickel									
17. Potassium									
18. Selenium									
19. Silver									
20. Sodium									
21. Thallium									
22. Vanadium									
23. Zinc									
Other: _____									
Cyanide									

¹ Initial Calibration Source _____² Continuing Calibration Source _____³ Control Limits: Mercury and Tin 80-120; Other Metals 90-110; Cyanide 85-115⁴ Indicate Analytical Method Used: P - ICP; A - Flame AA; F - Furnace AA

Q. C. Report No. _____

BLANKS

LAB NAME _____

CASE NO. _____

DATE _____

UNITS _____

Matrix _____

Compound	<u>Initial</u> Calibration Blank Value	<u>Continuing Calibration</u> <u>Blank Value</u>				<u>Preparation Blank</u>	
		1	2	3	4	Matrix: 1	Matrix: 2
Metals:							
1. <u>Aluminum</u>							
2. <u>Antimony</u>							
3. <u>Arsenic</u>							
4. <u>Barium</u>							
5. <u>Beryllium</u>							
6. <u>Cadmium</u>							
7. <u>Calcium</u>							
8. <u>Chromium</u>							
9. <u>Cobalt</u>							
10. <u>Copper</u>							
11. <u>Iron</u>							
12. <u>Lead</u>							
13. <u>Magnesium</u>							
14. <u>Manganese</u>							
15. <u>Mercury</u>							
16. <u>Nickel</u>							
17. <u>Potassium</u>							
18. <u>Selenium</u>							
19. <u>Silver</u>							
20. <u>Sodium</u>							
21. <u>Thallium</u>							
22. <u>Vanadium</u>							
23. <u>Zinc</u>							
Other: _____							
Cyanide							

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Form IV

Q. C. Report No. _____

ICP INTERFERENCE CHECK SAMPLE

LAB NAME _____

CASE NO. _____

DATE _____

Check Sample I.D. _____

Check Sample Source _____

Units _____

Compound	Control Limits ¹		True ²	Initial		Final	
	Mean	Std. Dev.		Observed	±R	Observed	±R
Metals:							
1. Aluminum							
2. Antimony							
3. Arsenic							
4. Barium							
5. Beryllium							
6. Cadmium							
7. Calcium							
8. Chromium							
9. Cobalt							
10. Copper							
11. Iron							
12. Lead							
13. Magnesium							
14. Manganese							
15. Mercury							
16. Nickel							
17. Potassium							
18. Selenium							
19. Silver							
20. Sodium							
21. Thallium							
22. Vanadium							
23. Zinc							
Other: _____							

1 Mean value based on n = _____.

2 True value of EPA ICP Interference Check Sample or contractor standard.

Q. C. Report No. _____

SPIKE SAMPLE RECOVERY

LAB NAME _____

CASE NO. _____

DATE _____

EPA Sample No. _____

Lab Sample ID No. _____

Units _____

Matrix _____

Compound	Control Limit ZR	Spiked Sample Result (SSR)	Sample Result (SR)	Spiked Added (SA)	ZR ¹
Metals:					
1. <u>Aluminum</u>	75-125				
2. <u>Antimony</u>	"				
3. <u>Arsenic</u>	"				
4. <u>Barium</u>	"				
5. <u>Beryllium</u>	"				
6. <u>Cadmium</u>	"				
7. <u>Calcium</u>	"				
8. <u>Chromium</u>	"				
9. <u>Cobalt</u>	"				
10. <u>Copper</u>	"				
11. <u>Iron</u>	"				
12. <u>Lead</u>	"				
13. <u>Magnesium</u>	"				
14. <u>Manganese</u>	"				
15. <u>Mercury</u>	"				
16. <u>Nickel</u>	"				
17. <u>Potassium</u>	"				
18. <u>Selenium</u>	"				
19. <u>Silver</u>	"				
20. <u>Sodium</u>	"				
21. <u>Thallium</u>	"				
22. <u>Vanadium</u>	"				
23. <u>Zinc</u>	"				
Other: _____					
Cyanide	"				

$$^1 \text{ZR} = [(SSR - SR)/SA] \times 100$$

"N" - out of control

"NR" - Not required

Comments: _____

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Form VI

Q. C. Report No. _____

DUPLICATES

LAB NAME _____

CASE NO. _____

DATE _____

EPA Sample No. _____

Lab Sample ID No. _____

Units _____

Matrix _____

Compound	Control Limit ¹	Sample(S)	Duplicate(D)	RPD ²
Metals:				
1. <u>Aluminum</u>				
2. <u>Antimony</u>				
3. <u>Arsenic</u>				
4. <u>Barium</u>				
5. <u>Beryllium</u>				
6. <u>Cadmium</u>				
7. <u>Calcium</u>				
8. <u>Chromium</u>				
9. <u>Cobalt</u>				
10. <u>Copper</u>				
11. <u>Iron</u>				
12. <u>Lead</u>				
13. <u>Magnesium</u>				
14. <u>Manganese</u>				
15. <u>Mercury</u>				
16. <u>Nickel</u>				
17. <u>Potassium</u>				
18. <u>Selenium</u>				
19. <u>Silver</u>				
20. <u>Sodium</u>				
21. <u>Thallium</u>				
22. <u>Vanadium</u>				
23. <u>Zinc</u>				
Other: _____				
Cyanide				

• Out of Control

¹ To be added at a later date.² $RPD = [|S - D| / ((S + D)/2)] \times 100$

NC - Non calculable RPD due to value(s) less than CRDL

Form VII

Q.C. Report No. _____

INSTRUMENT DETECTION LIMITS AND
LABORATORY CONTROL SAMPLELAB NAME _____ CASE NO. _____ DATE _____
LCS NO. _____

Compound	Required Detection Limits (CRDL)-ug/l	Instrument Detection Limits (IDL)-ug/l		Lab Control Sample		
				ug/L	mg/kg	
		ICP/AA	Furnace	(circle one)		
		ID#	ID#	True	Found	TR
Metals:						
1. Aluminum	200					
2. Antimony	60					
3. Arsenic	10					
4. Barium	200					
5. Beryllium	5					
6. Cadmium	5					
7. Calcium	5000					
8. Chromium	10					
9. Cobalt	50					
10. Copper	25					
11. Iron	100					
12. Lead	5					
13. Magnesium	5000					
14. Manganese	15					
15. Mercury	0.2					
16. Nickel	40					
17. Potassium	5000					
18. Selenium	5					
19. Silver	10					
20. Sodium	5000					
21. Thallium	10					
22. Vanadium	50					
23. Zinc	20					
Other:						
Cyanide	10	NR	NR			

NR - Not required

Form IX

Q. C. Report No. _____

ICP SERIAL DILUTIONS

LAB NAME _____

CASE NO. _____

DATE _____

EPA Sample No. _____

Lab Sample ID No. _____

Units _____

Matrix _____

Compound	Initial Sample Concentration(I)	Serial Dilution ¹ Result(S)	% Difference ²
Metals:			
1. Aluminum			
2. Antimony			
3. Arsenic			
4. Barium			
5. Beryllium			
6. Cadmium			
7. Calcium			
8. Chromium			
9. Cobalt			
10. Copper			
11. Iron			
12. Lead			
13. Magnesium			
14. Manganese			
15. Nickel			
16. Potassium			
17. Selenium			
18. Silver			
19. Sodium			
20. Thallium			
21. Vanadium			
22. Zinc			
Other: _____			

¹ Diluted sample concentration corrected for 1:4 dilution (see Exhibit D)² Percent Difference = $\frac{|I - S|}{I} \times 100$

NR - Not Required, initial sample concentration less than 10 times IDL

NA - Not Applicable, analyte not determined by ICP

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APPENDIX B

APPENDIX B
U.S. ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
REPORTING FORMS FOR ORGANICS ANALYSIS

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) _____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ Date Analyzed: _____

Column: (pack/cap) _____ Dilution Factor: _____

CAS NO. COMPOUND CONCENTRATION UNITS:
(ug/L or ug/Kg) _____ Q

74-87-3-----	Chloromethane		
74-83-9-----	Bromomethane		
75-01-4-----	Vinyl Chloride		
75-00-3-----	Chloroethane		
75-09-2-----	Methylene Chloride		
67-64-1-----	Acetone		
75-15-0-----	Carbon Disulfide		
75-35-4-----	1,1-Dichloroethene		
75-34-3-----	1,1-Dichloroethane		
540-59-0-----	1,2-Dichloroethene (total)		
67-66-3-----	Chloroform		
107-06-2-----	1,2-Dichloroethane		
78-93-3-----	2-Butanone		
71-55-6-----	1,1,1-Trichloroethane		
56-23-5-----	Carbon Tetrachloride		
108-05-4-----	Vinyl Acetate		
75-27-4-----	Bromodichloromethane		
78-87-5-----	1,2-Dichloropropane		
10061-01-5-----	cis-1,3-Dichloropropene		
79-01-6-----	Trichloroethene		
124-48-1-----	Dibromochloromethane		
79-00-5-----	1,1,2-Trichloroethane		
71-43-2-----	Benzene		
10061-02-6-----	trans-1,3-Dichloropropene		
75-25-2-----	Bromoform		
108-10-1-----	4-Methyl-2-Pentanone		
591-78-6-----	2-Hexanone		
127-18-4-----	Tetrachloroethene		
79-34-5-----	1,1,2,2-Tetrachloroethane		
108-88-3-----	Toluene		
108-90-7-----	Chlorobenzene		
100-41-4-----	Ethylbenzene		
100-42-5-----	Styrene		
1330-20-7-----	Xylene (total)		

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

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EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) _____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ dec. _____ Date Extracted: _____

Extraction: (SepF/Cont/Sonc) _____ Date Analyzed: _____

GPC Cleanup: (Y/N) _____ pH: _____ Dilution Factor: _____

CAS NO. COMPOUND CONCENTRATION UNITS:
(ug/L or ug/Kg) _____ Q

108-95-2-----	Phenol		
111-44-4-----	bis(2-Chloroethyl) ether		
95-57-8-----	2-Chlorophenol		
541-73-1-----	1,3-Dichlorobenzene		
106-46-7-----	1,4-Dichlorobenzene		
100-51-6-----	Benzyl alcohol		
95-50-1-----	1,2-Dichlorobenzene		
95-48-7-----	2-Methylphenol		
108-60-1-----	bis(2-Chloroisopropyl) ether		
106-44-5-----	4-Methylphenol		
621-64-7-----	N-Nitroso-di-n-propylamine		
67-72-1-----	Hexachloroethane		
98-95-3-----	Nitrobenzene		
78-59-1-----	Isophorone		
88-75-5-----	2-Nitrophenol		
105-67-9-----	2,4-Dimethylphenol		
65-85-0-----	Benzoic acid		
111-91-1-----	bis(2-Chloroethoxy) methane		
120-83-2-----	2,4-Dichlorophenol		
120-82-1-----	1,2,4-Trichlorobenzene		
91-20-3-----	Naphthalene		
106-47-8-----	4-Chloroaniline		
87-68-3-----	Hexachlorobutadiene		
59-50-7-----	4-Chloro-3-methylphenol		
91-57-6-----	2-Methylnaphthalene		
77-47-4-----	Hexachlorocyclopentadiene		
88-06-2-----	2,4,6-Trichlorophenol		
95-95-4-----	2,4,5-Trichlorophenol		
91-58-7-----	2-Chloronaphthalene		
88-74-4-----	2-Nitroaniline		
131-11-3-----	Dimethylphthalate		
208-96-8-----	Acenaphthylene		
606-20-2-----	2,6-Dinitrotoluene		

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1C
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) _____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ dec. _____ Date Extracted: _____

Extraction: (SepF/Cont/Sonc) _____ Date Analyzed: _____

GPC Cleanup: (Y/N) _____ pH: _____ Dilution Factor: _____

CAS NO. COMPOUND CONCENTRATION UNITS:
(ug/L or ug/Kg) _____ Q

99-09-2-----	3-Nitroaniline		
83-32-9-----	Acenaphthene		
51-28-5-----	2,4-Dinitrophenol		
100-02-7-----	4-Nitrophenol		
132-64-9-----	Dibenzofuran		
121-14-2-----	2,4-Dinitrotoluene		
84-66-2-----	Diethylphthalate		
7005-72-3-----	4-Chlorophenyl-phenylether		
86-73-7-----	Fluorene		
100-01-6-----	4-Nitroaniline		
534-52-1-----	4,6-Dinitro-2-methylphenol		
86-30-6-----	N-Nitrosodiphenylamine (1)		
101-55-3-----	4-Bromophenyl-phenylether		
118-74-1-----	Hexachlorobenzene		
87-86-5-----	Pentachlorophenol		
85-01-8-----	Phenanthrene		
120-12-7-----	Anthracene		
84-74-2-----	Di-n-butylphthalate		
206-44-0-----	Fluoranthene		
129-00-0-----	Pyrene		
85-68-7-----	Butylbenzylphthalate		
91-94-1-----	3,3'-Dichlorobenzidine		
56-55-3-----	Benzo(a)anthracene		
218-01-9-----	Chrysene		
117-81-7-----	bis(2-Ethylhexyl)phthalate		
117-84-0-----	Di-n-octylphthalate		
205-99-2-----	Benzo(b)fluoranthene		
207-08-9-----	Benzo(k)fluoranthene		
50-32-8-----	Benzo(a)pyrene		
193-39-5-----	Indeno(1,2,3-cd)pyrene		
53-70-3-----	Dibenz(a,h)anthracene		
191-24-2-----	Benzo(g,h,i)perylene		

(1) - Cannot be separated from Diphenylamine

6180 = 1

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) _____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ dec. _____ Date Extracted: _____

Extraction: (SepF/Cont/Sonc) _____ Date Analyzed: _____

GPC Cleanup: (Y/N) _____ pH: _____ Dilution Factor: _____

CAS NO. COMPOUND CONCENTRATION UNITS:
(ug/L or ug/Kg) _____ Q

319-84-6-----	alpha-BHC		
319-85-7-----	beta-BHC		
319-86-8-----	delta-BHC		
58-89-9-----	gamma-BHC (Lindane)		
76-44-8-----	Heptachlor		
309-00-2-----	Aldrin		
1024-57-3-----	Heptachlor epoxide		
959-98-8-----	Endosulfan I		
60-57-1-----	Dieldrin		
72-55-9-----	4,4'-DDE		
72-20-8-----	Endrin		
33213-65-9-----	Endosulfan II		
72-54-8-----	4,4'-DDD		
1031-07-8-----	Endosulfan sulfate		
50-29-3-----	4,4'-DDT		
72-43-5-----	Methoxychlor		
53494-70-5-----	Endrin ketone		
5103-71-9-----	alpha-Chlordane		
5103-74-2-----	gamma-Chlordane		
8001-35-2-----	Toxaphene		
12674-11-2-----	Aroclor-1016		
11104-28-2-----	Aroclor-1221		
11141-16-5-----	Aroclor-1232		
53469-21-9-----	Aroclor-1242		
12672-29-6-----	Aroclor-1248		
11097-69-1-----	Aroclor-1254		
11096-82-5-----	Aroclor-1260		

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) _____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ Date Analyzed: _____

Column: (pack/cap) _____ Dilution Factor: _____

Number TICs found: _____ CONCENTRATION UNITS:
(ug/L or ug/Kg) _____

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

6180 =
EPA SAMPLE NO.

1F
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____ Lab Sample ID: _____

Sample wt/vol: _____ (g/mL) _____ Lab File ID: _____

Level: (low/med) _____ Date Received: _____

% Moisture: not dec. _____ dec. _____ Date Extracted: _____

Extraction: (SepF/Cont/Sonc) _____ Date Analyzed: _____

GPC Cleanup: (Y/N) _____ pH: _____ Dilution Factor: _____

Number TICs found: _____ CONCENTRATION UNITS:
(ug/L or ug/Kg) _____

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

2A
WATER VOLATILE SURROGATE RECOVERY

6180 = 1

Lab Name: _____ Contract: _____
Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

	EPA SAMPLE NO.	S1 (TOL) #	S2 (BFB) #	S3 (DCE) #	OTHER	TOT OUT
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

QC LIMITS

S1 (TOL) = Toluene-d8 (88-110)
S2 (BFB) = Bromofluorobenzene (86-115)
S3 (DCE) = 1,2-Dichloroethane-d4 (76-114)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

2B
SOIL VOLATILE SURROGATE RECOVERY

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Level: (low/med) _____

	EPA SAMPLE NO.	S1 (TOL) #	S2 (BFB) #	S3 (DCE) #	OTHER	TOT OUT
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

QC LIMITS

S1 (TOL) = Toluene-d8 (81-117)
 S2 (BFB) = Bromofluorobenzene (74-121)
 S3 (DCE) = 1,2-Dichloroethane-d4 (70-121)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

1180

2C
WATER SEMIVOLATILE SURROGATE RECOVERY

Lab Name: _____ Contract: _____
Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

	EPA SAMPLE NO.	S1 (NBZ) #	S2 (FBP) #	S3 (TPH) #	S4 (PHL) #	S5 (2FP) #	S6 (TBP) #	OTHER	TOT OUT
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

QC LIMITS

S1 (NBZ) = Nitrobenzene-d5 (35-114)
 S2 (FBP) = 2-Fluorobiphenyl (43-116)
 S3 (TPH) = Terphenyl-d14 (33-141)
 S4 (PHL) = Phenol-d5 (10-94)
 S5 (2FP) = 2-Fluorophenol (21-100)
 S6 (TBP) = 2,4,6-Tribromophenol (10-123)

Column to be used to flag recovery values
 * Values outside of contract required QC limits
 D Surrogates diluted out

2D
SOIL SEMIVOLATILE SURROGATE RECOVERY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Level: (low/med) _____

	EPA SAMPLE NO.	S1 (NBZ) #	S2 (FBP) #	S3 (TPH) #	S4 (PHL) #	S5 (2FP) #	S6 (TBP) #	OTHER	TOT OUT
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

QC LIMITS

S1 (NBZ) = Nitrobenzene-d5 (23-120)
 S2 (FBP) = 2-Fluorobiphenyl (30-115)
 S3 (TPH) = Terphenyl-d14 (18-137)
 S4 (PHL) = Phenol-d5 (24-113)
 S5 (2FP) = 2-Fluorophenol (25-121)
 S6 (TBP) = 2,4,6-Tribromophenol (19-122)

Column to be used to flag recovery values
 * Values outside of contract required QC limits
 D Surrogates diluted out

2E
WATER PESTICIDE SURROGATE RECOVERY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

	EPA SAMPLE NO.	S1 (DBC) #	OTHER
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

ADVISORY
QC LIMITS
(24-154)

S1 (DBC) = Dibutylchloroendate

Column used to flag recovery values

• Values outside of QC limits

D Surrogates diluted out

2F
SOIL PESTICIDE SURROGATE RECOVERY

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Level: (low/med) _____

	EPA SAMPLE NO.	S1 (DBC) #	OTHER
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

ADVISORY
QC LIMITS
(20-150)

S1 (DBC) = Dibutylchloroendate

Column to be used to flag recovery values

* Values outside of QC limits

D Surrogates diluted out

618047

3A

WATER VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC #	QC LIMITS REC.
1,1-Dichloroethene					61-145
Trichloroethene					71-120
Benzene					76-127
Toluene					76-125
Chlorobenzene					75-130

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC #	% RPD #	QC LIMITS RPD	REC.
1,1-Dichloroethene					14	61-145
Trichloroethene					14	71-120
Benzene					11	76-127
Toluene					13	76-125
Chlorobenzene					13	75-130

Column to be used to flag recovery and RPD values with an asterisk

• Values outside of QC limits

RPD: _____ out of _____ outside limits

Spike Recovery: _____ out of _____ outside limits

COMMENTS: _____

3B

SOIL VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____ Level: (low/med) _____

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMITS REC.
1,1-Dichloroethene					59-172
Trichloroethene					62-137
Benzene					66-142
Toluene					59-139
Chlorobenzene					60-133

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIMITS RPD	REC.
1,1-Dichloroethene					22	59-172
Trichloroethene					24	62-137
Benzene					21	66-142
Toluene					21	59-139
Chlorobenzene					21	60-133

Column to be used to flag recovery and RPD values with an asterisk

• Values outside of QC limits

RPD: _____ out of _____ outside limits

Spike Recovery: _____ out of _____ outside limits

COMMENTS: _____

6180-14

3C

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC #	QC LIMIT REC.
Phenol					12- 8
2-Chlorophenol					27-12
1,4-Dichlorobenzene					36- 9
N-Nitroso-di-n-prop. (1)					41-11
1,2,4-Trichlorobenzene					39- 9
4-Chloro-3-methylphenol					23- 9
Acenaphthene					46-11
4-Nitrophenol					10- 8
2,4-Dinitrotoluene					24- 9
Pentachlorophenol					9-10
Pyrene					26-12

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC #	% RPD #	QC LIMITS RPD	REC.
Phenol					42	12- 8
2-Chlorophenol					40	27-12
1,4-Dichlorobenzene					28	36- 9
N-Nitroso-di-n-prop. (1)					38	41-11
1,2,4-Trichlorobenzene					28	39- 9
4-Chloro-3-methylphenol					42	23- 9
Acenaphthene					31	46-11
4-Nitrophenol					50	10- 8
2,4-Dinitrotoluene					38	24- 9
Pentachlorophenol					50	9-10
Pyrene					31	26-12

(1) N-Nitroso-di-n-propylamine

Column to be used to flag recovery and RPD values with an asterisk
 • Values outside of QC limits

RPD: _____ out of _____ outside limits

Spike Recovery: _____ out of _____ outside limits

COMMENTS: _____

3D

SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____ Level: (low/med) _____

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMITS REC.
Phenol					26- 90
2-Chlorophenol					25-102
1,4-Dichlorobenzene					28-104
N-Nitroso-di-n-prop. (1)					41-126
1,2,4-Trichlorobenzene					38-107
4-Chloro-3-methylphenol					26-103
Acenaphthene					31-137
4-Nitrophenol					11-114
2,4-Dinitrotoluene					28- 89
Pentachlorophenol					17-109
Pyrene					35-142

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIMITS RPD	REC.
Phenol					35	26- 90
2-Chlorophenol					50	25-102
1,4-Dichlorobenzene					27	28-104
N-Nitroso-di-n-prop. (1)					38	41-126
1,2,4-Trichlorobenzene					23	38-107
4-Chloro-3-methylphenol					33	26-103
Acenaphthene					19	31-137
4-Nitrophenol					50	11-114
2,4-Dinitrotoluene					47	28- 89
Pentachlorophenol					47	17-109
Pyrene					36	35-142

(1) N-Nitroso-di-n-propylamine

Column to be used to flag recovery and RPD values with an asterisk
 * Values outside of QC limits

RPD: _____ out of _____ outside limits

Spike Recovery: _____ out of _____ outside limits

COMMENTS: _____

3E
WATER PESTICIDE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Matrix Spike - EPA Sample No.: _____

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC #	QC LIMITS REC.
Lindane					56-123
Heptachlor					40-131
Aldrin					40-120
Dieldrin					52-126
Endrin					56-121
4,4' DDT					38-127

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC #	% RPD #	QC LIMITS RPD REC.
Lindane					15 56-123
Heptachlor					20 40-131
Aldrin					22 40-120
Dieldrin					18 52-126
Endrin					21 56-121
4,4' DDT					27 38-127

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: _____ out of _____ outside limits
 Spike Recovery: _____ out of _____ outside limits

COMMENTS: _____

6180

3F

SOIL PESTICIDE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: _____ Level: (low/med) _____

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMITS REC.
Lindane					46-127
Heptachlor					35-130
Aldrin					34-132
Dieldrin					31-134
Endrin					42-139
4,4' DDT					23-134

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIMITS RPD	REC.
Lindane					50	46-127
Heptachlor					31	35-130
Aldrin					43	34-132
Dieldrin					38	31-134
Endrin					45	42-139
4,4' DDT					50	23-134

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: _____ out of _____ outside limits

Spike Recovery: _____ out of _____ outside limits

COMMENTS: _____

6180

4A
VOLATILE METHOD BLANK SUMMARY

Lab Name: _____ Contract: _____
Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
Lab File ID: _____ Lab Sample ID: _____
Date Analyzed: _____ Time Analyzed: _____
Matrix: (soil/water) _____ Level: (low/med) _____
Instrument ID: _____

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	TIME ANALYZED
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

COMMENTS: _____

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4B

SEMIVOLATILE METHOD BLANK SUMMARY

Lab Name: _____ Contract: _____
Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
Lab File ID: _____ Lab Sample ID: _____
Date Extracted: _____ Extraction: (SepF/Cont/Sonc) _____
Date Analyzed: _____ Time Analyzed: _____
Matrix: (soil/water) _____ Level: (low/med) _____
Instrument ID: _____

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

COMMENTS: _____

5A
VOLATILE ORGANIC GC/MS TUNING AND MASS
CALIBRATION - BROMOFLUOROBENZENE (BFB)

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Lab File ID: _____ BFB Injection Date: _____
 Instrument ID: _____ BFB Injection Time: _____
 Matrix: (soil/water) _____ Level: (low/med) _____ Column: (pack/cap) _____

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	15.0 - 40.0% of mass 95	
75	30.0 - 60.0% of mass 95	
95	Base peak, 100% relative abundance	
96	5.0 - 9.0% of mass 95	
173	Less than 2.0% of mass 174	() 1
174	Greater than 50.0% of mass 95	
175	5.0 - 9.0% of mass 174	() 1
176	Greater than 95.0%, but less than 101.0% of mass 174	() 1
177	5.0 - 9.0% of mass 176	() 2

1-Value is % mass 174

2-Value is % mass 176

THIS TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01					
02					
03					
04					
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

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SEMIVOLATILE ORGANIC GC/MS TUNING AND MASS
CALIBRATION - DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Lab File ID: _____ DFTPP Injection Date: _____
 Instrument ID: _____ DFTPP Injection Time: _____

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	30.0 - 60.0% of mass 198	
68	Less than 2.0% of mass 69	() 1
69	Mass 69 relative abundance	
70	Less than 2.0% of mass 69	() 1
127	40.0 - 60.0% of mass 198	
197	Less than 1.0% of mass 198	
198	Base Peak, 100% relative abundance	
199	5.0 to 9.0% of mass 198	
275	10.0 - 30.0% of mass 198	
365	Greater than 1.00% of mass 198	
441	Present, but less than mass 443	
442	Greater than 40.0% of mass 198	
443	17.0 - 23.0% of mass 442	() 2

1-Value is % mass 69

2-Value is % mass 442

THIS TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01					
02					
03					
04					
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

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6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Instrument ID: _____ Calibration Date(s): _____
 Matrix: (soil/water) _____ Level: (low/med) _____ Column: (pack/cap) _____
 Min $\overline{RRF}$ for SPCC(†) = 0.300 (0.250 for Bromoform) Max †RSD for CCC(*) = 30.0

LAB FILE ID: _____		RRF20 = _____		RRF50 = _____		RRF100 = _____		RRF150 = _____		RRF200 = _____		RRF		†
RRF100= _____		RRF150= _____		RRF200= _____										RSD
COMPOUND		RRF20	RRF50	RRF100	RRF150	RRF200								
Chloromethane	#													
Bromomethane														
Vinyl Chloride	*													
Chloroethane														
Methylene Chloride														
Acetone														
Carbon Disulfide														
1,1-Dichloroethene	*													
1,1-Dichloroethane	#													
1,2-Dichloroethene (total)														
Chloroform	*													
1,2-Dichloroethane														
2-Butanone														
1,1,1-Trichloroethane														
Carbon Tetrachloride														
Vinyl Acetate														
Bromodichloromethane														
1,2-Dichloropropane	•													
cis-1,3-Dichloropropene														
Trichloroethene														
Dibromochloromethane														
1,1,2-Trichloroethane														
Benzene														
trans-1,3-Dichloropropene														
Bromoform	#													
4-Methyl-2-Pentanone														
2-Hexanone														
Tetrachloroethene														
1,1,2,2-Tetrachloroethane	#													
Toluene	•													
Chlorobenzene	#													
Ethylbenzene	•													
Styrene														
Xylene (total)														
Toluene-d8														
Bromofluorobenzene														
1,2-Dichloroethane-d4														

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6B

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Instrument ID: _____ Calibration Date(s): _____

Min RRF for SPCC(†) = 0.050

Max †RSD for CCC(†) = 30.0%

LAB FILE ID: _____ RRF20 = _____ RRF50 = _____
 RRF80 = _____ RRF120 = _____ RRF160 = _____

COMPOUND	RRF20	RRF50	RRF80	RRF120	RRF160	RRF	† RSD
Phenol	*						
bis(2-Chloroethyl) ether							
2-Chlorophenol							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene	•						
Benzyl alcohol							
1,2-Dichlorobenzene							
2-Methylphenol							
bis(2-Chloroisopropyl) ether							
4-Methylphenol							
N-Nitroso-di-n-propylamine	†						
Hexachloroethane							
Nitrobenzene							
Isophorone							
2-Nitrophenol	•						
2,4-Dimethylphenol							
Benzoic acid							
bis(2-Chloroethoxy) methane							
2,4-Dichlorophenol	•						
1,2,4-Trichlorobenzene							
Naphthalene							
4-Chloroaniline							
Hexachlorobutadiene	•						
4-Chloro-3-methylphenol	•						
2-Methylnaphthalene							
Hexachlorocyclopentadiene	†						
2,4,6-Trichlorophenol	•						
2,4,5-Trichlorophenol							
2-Chloronaphthalene							
2-Nitroaniline							
Dimethylphthalate							
Acenaphthylene							
2,6-Dinitrotoluene							
3-Nitroaniline							
Acenaphthene	*						
2,4-Dinitrophenol	†						
4-Nitrophenol	†						

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Instrument ID: _____ Calibration Date(s): _____

Min RRF for SPCC(%) = 0.050

Max %RSD for CCC(%) = 30.0%

LAB FILE ID: _____	RRF20 = _____	RRF50 = _____	RRF80 = _____	RRF120 = _____	RRF160 = _____		
RRF80 = _____	RRF120 = _____	RRF160 = _____					
COMPOUND	RRF20	RRF50	RRF80	RRF120	RRF160	RRF	% RSD
Dibenzofuran							
2,4-Dinitrotoluene							
Diethylphthalate							
4-Chlorophenyl-phenylether							
Fluorene							
4-Nitroaniline							
4,6-Dinitro-2-methylphenol							
N-Nitrosodiphenylamine (1) *							
4-Bromophenyl-phenylether							
Hexachlorobenzene							
Pentachlorophenol							
Phenanthrene							
Anthracene							
Di-n-butylphthalate							
Fluoranthene							
Pyrene							
Butylbenzylphthalate							
3,3'-Dichlorobenzidine							
Benzo(a)anthracene							
Chrysene							
bis(2-Ethylhexyl)phthalate							
Di-n-octylphthalate							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(a)pyrene							
Indeno(1,2,3-cd)pyrene							
Dibenz(a,h)anthracene							
Benzo(g,h,i)perylene							
Nitrobenzene-d5							
2-Fluorobiphenyl							
Terphenyl-d14							
Phenol-d5							
2-Fluorophenol							
2,4,6-Tribromophenol							

(1) Cannot be separated from Diphenylamine

7A
VOLATILE CONTINUING CALIBRATION CHECK

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Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Instrument ID: _____ Calibration Date: _____ Time: _____
 Lab File ID: _____ Init. Calib. Date(s): _____
 Matrix: (soil/water) _____ Level: (low/med) _____ Column: (pack/cap) _____
 Min RRF50 for SPCC(%) = 0.300 (0.250 for Bromoform) Max %D for CCC(*) = 25.0

COMPOUND	RRF	RRF50	%D
Chloromethane	*		*
Bromomethane			
Vinyl Chloride	*		*
Chloroethane			
Methylene Chloride			
Acetone			
Carbon Disulfide			
1,1-Dichloroethene	*		*
1,1-Dichloroethane	*		*
1,2-Dichloroethene (total)			
Chloroform	*		*
1,2-Dichloroethane			
2-Butanone			
1,1,1-Trichloroethane			
Carbon Tetrachloride			
Vinyl Acetate			
Bromodichloromethane			
1,2-Dichloropropane	*		*
cis-1,3-Dichloropropene			
Trichloroethene			
Dibromochloromethane			
1,1,2-Trichloroethane			
Benzene			
trans-1,3-Dichloropropene			
Bromoform	*		*
4-Methyl-2-Pentanone			
2-Hexanone			
Tetrachloroethene			
1,1,2,2-Tetrachloroethane	*		*
Toluene	*		*
Chlorobenzene	*		*
Ethylbenzene	*		*
Styrene			
Xylene (total)			
Toluene-d8			
Bromofluorobenzene			
1,2-Dichloroethane-d4			

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7B

SEMIVOLATILE CONTINUING CALIBRATION CHECK

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Instrument ID: _____ Calibration Date: _____ Time: _____

Lab File ID: _____ Init. Calib. Date(s): _____

Min RRF50 for SPCC(%) = 0.050 Max %D for CCC(%) = 25.0%

COMPOUND	RRF	RRF50	%D
Phenol	*		*
bis(2-Chloroethyl) ether			
2-Chlorophenol			
1,3-Dichlorobenzene			
1,4-Dichlorobenzene	*		*
Benzyl alcohol			
1,2-Dichlorobenzene			
2-Methylphenol			
bis(2-Chloroisopropyl) ether			
4-Methylphenol			
N-Nitroso-di-n-propylamine	*		*
Hexachloroethane			
Nitrobenzene			
Isophorone			
2-Nitrophenol	*		*
2,4-Dimethylphenol			
Benzoic acid			
bis(2-Chloroethoxy) methane			
2,4-Dichlorophenol	*		*
1,2,4-Trichlorobenzene			
Naphthalene			
4-Chloroaniline			
Hexachlorobutadiene	*		*
4-Chloro-3-methylphenol	*		*
2-Methylnaphthalene			
Hexachlorocyclopentadiene	*		*
2,4,6-Trichlorophenol	*		*
2,4,5-Trichlorophenol			
2-Chloronaphthalene			
2-Nitroaniline			
Dimethylphthalate			
Acenaphthylene			
2,6-Dinitrotoluene			
3-Nitroaniline			
Acenaphthene	*		*
2,4-Dinitrophenol	*		*
4-Nitrophenol	*		*

7C
SEMIVOLATILE CONTINUING CALIBRATION CHECK

6180

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Instrument ID: _____ Calibration Date: _____ Time: _____
 Lab File ID: _____ Init. Calib. Date(s): _____
 Min RRF50 for SPCC(%) = 0.050 Max %D for CCC(*) = 25.0

COMPOUND	RRF	RRF50	%D
Dibenzofuran			
2,4-Dinitrotoluene			
Diethylphthalate			
4-Chlorophenyl-phenylether			
Fluorene			
4-Nitroaniline			
4,6-Dinitro-2-methylphenol			
N-Nitrosodiphenylamine (1)	*		*
4-Bromophenyl-phenylether			
Hexachlorobenzene			
Pentachlorophenol	*		*
Phenanthrene			
Anthracene			
Di-n-butylphthalate			
Fluoranthene	*		*
Pyrene			
Butylbenzylphthalate			
3,3'-Dichlorobenzidine			
Benzo(a)anthracene			
Chrysene			
bis(2-Ethylhexyl)phthalate			
Di-n-octylphthalate	*		*
Benzo(b)fluoranthene			
Benzo(k)fluoranthene			
Benzo(a)pyrene	*		*
Indeno(1,2,3-cd)pyrene			
Dibenz(a,h)anthracene			
Benzo(g,h,i)perylene			
Nitrobenzene-d5			
2-Fluorobiphenyl			
Terphenyl-d14			
Phenol-d5			
2-Fluorophenol			
2,4,6-Tribromophenol			

(1) Cannot be separated from Diphenylamine

8A
VOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Lab File ID (Standard): _____ Date Analyzed: _____
 Instrument ID: _____ Time Analyzed: _____
 Matrix: (soil/water) _____ Level: (low/med) _____ Column: (pack/cap) _____

	IS1 (BCM)		IS2 (DFB)		IS3 (CBZ)	
	AREA #	RT	AREA #	RT	AREA #	RT
=====	=====	=====	=====	=====	=====	=====
12 HOUR STD						
=====	=====	=====	=====	=====	=====	=====
UPPER LIMIT						
=====	=====	=====	=====	=====	=====	=====
LOWER LIMIT						
=====	=====	=====	=====	=====	=====	=====
EPA SAMPLE NO.						
=====	=====	=====	=====	=====	=====	=====
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

IS1 (BCM) = Bromochloromethane
 IS2 (DFB) = 1,4-Difluorobenzene
 IS3 (CBZ) = Chlorobenzene

UPPER LIMIT = + 100%
 of internal standard area.
 LOWER LIMIT = - 50%
 of internal standard area.

Column used to flag internal standard area values with an asterisk

page __ of __

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8B

SEMIVOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Lab File ID (Standard): _____ Date Analyzed: _____

Instrument ID: _____ Time Analyzed: _____

	IS1 (DCB)	RT	IS2 (NPT)	RT	IS3 (ANT)	RT
	AREA #		AREA #		AREA #	
=====	=====	=====	=====	=====	=====	=====
12 HOUR STD						
=====	=====	=====	=====	=====	=====	=====
UPPER LIMIT						
=====	=====	=====	=====	=====	=====	=====
LOWER LIMIT						
=====	=====	=====	=====	=====	=====	=====
EPA SAMPLE NO.						
=====	=====	=====	=====	=====	=====	=====
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

IS1 (DCB) = 1,4-Dichlorobenzene-d4
 IS2 (NPT) = Naphthalene-d8
 IS3 (ANT) = Acenaphthene-d8

UPPER LIMIT = + 100%
 of internal standard area.
 LOWER LIMIT = - 50%
 of internal standard area.

Column used to flag internal standard area values with an asterisk

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8C
SEMIVOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Lab File ID (Standard): _____ Date Analyzed: _____
 Instrument ID: _____ Time Analyzed: _____

	IS4 (PHN) AREA #	RT	IS5 (CRY) AREA #	RT	IS6 (PRY) AREA #	RT
=====	=====	=====	=====	=====	=====	=====
12 HOUR STD						
=====	=====	=====	=====	=====	=====	=====
UPPER LIMIT						
=====	=====	=====	=====	=====	=====	=====
LOWER LIMIT						
=====	=====	=====	=====	=====	=====	=====
EPA SAMPLE NO.						
=====	=====	=====	=====	=====	=====	=====
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

IS4 (PHN) = Phenanthrene-d10
 IS5 (CRY) = Chrysene-d12
 IS6 (PRY) = Perylene-d12

UPPER LIMIT = + 100%
 of internal standard area.
 LOWER LIMIT = - 50%
 of internal standard area.

Column used to flag internal standard area values with an asterisk

80
PESTICIDE EVALUATION STANDARDS SUMMARY

Lab Name: _____ Contract: _____
 Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____
 Instrument ID: _____ GC Column ID: _____
 Dates of Analyses: _____ to _____

Evaluation Check for Linearity

PESTICIDE	CALIBRATION FACTOR EVAL MIX A	CALIBRATION FACTOR EVAL MIX B	CALIBRATION FACTOR EVAL MIX C	%RSD ($\leq$ 10.0%)
=====	=====	=====	=====	=====
ALDRIN				
ENDRIN				
4,4'-DDT				
DBC				

(1)

(1) If $> 10.0\%$ RSD, plot a standard curve and determine the ng for each sample in that set from the curve.

Evaluation Check for 4,4'-DDT/Endrin Breakdown
(percent breakdown expressed as total degradation)

	DATE ANALYZED	TIME ANALYZED	ENDRIN	4,4'-DDT	COMBINED (2)
=====	=====	=====	=====	=====	=====
INITIAL					
01 EVAL MIX B					
02 EVAL MIX B					
03 EVAL MIX B					
04 EVAL MIX B					
05 EVAL MIX B					
06 EVAL MIX B					
07 EVAL MIX B					
08 EVAL MIX B					
09 EVAL MIX B					
10 EVAL MIX B					
11 EVAL MIX B					
12 EVAL MIX B					
13 EVAL MIX B					
14 EVAL MIX B					

(2) See Form instructions.

8E

PESTICIDE EVALUATION STANDARDS SUMMARY
Evaluation of Retention Time Shift for Dibutylchloroendate

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Instrument ID: _____ GC Column ID: _____

Dates of Analyses: _____ to _____

	EPA SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	% D	*
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						

* Values outside of QC limits (2.0% for packed columns,
0.3% for capillary columns)

PESTICIDE/PCB STANDARDS SUMMARY

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Instrument ID: _____ GC Column ID: _____

COMPOUND	RT	RT WINDOW		CALIBRATION FACTOR	RT	CALIBRATION FACTOR	QNT Y/N	%D
		FROM	TO					
alpha-BHC								
beta-BHC								
delta-BHC								
gamma-BHC								
Heptaclor								
Aldrin								
Hept. epoxide								
Endosulfan I								
Dieldrin								
4,4'-DDE								
Endrin								
Endosulfan II								
4,4'-DDD								
Endo. sulfate								
4,4'-DDT								
Methoxychlor								
Endrin ketone								
a. Chlordane								
g. Chlordane								
Toxaphene								
Aroclor-1016								
Aroclor-1221								
Aroclor-1232								
Aroclor-1242								
Aroclor-1248								
Aroclor-1254								
Aroclor-1260								

Under QNT Y/N: enter Y if quantitation was performed, N if not performed.
 %D must be less than or equal to 15.0% for quantitation, and less than or equal to 20.0% for confirmation.

Note: Determining that no compounds were found above the CRQL is a form of quantitation, and therefore at least one column must meet the 15.0% criteria.

For multicomponent analytes, the single largest peak that is characteristic of the component should be used to establish retention time and %D. Identification of such analytes is based primarily on pattern recognition