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**JANUS
CHARACTERIZATION REPORT**

Prepared by ESH-HP

for the

TD Division of Argonne National Laboratory

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March 1996 (Original)
July 1996 (Updated)

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JANUS CHARACTERIZATION REPORT

ARGONNE NATIONAL LABORATORY ARGONNE, ILLINOIS

March 1996
July 1996

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JANUS REACTOR CHARACTERIZATION

I. OBJECTIVE

The principal objectives of characterizing the JANUS Reactor were to collect sufficient information:

- to provide a quantitative basis for preparation of a Decommissioning Plan, and to support analysis of alternative D&D approaches,
- to plan the measures required to protect workers, the public, and the environment during decommissioning,
- to estimate the personnel collective dose to workers during the D&D,
- to estimate the types and amounts of waste that will be generated during the D&D,
- to estimate the amount of material that might be salvaged or recycled.

II. HISTORY OF THE JANUS FACILITY

The location of the JANUS reactor on the ANL-E site is shown in Figure 1. The reactor, which operated from June 1965 to April 1992, was a light water moderated reactor located on two levels of J-wing of Building 202. Its location in Building 202 is shown in Figure 2. The operating thermal power level ranged from 20 - 200 kW. This facility was designed and used for the study of chronic and acute effects of fission-spectrum neutrons on organisms such as small animals and other biological materials. There were two specific areas where this experimentation could occur: the low-dose room and the high-dose room. The low-dose room was never used for these purposes. The high-dose room had been used and modified with the addition of borated hardboard and lead shielding materials to reduce the gamma radiation contribution from activated concrete walls. Other facility-related areas are the main reactor room, the reactor control room, the fan and pump rooms, the high-dose preparation and biological control rooms, and a cooling tower. A photograph of a cut-away model of the reactor is shown in Figure 3 and an elevation cross section in Figure 4. Floor plans of the main floor and service floor are shown in Figures 5 and 6.

The reactor had contained 19 irradiated fuel assemblies and a converter plate assembly. Each fuel assembly contained about 140 g ^{235}U , whereas the converter assembly consisted of 34 kg ^{235}U in 19.77% enriched uranium. All fuel was removed and shipped to Savannah River Plant in February and March 1993. The converter plates were removed in June 1993 and placed in temporary storage at building 315 prior to disposal.

Since late spring 1992, the facility has been placed in a non-reactor status. That involved the removal of fluids, gases, chemicals and various equipment and systems. The JANUS facility remains in such a state at this time. Original design information is documented in "The Biological Irradiation Facility (JANUS Reactor) Design Manual," ANL-6745, dated June 1963.

Figure 1. Location of the JANUS Reactor on the ANL-E Site

Figure 2. Location of JANUS Reactor in Building 202

Figure 3. Model of the JANUS Reactor

Key to Drawing

- (A) Fuel core, 19 CP-5 type fuel assemblies
- (B) Pneumatic sample tube
- (C) Converter plates, one-inch thick uranium
- (D) Attenuator tank on low dose side, 4 feet by 10 feet by 4 inches
- (E) Lead gamma shields, 6 inches thick on high dose side, 4 inches thick on low dose side
- (F) 16 inch square hole in thermal column on high dose side, normally packed with graphite
- (G) Storage pit, 3 feet deep, location for gamma source, if needed

Figure 4. Elevation Cross Section of the JANUS Reactor Facility

Figure 5.. JANUS Reactor Main Floor with Room Numbers

Figure 6. JANUS Reactor Service Floor with Room Numbers

III. CHARACTERIZATION METHODOLOGY

The characterization was performed according to the November 1995 NES, Inc. report (reference 10) "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)." The general approach can be summarized by the following steps:

- thoroughly gamma scanned each area (individual rooms, corridor) to look for localized regions or spots with elevated radiation levels,
- measure average radiation exposure rate in each area,
- randomly selected locations at which stationary measurements and samples were taken on walls, floors and ceiling. Recorded X, Y, Z coordinates of each location (if a spot or area with elevated radiation levels was identified during the general gamma scan, that location was selected for a sample),
- at each selected location took an α and $\beta\gamma$ (dpm/100 cm²) direct reading, a "contact" exposure rate (μ R/h) reading, a smear (to determine removable α and $\beta\gamma$ dpm/100 cm²), and a paint sample (to determine α and $\beta\gamma$ activity in paint), if object was painted. Analyze some samples by alpha spectrometry and some by gamma spectrometry,
- repeated α and $\beta\gamma$ direct readings (dpm/100 cm²) at each location after paint sample was removed,
- took core samples (concrete, lead, graphite, hardboard) at specified locations. Analyzed samples by gamma ray spectroscopy (and some by alpha spectrometry) to determine radionuclide concentration,
- took samples and direct measurements from specified reactor components and analyzed to determine radionuclide concentration,
- took samples from pits and tanks and analyzed for radioactivity and hazardous materials,
- took samples of insulation in all areas and tested for asbestos,
- tested paint on walls for lead,
- took samples for airborne radioactive particulates, tritium, and lead,
- removed instrument packages from the thimbles. Measured the exposure rate of the packages. Measured γ spec of one package. Measured exposure rates at every foot in the empty thimbles,

- took samples from outdoor soil drillings and analyzed for radioactivity and hazardous materials.

Every required task was entered on a spreadsheet and checked off when completed. The full check-off list is given in Appendix A.

Field measurements and sample location data were recorded on special forms. Examples of completed forms are shown in Appendix B. All of the field data were entered in a spreadsheet for processing and QA checking. The complete set of field data is given in Appendix C.

Special procedures were prepared for non routine tasks. Examples of such procedures are given in Appendix D.

IV. SCHEDULE

The Health Physics Section of the ANL-E Environment Safety and Health Division began characterization field work on January 9, 1996 and completed field work on February 9, 1996. Analyses of all samples were completed on March 22, 1996.

V. QUALITY ASSURANCE

Quality of the characterization process was assured by the following actions:

- All work was performed in compliance to the QA plans of the ESH Division, and the Health Physics Section.
- Calibration and Operational Checks - all instrumentation used in the characterization surveys were checked daily for proper operation. A log was maintained for operational checks. All radiation detection instrumentation were calibrated with NIST traceable radioactive sources. Instruments' calibration records are given in Appendix M.
- Chain of Custody - labels, sample collection forms, logs, custody seals, and designated sample custodians were used to assure that samples could be traced from collection to completion of analyses. An example of labels, request for analysis form, and chain of custody record form are given in Appendix E.
- Data Protection - all data stored on computers were backed up daily.
- Special attention was given to contamination control during intrusive sampling of potentially contaminated materials (e.g., during concrete coring) to assure that the characterization process did not alter or bias the true condition of the facility.
- For the inorganic and organic parameters, when practicable, the quality control (QC) samples were those specified in the EPA SW-846 method. For the radiological parameters, again when practicable, the QC samples used were those specified in the

Analytical Chemistry Laboratory of Argonne National Laboratory. More detailed information on the QC of analytical samples is given in Appendix G.

VI. SAMPLES AND MEASUREMENTS IDENTIFICATION SYSTEM

Samples and measurements of general areas were identified by a four element code:

Room no. or area	Element 1
Wall direction, ceiling, or floor	Element 2
X, Y coordinate	Element 3
Type measurement or sample	Element 4

Following are the notations used for each element.

Room or Area Location No.

200T	Top of Reactor
105	High Bay Reactor Room J105
112	Control Room J112
102	Fan Room J102
	Etc

Wall Direction, Ceiling, or Floor

N	North Wall
S	South Wall
E	East Wall
W	West Wall
F	Floor
C	Ceiling

X,Y Coordinate (all distances in feet)

- For walls, the origin 0,0 is at the lower left corner
- For floors and ceilings, the origin 0,0 is at the southwest corner

VII. SAMPLES AND MEASUREMENTS COORDINATE SYSTEM

The locations of samples and measurements on walls, floors and ceilings were identified by a simple rectangular coordinate system. For walls, the origin (the 0,0 coordinate) was the lower left corner (when facing the wall). The positive X axis was to the right of the origin along the floor line and the positive Y axis was up from the floor. The coordinate of a point was given by the standard notation of abscissa and ordinate (i.e. X,Y). All distances are given in feet.

For floors and ceilings, the southwest corner was used as the origin. The X axis is in the west-east direction and the Y axis is in the south-north direction.

The location of samples and measurements taken from the reactor proper are identified by cylindrical coordinates R , θ , Z so that all positions are referenced to the center of the reactor core (see Figure 7). The R coordinate is the radial distance in feet measured perpendicular from the vertical centerline of the reactor core. The coordinate θ is the angular distance in degrees measured clockwise from a horizontal west-east line which passes through the center of the core and the graphite thermal column. The coordinate Z is the vertical distance in feet measured from the horizontal center line of the reactor core. Z is positive above the horizontal core center line and negative below it.

A cylindrical coordinate system with the origin at the center of the reactor core was chosen to simplify estimation of the total activity in the materials surrounding the core.

Figure 7. Cylindrical Coordinate System Used to Identify Locations of Samples and Measurements

VIII. RELEASE CRITERIA AND BACKGROUND VALUES

To interpret the quantitative results of the characterization, the data were compared to currently accepted release criteria and background values typically found in the natural environment, and in structures where no work has ever been performed with radioactive materials.

Background reference values were determined by applying the characterization procedure to room R105 in Bldg 202. The room R105 was chosen as a reference because it is of similar construction and was never used for work with radioactive materials. Results of the R105 "characterization" are given in Appendix C.

Following are the principal release and background values:

Surface Contamination Release Criteria- Removable and total surface contamination limits (for unrestricted release of nonporous materials) used by the USNRC and by DOE are given in USNRC Regulatory Guide 1.86 (reference 1) and are listed in the following Table 1. The Regulatory Guide 1.86 values were adopted by DOE and are also listed in DOE Order 5400.5A (reference 2) and the draft rule 10 CFR 834 (reference 3).

Table 1. Allowable Residual Surface Contamination Limits (dpm/100 cm²)

<u>Total (fixed and removable)</u> <u>Radionuclides</u>	<u>Average</u>	<u>Maximum</u>	<u>Removable</u>
Transuranics, I-125, I-129, Ra-226, Ac-227, Ra-228, Th-228, Th-230, Pa-231.	100	300	20
Th-Natural, Sr-90, I-126, I-131, I-133, Ra-233, Ra-224, U-232, Th-232.	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay product, alpha emitters	5,000	15,000	1,000
Beta-gamma emitters (except Sr-90)	5,000	15,000	1,000

Radioactivity in wall paint - samples of paint from the background reference area (room R105 in Bldg 202) had maximum activity values of 1.2 dpm/100 cm² α and 9 dpm/100 cm² $\beta\gamma$.

Lead in paint release criteria - paint is considered to be lead-containing if it has greater than 0.5% lead by weight.

Background radiation exposure rate - the radiation exposure rate inside most buildings at ANL-E is typically 10-15 $\mu\text{R/h}$. This value is consistent with the natural background exposure rate in the midwestern USA (reference 4). The environmental penetrating radiation from areas surrounding ANL were $82 \pm 10 \text{ mrem/y}$ ($9.4 \pm 1.1 \mu\text{R/h}$); from the ANL boundaries the penetration radiation ranged from 67 mrem/y ($7.7 \mu\text{R/h}$) to 95 mrem/y ($10.9 \mu\text{R/h}$) (from reference 8).

Background radioactivity in soil - the activity concentration in soil is predominantly due to naturally occurring radionuclides in the uranium and thorium series. Some non natural radionuclides found in soil are due to atmospheric fallout. Typical concentrations in soil of the major natural and fallout radionuclides are listed in Table 2 from reference 8.

Asbestos release criteria - a material (e.g., insulation, pipe joint compound, floor tile) is considered asbestos-containing if it contains greater than 1% asbestos by weight.

Hazardous material release criteria - a RCRA (Resource Conservation Recovery Act) hazardous waste is defined as waste which meets one of the following two criteria:

1. it exhibits the 40 CFR 261.20 (reference 7) specific properties of
 - ignitability
 - corrosivity
 - reactivity
 - toxicity, and
2. it is listed in 40 CFR 265 (reference 7) as a RCRA hazardous waste, and it exceeds the specified concentration limits.

Airborne radioactivity limits - annual average concentration guidelines for the workplace are listed as derived air concentrations (DAC) in the DOE rule 10 CFR 835 (reference 5). However, the concentration on non naturally occurring radionuclides is expected to be non detectable in non radiological areas.

Airborne lead limits - the OSHA standard for airborne lead requires personnel blood lead level monitoring when the airborne concentration is greater than $30 \mu\text{g/m}^3$ and requires respiratory protection when the airborne concentration is greater than $50 \mu\text{g/m}^3$.

Retention tanks radioactivity release limits - at ANL-E, laboratory waste water is collected in retention tanks and is sampled and analyzed for alpha and beta radioactivity before being released to the laboratory waste water treatment plant. The release limits are 0.03 pCi/ml (the derived concentration guide for ^{239}Pu) for alpha activity, and 1.0 pCi/ml (the derived concentration guide for ^{90}Sr) for beta activity. Liquid waste exceeding these limits is processed to remove the contamination, normally by evaporation, and the residue disposed of as radioactive waste.

Table 2. Typical Background Concentrations in Soil and Sediments

Location	pCi/g					fCi/g		
	⁴⁰ K	¹³⁷ Cs	²²⁶ Ra	²²⁸ Th	²²⁸ Th	²³⁸ Pu	²³⁹ Pu	²⁴¹ Am
Soil Average								
ANL Perimeter	18.62 ± 2.39	0.49 ± 0.40	1.07 ± 0.39	1.11 ± 0.32	0.86 ± 0.17	0.5 ± 0.2	13.2 ± 2.7	4.5 ± 0.9
Off-site	19.03 ± 7.01	0.33 ± 0.31	1.22 ± 0.88	1.10 ± 0.44	0.81 ± 0.29	0.3 ± 0.1	8.7 ± 2.3	3.4 ± 1.0
Bottom Sediments Average								
ANL Perimeter	8.28 ± 3.16	0.36 ± 0.19	0.48 ± 0.16	0.38 ± 0.15	0.30 ± 0.09	0.7 ± 0.7	10.3 ± 6.8	4.0 ± 2.7
Off-site	11.09 ± 11.53	0.13 ± 0.35	0.80 ± 1.03	0.65 ± 0.83	0.52 ± 0.60	0.1 ± 0.4	3.7 ± 9.0	1.9 ± 2.7

pCi = 10⁻¹² Ci

fCi = 10⁻¹⁵ Ci

IX. INSTRUMENTATION

Instrumentation was chosen to assure that the MDAs for the selected instrument/technique was less than the release criteria. A listing of the principal instruments used and their typical MDAs is given in Table 3. Photographs of the principal portable instruments used are shown in Figures 8 through 14.

Figure 8. Tennelec APC MII Smear Counting System

Table 3. Instruments Used for Characterization

Purpose	Instrument	Detector Description	Measurement Units	Typical Characteristics	Typical MDA*
Total Surface (α)	NE Technology, Ltd. ELECTRA	Dual Scintillator 100 cm ² sampling area 0.5 mg/cm ²	cpm	21% ²⁴¹ Am efficiency, 30 sec integral time, ≤ 7 cpm background	95 dpm
Total Surface (β - γ)	NE Technology, Ltd. ELECTRA	Dual Scintillator 100 cm ² sampling area ~ 6 mg/cm ²	cpm	29% ⁹⁰ Sr-Y efficiency, 30 sec integral time, ≤ 400 cpm background	370 dpm
Removable Surface (α)	Tennelec APC	Gas Proportional 5 cm dia. 0.1 mg/cm ²	cpm	30% ²⁴¹ Am efficiency, 2 min count time, ≤ 1 cpm background	16 dpm
Removable Surface (β - γ)	Tennelec APC	Gas Proportional 5 cm dia. 0.1 mg/cm ²	cpm	42% ⁹⁰ Sr-Y efficiency, 2 min count time, ≤ 40 cpm background	48 dpm
Exposure Rate (γ)	Eberline ASP-1	TGM N378 Energy Compensated High Sensitivity GM	μ R/h	3.75 cps/ μ R/h ¹³⁷ Cs, 2 sec residence time, 10 μ R/h background	22 μ R/h net
Exposure Rate (γ)	Eberline E530 with HP-270 detector	HP-207 Energy Compensated GM with 12 ft cable	mR/h	20 cps/mR/h ¹³⁷ Cs, 2 sec residence time, 0.01 mR/h background	0.15 mR/h net
Exposure Rate (γ)	Ludlum Teletector	High range extended reach	mR/h; R/h	1000 R/h max	NA
Special Measurements (α)	Eberline FM-4 (Floor Monitor)	Gas Proportional 330 cm ² 0.85 mg/cm ²	dpm (2 π)	11% ²³⁹ Pu efficiency, 2 sec residence time, ≤ 5 cpm background	1300 dpm
Special Measurements (β - γ)	Eberline FM-4 (Floor Monitor)	Gas Proportional 330 cm ² 0.85 mg/cm ²	dpm (2 π)	6% ⁹⁰ Sr-Y efficiency, 2 sec residence time, ≤ 110 cpm background	6000 dpm
Exposure Rate	Eberline PRM 7	2.5 cm x 2.5 cm NaI (Tl) detector	μ R/h	3.75 cps/ μ R/h, 2 sec residence time, 10 μ R/h background	26 μ R/h net
Find Elevated x- γ	Eberline PRM 5-3 or ASP-1 with PG-2 detector	5 cm diameter x 2 mm thick NaI (Tl)	cpm	2 sec residence time, 500 cpm background	1500 cpm net

* **Note:** The typical MDA for all instrumentation except the Tennelec APC, the Eberline RO-20, and the Bicorn Microrem is based upon the use of audio output to enhance the discernment of recordable measurements.

Figure 9. Energy Compensated High Sensitivity Instrument
for $\mu\text{R/h}$ Measurements: TGM N 378 Detector with
Eberline ASP-1 Integrating Ratemeter

Figure 10. NE Technology Model Electra with 100 cm^2
Detector for Measuring $\alpha\beta\gamma$ Surface Contamination

Figure 11. Ludlum Model 3 with Energy Compensated GM Detector

Figure 12. Eberline PRM-5-3 with PG-2 Scintillation Detector
(2" x 2mm thick NaI detector)

Figure 13. Eberline FM-46 Floor Monitor with
325 cm² Gas Proportional Detector

Figure 14. Ludlum Teletector High Range
Extendable Detector

X. NUMBER OF MEASUREMENTS AND SAMPLES

A listing of the type and number of measurements performed and samples collected during the characterization is given in Table 4.

Table 4. Number of Measurements and Samples Required for Janus Characterization

ITEM	TOTAL NUMBER
Type of measurement	
● General γ scan	39
● General exposure rate	39
● Spot direct $\alpha\beta\gamma$	1278
● Spot exposure rate	840
● In-situ γ ray spectroscopy	1
Type of samples collected	
● Smears	987
● Wall paint scrapings	412
● Concrete	21
● Lead	6
● Hardboard	3
● Graphite	3
● Asbestos	20
● Air	14
Type of sample analyses	
● Gross $\alpha\beta\gamma$	1413
● γ spectroscopy	60
● α spectroscopy	13
● Lead	7
● Asbestos	20
● Hazardous materials	78
● PCB 9	

XI. RESULTS

A. Surprises

The characterization identified the following unexpected conditions:

1. The highest exposure rate in the reactor tank was only 175 mR/h.
2. The second highest source of radiation exposure (110 mR/h on contact) was from an activated instrument package in a vertical thimble.
3. The only locations with detected removable contamination were in the upper portion of the rabbit tube, in the two source storage holes, in the primary piping, and on the instrument packages, and in the reactor tank.
4. In the 10 ft horizontal core into the concrete base of the reactor, the magnite concrete section of the core had a fuel oil smell. The magnite concrete is in the steel clad pedestals which support the low dose brick wall and the shutter. The volatile organic analysis of a sample of the smelly core found 5 TICs (Tentatively Identified Compounds).
5. The concentration of sulfides in the west outdoor soil boring was more than 18 times greater than the concentration in the east boring.
6. The highest level of removable activity (4410 pCi ^{152}Eu /smear) was in the upper rabbit tube.
7. The highest activation (6.5 pCi ^{152}Eu /g) in the high dose room were in the shield door.
8. No activation was found in the lead and hardboard on the floor and walls of the high dose room.
9. Low levels of alpha contamination were found at three locations: at a single spot on the floor in the low level dose room, in the glovebox, and in the rabbit tube.

B. Soil Samples Results

Two 10 ft deep soil corings were taken outside the JANUS Facility. One was taken 45 feet southeast of the JANUS exhaust stack and the other was taken 298 feet west of the exhaust stack. A sketch of the sample locations is shown in Figure 15.

Figure 15. Location of Soil Samples Outside the JANUS Facility

No hazardous materials (per the RCRA definition) were found in the soil samples. The highest concentration of volatile organic compounds (VOCs) was 9 PPB tetrahydro-furan in the six foot sample south of the reactor. The highest concentration of semi-volatile compounds (SVOCs) was 7 ppm dioctylester hexanedioic acid in the one foot sample west of the reactor. While none of the VOCs and SVOCs identified are currently on the list of compounds regulated as toxic wastes under RCRA, the fact that VOCs and SVOCs were identified in some of the samples could mean that some additional characterization might be required prior to disposal of these materials. This is predicated on the regulatory requirements that apply to the final disposition of these materials. The sulfide concentrations, while below the EPA interim guidance for reactive sulfide of 500 mg H₂S/kg, are interesting because elevated concentrations were seen only in the boring west of the JANUS. The highest sulfide concentration, 359 mg/kg, was at the 9 ft depth. The concentration at 6 ft was 44 mg/kg. The sulfide concentrations in the boring taken east of the JANUS were all less than 20 mg/kg, the method detection limit (MDL). In the case of the boring west of the reactor additional sampling and analysis might be required to more completely determine the extent and maximum concentration of the sulfide-bearing material.

All soil samples contained only background levels of naturally occurring radionuclides. A summary from gamma ray spectroscopy and hazardous substance analyses are given in Table 5. The analytical results are in Appendix G. The geotechnical data provided by the driller are enclosed in Appendix H.

Table 5. Soil Sample Results

Analysis	Highest Concentration/Activity	Limit or Background Values
pH	8.09 $\pm$ 0.10 to 8.45 $\pm$ 0.10	≤ 2 or ≥ 12.5
Phenols	1330 μ g/kg	No action limit specified ¹
Cyanide	0.15 mg/kg	EPA 250 mg HCN/kg ²
Sulfide	359 mg/kg	EPA 500 mg H ₂ S/kg ³
Volatile Organic	8.02 μ g/kg tetrahydro Furan	No action limit specified for this compound ⁴
Semivolatile Organic	7190 μ g/kg dioctylester Hexanedioic acid	No action limit specified for this compound ⁴
PCB	none detected	EPA 50 ppm
Gamma Spectroscopy	2.2 $\pm$ 0.2 pCi/g ²¹⁴ Bi	1.22 $\pm$ 0.88 pCi/g ²²⁶ Ra
Metals	77.1 mg/kg Ba	EPA 2000 mg/kg Ba
Total Organic Carbon	1.37 Wt%	No action limit specified ¹

¹ Currently not on the list of compounds regulated under RCRA

² Total releasable cyanide

³ Total releasable sulfide

⁴ Currently the compound identified is not on the list of compounds regulated under RCRA

C. Surface Contamination and Exposure Rate Results (walls, floors, ceilings)

As expected the high dose room had exposure rates above normal background. For the other rooms, except for one spot, no surface contamination or exposure rates statistically above background values were detected on any walls, floors, ceilings, or steps. All of the data for these areas are given in Appendix C. Plan views of the JANUS Facility given in Figures 5 and 6 show these areas. The exception was one spot of alpha contamination found on the floor in the low level dose room. The spot was about 10 inches in diameter and the direct alpha measurement was 99 dpm/100 cm². The spot had no removable activity. An alpha survey (with a floor monitor) of the entire floor of the low dose room found no other spots of surface contamination. Alpha spectroscopy of a sample of the concrete from the contaminated spot showed only naturally occurring uranium and thorium. Detailed alpha spec results are given in Appendix K.

A listing of all of the areas in the JANUS Facility where surface contamination and exposure rates are below background or less than the release criteria is given in Table 6.

Table 6. Summary of Areas Below Release Criteria

Room		Maximum Smear Activity (dis/min)		Maximum Paint Activity(dis/min)		Exposure Rate (μ R/h)
Number	Name	alpha	beta	alpha	beta	
J-000	Stairway	5.3	20	3.3	17	10
J-002	High Dose Prep Room	5.3	20	3.3	20	10
J-014	Low Dose Prep Room	5.3	21	9.5	15	10
J-015	Low Dose Area Room	7.4	15			7
J-101	Final Filter Room	13.7	22	3.3	4	9
J-102	Fan Room	9.5	12	1.2	11	1
J-105	High Bay	9.5	33	11.6	25	20
J-108	Corridor	1.2	12	1.2	14	8
J-112	Control Room	9.5	12	3.3	12	9
J-118	Mechanical Room	5.3	23	1.2	14	6
J-300	Outside	3.3	20			14
J-400	Cooling Tower	1.2	11			8
Tanks	Retention Tank Farm	3.3	5			12
R-105	Background Reference Room	1.2	39	1.2	9	8

D. Crane Results

No direct or removable contamination was found on any part (hook, block, bridge, tracks, motor) of the crane in the reactor high bay room (J105).

E. Lead in Wall Paint Results

Paint on surfaces in the JANUS facility was tested for lead by the BGI Colormetric lead check test kit method. No paint containing lead was found on walls, ceilings, or floors in the JANUS Facility. Paint is considered to be lead-containing if it has greater than 0.5% lead by weight. Paint containing greater than 0.5% lead was found on the following objects in Table 7:

Table 7. Paint Sample Results

Room No.	Object	Paint
J105	Shutter air cylinder platform	Blue Paint
J105	Shield blocks above reactor	Gray paint with red undercoating
J105	Shield blocks above high dose room	Red paint
J105	Shield blocks above low dose room	Red Paint
J101	Gasometer in pump room	Gray Paint
J010	Heat exchanger in pump room	Green Paint
J101	Air storage tanks for pneumatic shutter activating system	Green Paint

F. Asbestos Results

Insulation and floor tiles in the JANUS Facility (those areas shown in Figures 5 and 6) were tested by the Boelter Environmental Consultants and by the Industrial Hygiene Section of the ANL-E Environment Safety and Health Division. The polarized light microscopy method was

used for asbestos identification. Materials with greater than 1 % asbestos (by weight) are considered to be asbestos-containing. Asbestos was found on the following objects presented in Table 8:

Table 8. Location of Asbestos

<u>Object</u>	<u>Room No.</u>
Air conditioning duct (insulation)	J101
Condensate (pipe joint compound)	J102
Steam pipe (pipe joint compound)	J102
Air conditioning duct (insulation)	J102
Condensate pipe (insulation)	J105
Condensate pipe (pipe joint compound)	J105
Steam pipe (pipe joint compound)	J105
Condensate pipe (pipe joint compound)	J002
Steam pipe (pipe joint compound)	J002
Air conditioning duct (insulation)	J002
Condensate pipe (pipe joint compound)	J010
Steam pipe (pipe joint compound)	J010
Air conditioning duct (insulation)	J010
Lab cold water pipe (insulation)	J010
Helium dryer (electrical heat tape)	J010
Condensate pipe (pipe joint compound)	J014
Domestic hot water pipe (insulation)	J014
Domestic cold water pipe (pipe joint compound)	J014
Steam pipe (pipe joint compound)	J014
Lab cold water pipe (insulation)	J014

All asbestos containing material in the JANUS facility is currently intact and contained. Each location that has asbestos-containing material was labeled.

G. Air Samples Results

To provide an indicator of what kinds of airborne contamination might be expected during "routine" phases of decommissioning, air samples were taken during the most intrusive parts of the characterization. The most intrusive work involved coring through activated lead, hardboard, concrete, and graphite.

Air samples taken during these operations showed no radioactivity other than short half-life decay products of naturally occurring radon.

Air samples collected in the high dose room showed lead concentrations of less than OSHA guidelines for personnel blood lead level monitoring or use of respirators. OSHA requires blood lead level monitoring when the airborne concentration of lead in the work area is greater than $30 \mu\text{g}/\text{m}^3$. Respiratory protection is required when the airborne lead concentration is greater than $50 \mu\text{g}/\text{m}^3$. During the lead coring, workers did wear respirators because we had the concentration results only after the work was completed.

A tritium air sample from the JANUS pump room was collected for a week. The airborne tritium concentration was less than 1×10^{-5} DAC. The DAC (Derived Concentration Guide) for tritiated water vapor is $20 \mu\text{Ci}/\text{m}^3$. (See Appendix F)

H. Roof, Stack and Cooling Tower Results

No radioactive contamination or elevated radiation levels were detected on the roof, inside and outside the ≈ 60 ft tall exhaust stack, or on the cooling tower. Sludge from the cooling tower had only naturally occurring gamma emitting radionuclides. Figure 16 is a photograph of the cooling tower, and Figure 17 is a photograph which shows the reactor high bay room, the exhaust ducts along the south wall, and the exhaust stack.

Figure 16. JANUS Cooling Tower

Figure 17. (Looking north-east) Reactor High Bay Room
with Exhaust Stack above Roof

I. Outdoor Wall, Outdoor Exhaust Ducts and Exhaust Duct Pits Results

No radioactive contamination or above background radiation levels were detected on the outer south and east walls, or on the 12 in. diameter metal exhaust ducts on the outer south wall which go from the low dose room and the high dose room to the exhaust stack.

The location where the exhaust ducts come out of the walls of the low dose and high dose rooms is about 14 ft below the outside grade. The ducts are enclosed by a 14 ft long steel half cylinder which isolates the ducts from the surrounding soil and allows access via a ladder to the bottom of the half cylinder pit. The pits have steel locked covers. The pit for the high dose room exhaust duct has several 8 ft long aluminum downspouts (rectangular tubes with cross section of about 2 in. by 3 in.) which were filled with plastic bags of borax. No contamination or elevated radiation levels were detected in either one of the pits. Analysis of a sample of the borax found no radionuclides above background concentration. A photograph of the inside of the high dose room exhaust duct pit is shown in Figure 18.

Figure 18. Inside of 14 ft Deep Pit for Exhaust Duct
from High Dose Room

J. Tanks, Sump and Pit Results (liquid and sludge)

Liquid and sludge samples were analyzed for hazardous materials and for radioactivity from the following tanks, and pits:

<u>Item</u>	<u>Location/Room No.</u>
Septic tank	Hallway outside E024
Retention tanks No. 5, 6, 7 and 8	Tank area
Sump	J014

Tests for hazardous materials included the following categories of analyses:

TCLP volatiles
TCLP semivolatiles
TCLP metals
reactivity

None of the samples exceeded the RCRA waste guidelines. Tests for radioactivity included gross $\alpha\beta\gamma$ assay, and gamma spectrometry. None of the measured concentrations in retention tanks exceeded the ANL-E discharge limits. A summary of results is given in Table 9. A copy of the detailed analytical results for the sampled tanks, pits and sumps is given in Appendix J.

Table 9. Liquid and Sludge Samples

<u>Analysis</u>	<u>Highest Concentration/Activity</u>	<u>Limit or Background Values</u>
pH	6.4 to 8.67 $\pm$ 0.10	≤ 2 or ≥ 12.5
Phenols	none detected	No action limit specified ¹
Cyanide	none detected	EPA 250 mg HCN/kg ²
Sulfide	none detected	EPA 500 mg H ₂ S/kg ³
Volatile Organic	246 μ g/L dimethoxy Methane	No action limit specified for this compound ⁴
Semivolatile Organic	58 μ g/L 6-chloro-2-heptane	No action limit specified for this compound ⁴
PCB	17 mg/L Aroclor 1254	EPA 50 ppm
Gamma Spectroscopy	10 pCi/g ⁶⁰ Co	1.22 $\pm$ 0.88 pCi/g ²²⁶ Ra
Metals	0.932 mg/L Ba	EPA 5.0 mg/L Ba
Total Organic Carbon	2.36 mg/L	No action limit specified ¹
Gross α	26.9 pCi/g	
Gross β	60.8 pCi/g	

¹ Currently not on the list of compounds regulated under RCRA

² Total releasable cyanide

³ Total releasable sulfide

⁴ Currently the compound identified is not on the list of compounds regulated under RCRA

K. Ductwork and Air Vents

No fixed or removable contamination was detected on any ductwork or air vents (both intake and supply). The filters on the north wall of the pump room accumulated rather high levels of naturally occurring ^{222}Rn and ^{220}Rn daughters. This however, is not a result of the reactor operation.

L. Glovebox Results

The small four-port glovebox in room J120 is not connected to the exhaust system and was, according to Building 202 management, never used. The entire inside surface of the box is covered with tape and the tape is covered with a white paint.

There are no hazardous materials or containers inside the box. The only objects inside the box are miscellaneous pieces of 5 inch diameter stainless steel duct. No radioactive contamination was detected by direct measurements on the outside or inside of the box. However, alpha activity was detected on one smear sample taken inside the box. Alpha spectroscopy of that sample indicated 2.0 ± 0.2 pCi $^{239}\text{Pu}/100\text{ cm}^2$ and 0.15 ± 0.04 pCi $^{238}\text{Pu}/100\text{ cm}^2$. Two tape/paint samples from the glovebox were analyzed for alpha emitters and another two samples were analyzed for gamma emitters. The alpha spectrometry data indicate low levels of only naturally occurring radionuclides. There is 0.32 ± 0.03 pCi/g of ^{137}Cs activity on one of the samples. No fixed or removable contamination was detected on the outside ductwork.

All of the analytical results for glovebox samples are given in Appendix I.

M. Pump Room Results

The pump room (J010), also called the reactor equipment room, was a prime suspect for contamination because the piping and pumps there handled primary cooling water from the reactor tank. Views of the pump room are shown in Figure 19 and 20. Any activation and corrosion products produced in the reactor tank would be expected to be seen in the primary cooling system. When the primary cooling system was drained and flushed in 1993, the primary water had 1400 ± 100 pCi $^3\text{H}/\text{ml}$, and the flush water had 15.6 ± 0.8 pCi $^3\text{H}/\text{ml}$.

The heat exchanger was still present but most of the piping, pumps and filters associated with the secondary cooling system were removed after the fuel removal in 1993.

Direct measurements and samples were taken in the pump room at all accessible open flanges and pipes. Some of these locations are shown in Figures 21 and 22.

No contamination was detected by direct measurements or by smear on any parts of what is left of the secondary cooling system.

Figure 20. West Wall of J010 with Portion of
Primary Water Storage Tanks

Figure 19. East Wall of J010 with Gasometer,
Heat Exchangers and Primary
Cooling Water Pumps

Figure 21. Bottom of Primary Water Storage Tank in J010

Figure 22. Sampling Locations for Pumps PW24 and PW25 in J010

N. Activation of Material in High Dose and Low Dose Rooms

High Dose Room - four 3 inch diameter core samples were taken in the high dose room. Figure 23 is a vertical cross section through the high dose room which shows that the concrete walls and floor of the high dose room are covered with approximately 4 inches of borated hardboard and 4 inches of lead. Corings (location shown in Figure 24) were taken from the floor, south wall, west wall, and from the shield door. The concrete shield door did not have a lead or hardboard covering. The wall and door corings were taken at the height of the reactor core horizontal center line. The south wall and floor corings were 14 inches deep (4 in. lead, 4 in. hardboard, and 6 in. concrete). The west wall coring was 24 inches deep (4 in. lead, 4 in. hardboard, and 16 in. concrete). The core taken in the concrete shield door was 19 inches deep. The concrete cores were each split into sections 1 1/2 to 3 inches thick. One lead sample was taken from the reactor face. Another lead sample was taken from the planks on the floor.

A photograph of a cored area in the high dose room and one of the cores is shown in Figure 25. A photograph of a core of lead, hardboard and concrete is shown in Figure 26. The exposure rate at each coring location and the results of samples analyzed by gamma ray spectroscopy is shown in Table 11. Analytical results are also shown in Appendix K.

The analytical results show that the highest activity concentration was 11.8 pCi ^{152}Eu /g in the concrete material on the shield door. The concrete samples indicate oscillating concentration of the radionuclides with depth. However, there does appear to be a decrease in activity beyond about 5" deep in the shield door and beyond about 10" in the west wall of the high dose room. The dominant radionuclide is still ^{152}Eu . The results are presented in Table 11 and plotted as a function of concentration vs. the distance of the center of the piece of concrete from the surface closest to the reactor in Figures 27 and 28. The results show that the concentration at 15" deep is about the same as at the surface. No induced activity was detected in the hardboard from the floor, south wall or west wall.

Lead sample #1 was removed from the face of the reactor. Lead sample #2 was removed from the stored planks in the high dose room. The dominant radionuclide in sample #1 is $^{110\text{m}}\text{Ag}$ with a 249.85 day (~8 months) half-life. There was less than 0.2 pCi/g of ^{137}Cs or ^{60}Co in either sample.

The exposure rate from one spot on the frame of the converter plate was 3 mR/h on contact.

The average exposure rate in areas accessible to personnel in the high dose room was approximately 20 $\mu\text{R/h}$.

Figure 23. Vertical Cross Section through JANUS High Dose Room

Figure 24. Plan View of High Dose Room (to left of reactor), and Low Dose Room Showing Core Samples Locations

Figure 25. Inside the High Dose Room

Figure 26. Core from Wall of High Dose Room

Table 11. Analyses of Core Samples from High Dose Room

Location/Material	Sample Number	Exposure Rate (μ R/h) on contact	Activity by Radionuclide (pCi/g)				
			^{60}Co	^{134}Cs	^{152}Eu	^{154}Eu	^{226}Ra
Floor Lead	007F03, 08L1	15	BDL	BDL	BDL	BDL	<0.2
Floor Hardboard	007F03, 08B1	15	<0.2	BDL	BDL	BDL	<0.2
Floor Concrete Core 0" - 3"	007F03, 08C1	15	0.431 ± 0.043	<0.2	3.48 ± 0.35	<0.2	<0.2
Floor Concrete Core 3" - 6"	007F03, 08C2	15	0.371 ± 0.037	<0.2	3.14 ± 0.31	<0.2	<0.2
Door Concrete Core 0" - 3"	007N02, 3.5C1	15	2.24 ± 0.22	<0.2	5.51 ± 0.55	<0.2	<0.2
Door Deep Concrete Core 3" - 6"	007N02, 3.5C2	15	2.67 ± 0.27	<0.2	6.53 ± 0.65	0.423 ± 0.042	0.206 ± 0.021
Door Concrete Core 6" - 7.5"	Door #1A		0.0797 ± 0.008	<0.2	0.721 ± 0.072	<0.2	BDL
Door Concrete Core 7.5" - 11.5"	Door #2A		1.60 ± 0.16	<0.2	3.26 ± 0.33	0.348 ± 0.035	BDL
Door Concrete Core 11.5" - 15.3"	Door #3A		<0.2	<0.2	0.164 ± 0.016	<0.2	BDL
Door Concrete Core 15.3" - 18.8"	Door #4A		0.967 ± 0.097	<0.2	2.39 ± 0.24	0.206 ± 0.021	BDL
South Wall Lead	007S5.5, 3.5L	15	BDL	BDL	BDL	BDL	<0.2
South Wall Hardboard	007S5.5, 3.5B1	15	<0.2	BDL	BDL	BDL	<0.2
South Wall Concrete Core 0" - 3"	007S5.5, 3.5C1	15	1.94 ± 0.19	<0.2	3.19 ± 0.32	<0.2	0.321 ± 0.032
South Wall Concrete Core 3" - 6"	007S5.5, 3.5C2	15	0.558 ± 0.056	<0.2	3.81 ± 0.38	0.277 ± 0.028	<0.2
West Wall Lead	007W7.5, 3.5L	15	BDL	BDL	BDL	BDL	<0.2
West Wall Hardboard	007W7.5, 3.5B1	15	<0.2	BDL	BDL	BDL	<0.2
West Wall Concrete Core 0" - 3"	007W7.5, 3.5C1	20	0.324 ± 0.032	<0.2	2.10 ± 0.21	<0.2	<0.2
West Wall Concrete Core 3" - 6"	007W7.5, 3.5C2	15	0.510 ± 0.051	<0.2	3.43 ± 0.34	<0.2	<0.2
West Wall Concrete Core 6" - 8.5"	West wall #1		0.293 ± 0.029	<0.2	1.90 ± 0.19	<0.2	BDL
West Wall Concrete Core 8.5" - 10.5"	West wall #2		3.94 ± 0.39	0.16 ± 0.02	11.8 ± 1.2	1.07 ± 0.11	BDL
West Wall Concrete Core 10.5" - 14.5"	West wall #3		0.166 ± 0.017	<0.2	1.57 ± 0.16	<0.2	BDL
West Wall Concrete Core 14.5" - 15.5"	West wall #4		0.583 ± 0.058	<0.2	1.01 ± 0.10	0.202 ± 0.020	BDL

BDL Below Detection Level

Figure 27. Concrete Sample Analyses for High Dose Room Door

Figure 28. Concrete Sample Analyses for High Dose Room West Wall

Low Dose Room - five six inch deep samples were taken in the low dose room at the following location:

- Concrete bussell above reactor lead wall
- reactor lead wall
- south wall
- lead bricks on north wall
- east wall

These locations are also shown in the Figure 24.

Analytical results for the low dose room core samples are given in Appendix K. The data show that in all samples only naturally occurring radionuclides were detected. Lead from the reactor lead wall and from the row of lead bricks on the north wall had < 0.2 pCi/g of naturally occurring ^{226}Ra . In the concrete samples, the maximum activity concentration was 0.46 pCi $^{226}\text{Ra}/\text{g}$.

O. Fuel Storage Holes

There are two 5 in. diameter by 9 ft deep holes in the floor of the reactor high bay room (about 7 ft north of the center of the reactor tank). The locations of the storage holes (tubes) are shown in Figure 5. Low levels of removable $\beta\gamma$ contamination (up to 74 ± 26 dpm) were found in both holes.

P. Activation and Contamination of Reactor Components and Materials

Characterization of the reactor assembly and its associated shielding consisted of the following principal tasks:

- remove (and check for contamination) the 20 ton shield blocks above the reactor,
- measure exposure rate and contamination level on reactor top,
- remove instrument packages (radiation detectors) from the three vertical thimbles in the graphite region around the reactor tank. Measure exposure rate and contamination of instrument packages,
- make in-situ gamma spectroscopy analysis of one instrument package,
- measure exposure rate depth profile in thimbles,
- remove one vertical thimble and obtain graphite samples from thimble hole,
- drill 3 in. diameter by 9 ft deep core in concrete shield outside reactor tank and measure exposure rate depth profile in hole,

- remove fuel rods cover plate from reactor tank. Measure exposure rate depth profile and measure removable contamination (take smear),
- remove fuel rod grid plate. Remove one aluminum retainer clip from plate for analysis. Remove two stainless steel screws and washers for analysis,
- remove $\approx$ 200 pound cover plate from rabbit tube (accessible from low dose prep room). Measure exposure rate and take smears in tube. Check associated vacuum lines, filter and vacuum pump for contamination,
- drill 3 in diameter x 10 ft deep horizontal core into concrete base under reactor tank (the coring was done from low dose room),
- remove 20 ton double layer of shield blocks above high dose room and low dose room. Measure for contamination and activation,
- measure exposure rate and contamination on pulleys, cables, and air cylinder which operated high dose side converter plate and attenuator plate.

Performing those tasks gave the following information:

Shield blocks - the second layer of shield blocks above the high dose room are the only ones which show activation of the material ($20 \mu\text{R/h}$ at contact). None of the shield blocks (i.e. those over the high dose room, those over the reactor, and those over the low dose room) had detectable removable contamination.

Activation of components above high dose room - the horizontal air cylinders which were used to operate the cables which raised and lowered the converter plate (removed in 1993), and the attenuator plates are housed above the high dose room in the space below the shield blocks. The cables are guided by 8 steel pulleys arranged in two groups of four. The two outer pulleys in both groups were activated and gave exposure rates up to $50 \mu\text{R/h}$ on contact. No removable contamination was detected on the pulleys, on the air cylinders, on the air surge tank, or on any other object above the high dose room. A photograph of the area above the high dose room is shown in Figure 29.

Reactor top - no contamination was detected on the reactor top. A photograph of the top of the reactor is shown in Figure 30. The average exposure rate at 3 ft above the reactor top was less than 1 mR/h.

Instrument packages - the highest exposure rate measured anywhere outside the reactor tank was from the instrument packages. Exposure rate and contamination levels for instrument packages removed from the three vertical thimbles are given in Table 12. An entire instrument package was analyzed with a portable HPGe gamma ray spectrometer and the principle radionuclides identified were ^{60}Co and ^{65}Zn in an approximate 5:1 ratio. Those results are included in Table 12. A photograph of an instrument package is shown in Figure 31.

Table 12. Exposure Rate and Contamination from Instrument Packages

Thimble no.	Exposure rate (mR/h) ¹	Removable contamination (dpm/100 cm ²)	Principal radionuclides
1	60	1000	⁶⁰ Co, ⁶⁵ Zn
2	110	18,000	
3	70	1000	

¹ Exposure rate measured on contact

Exposure rates in thimble holes and core holes - after the instrument packages were removed from the 5 inch diameter vertical thimbles, the exposure rate in each thimble was measured (thimble locations shown in Figure 32). The highest exposure rate (50 mR/h) in a thimble was at the depth of the reactor core center line. To determine whether the exposure rate was due to activation of the thimble itself or to the surrounding graphite, thimble #1 was completely removed. After removal it was found that the thimble itself was a minor contribution to the measured exposure rate. The exposure rates measured in the thimble holes (all in the graphite region) are given in Table 13. There were low levels of removable contamination in the thimbles but the most likely sources are residue from the activated instrument packages.

Using the tool shown in Figure 33 through 36, samples of lead and graphite were taken from the wall of the hole where the thimble was removed. The activity concentrations measured in the lead and graphite samples are shown in Table 14. The exposure rates at the sampled locations are also given in Table 14. A cross section of the thimble hole is shown in Figure 37 and a cut-away of the reactor showing the thimbles is given in Figure 38.

Figure 29. Looking Down into Area Above the High Dose Room

Figure 30. Top of the Reactor (with shield blocks removed)

Figure 31. Instrument Package being Removed from a Thimble

Figure 32. Distance and Material Thickness Between Center of Reactor Core Center of Thimbles and Center of Core Hole in Concrete

Figure 33. Grinding Head Collecting Assembly
for Graphite from Thimble Hole #1

Figure 34. Drive Motor for Graphite Sample

Figure 36. Graphite Sample

Figure 35. Using Graphite Sampler

Figure 37. Thimble Hole in Graphite Region of Reactor Shell

Figure 38. Cut-away of Reactor Showing Thimble Hole in Graphite Region
of Reactor Shell and Core in Concrete Outside the Shell

A 3 in. diameter 9 ft deep hole was cored into the high density concrete shield just outside the steel shell of the reactor (location shown in Figure 32 & 38). Samples were analyzed by gamma ray spectroscopy. The activity concentration in the cored hole along with the activity concentration in the graphite of thimble hole No. 1 is given in Table 14. The position of samples in the vertical core is shown in Figure 39.

The dominant radionuclides ^{152}Eu and ^{154}Eu are produced by neutron capture of the non radioactive rare earths ^{151}Eu and ^{153}Eu , which are naturally occurring in concrete and in graphite.

Table 13. Exposure Rate in Thimble Holes and Cored Hole

Depth ¹ (feet)	Exposure Rate (mR/h)			
	Thimble #1 ²	Thimble #2 ³	Thimble #3 ⁴	Cored Hole ⁵
+5	0.02	0.02	0.1	
+4	0.05	0.06	0.1	< 0.01
+3	2.0	2.0	1.5	0.01
+2	5.0	6.0	9.0	0.5
+1	12.	17.	30.0	1.5
0	25.	30.	50.0	3.0
-1	25.	40.	50.0	1.5
-1½	21.	35.	40.0	
-2				0.5
-3				0.5

1

0 depth is at the reactor center line

2,3,4,5

Radial distance (R) from vertical center line of reactor core:

for Thimble #1, R = 1.30 feet

for Thimble #2, R = 1.28 feet

for Thimble #3, R = 1.28 feet

for Cored hole, R = 1.44 feet

**Table 14. Activity Concentration in Graphite from Wall of
Thimble Hole and Vertical Cored Concrete Adjacent to Reactor Tank**

Depth (feet)	Wall of Thimble Hole					Vertical Core in Concrete						
	Hole Expo- sure Rate (mR/h)	Activity Concentration (pCi/g)				Hole Ex- posure Rate (mR/h)	Activity Concentration (pCi/g)					
		²²⁶ Ra	⁶⁰ Co	¹⁵² Eu	¹⁵⁴ Eu		¹³⁴ Cs	⁶⁰ Co	¹⁵² Eu	¹⁵⁴ Eu	²²⁶ Ra	⁵⁴ Mn
+4½	*	0.26±0.03					<0.2	0.155±0.016	0.497± 0.050	<0.2	<0.2	
+4	0.05					< 0.01						
+3	2.0		35.5±3.5	97.7±9.8	6.2±0.6	0.01						
+2	5.0					0.05						
+1½							0.254±0.025	14.4±1.4	40.3±4.0	2.90±0.29	1.34±0.13	
+1	12.0		7.5±0.8	165.4±16.5	0.2±1.0	1.5						
0	25.0					3.0	0.848± 0.085	44.2±4.4	12.2±1.2	8.35±0.84	4.03±0.40	
-1	25.0		295±30	3,100±310	266±27	1.5						
-1 ½	21.0											
-2						0.5						
-2½							<0.2	6.09±0.61	16.4±1.6	1.03±0.10	0.259±0.026	
-3						0.5						
-4						0.05 @		10.6±1.0				0.7±0.1

* lead sample

@ steel rebar

Figure 39. Position of Samples in Vertical Concrete Core from Top of Reactor

Reactor tank - the 18 in. diameter cover plug of the reactor core was removed to allow easy access for collection of samples and exposure rate measurements. Low levels of removable contamination (150 & 170 dpm β /100 cm²) were detected in the tank during this characterization. On June 9, 1994, smears from inside the tank showed 3100 dpm $\beta\gamma$ /100 cm² on the top of the plenum, and 960 dpm $\beta\gamma$ /100 cm² on the reflector tank. A photograph of the cover plug being removed is shown in Figures 40 and 41. The exposure rate depth profile along the vertical center line of the reactor core is given in Table 15. TLD measurements made on June 1, 1994 are included in the Table 15 for comparisons with the January 26, 1996 ion chamber measurements.

Table 15. Exposure Rate in Reactor Tank

Depth (feet)	Exposure Rate (mR/h)	
	Ion Chamber	TLD (1994 Data)
+4¼		0
+4	17	
+3¼		120
+3	40	
+2 1/6		115
+2	70	
+1	115	
0	175	315
-1	175	
1.19		285
-1½	160	
-1.6		210

Figure 40. Removal of Reactor Core
Top Shield Plug

Figure 41. Removal of Plug Showing Interior of Reactor Tank

Fuel Rod Grid Plate - the grid plate was removed so that one of the four aluminum clips could be removed for gamma spectrometric analysis. The clips are made of the same type of aluminum (type 6061) as the grid plate and the reactor tank. It would have been simpler to cut a section out of the grid plate for a sample but the decision was made not to destroy the integrity of the plate. The stainless steel spring pins (used for positioning on the grid plate) in the clip were removed to avoid interference from activation of a different metal. The pins could not be removed by punching them out so the aluminum around them was removed by cutting slots into the clip. The stainless steel flat head screws used to attach the aluminum clip to the grid plate were analyzed separately. A photograph of the grid plate and the clip removed for analysis are shown in Figures 42 and 43. Results of the gamma spectroscopy measurements are given in Table 16. The data show that the dominant radionuclide in the aluminum is ^{60}Co . Complete analysis results are in Appendix K.

Table 16. Fuel Rod Grid Plate Samples

Item	Sample Number	^{60}Co (pCi/g)
Aluminum clip	200-1	165 ± 17
Steel Bolts, Washers, Retaining Clips	200-2	$97,400 \pm 9,700$

Rabbit Tube - the rabbit tube shield plug, located in the low dose prep room, was removed to gain access to the upper portion of the tube. The plug is estimated to weigh several hundred pounds. A photograph of the plug being removed is shown in Figure 44. It was expected that the antimony start-up source might still be in the upper part of the rabbit tube but it was not. It is assumed that the beryllium cup is still in the upper tube. There was no simple way to confirm this. Smears and exposure rate measurements were taken in the rabbit tube (see Figure 45). No removable contamination was detected in the lower portion of the rabbit tube but up to 3300 dpm $\beta\gamma/100\text{ cm}^2$ was detected in the upper portion. Samples of the smears were analyzed by alpha and gamma spectrometry. In the upper tube, removable activity was up to 4410 pCi ^{60}Co /smear, 3375 pCi ^{152}Eu /smear, and 0.6 pCi $^{239/240}\text{Pu}$ /smear. Results of gamma and alpha spectrometric analyses are shown in Table 17. The exposure rate and contamination level found in the rabbit tube are listed in Table 18. No contamination was found on the rabbit tube vacuum line filter or on the vacuum pump. The pump was not connected and is stored near the west wall of the low dose prep room. Analytical results are found in Appendix I and direct survey results are found in Appendix C.

Figure 42. Reactor Grid Plate

Figure 43. Solid Aluminum Clip Sample 200-1

Table 17. Removable Activity in Rabbit Tube

Depth (ft)	Radionuclides pCi/filter				
	¹³⁷ Cs	⁶⁰ Co	¹⁵² Eu	¹⁵⁴ Eu	^{239/240} Pu
Core Center -1/4	< 10	1005±100	380±38	< 10	0.11±0.02
Core Center	260±26	4410±441	3375±340	67±7	0.60±0.07

Table 18. Measurements in Rabbit Tube

Depth (feet)	Removable Activity βγ dpm/ 100 cm ²	Exposure Rate (mR/h)
		GM
0	12±19	<0.01
1	6±18	<0.01
2	-22±14	<0.01
3	-9±16	0.01
4	-17±20	0.02
5	-4±17	0.02
6	3±18	0.05
7	2±18	0.05
8	-14±16	0.08
9	-10±16	0.08
10	24±20	0.5
11	39±22	1.5
12	11±19	12
13	122±29	50
14	92±27	100
core center	148±31	100
15	254±38	150

Figure 44. Rabbit Tube Shield being removed (in J014) to Expose Upper Rabbit Tube

Figure 45. Taking Smear from Lower Rabbit Tube

Horizontal Core in Reactor Base - a 10 ft long horizontal core was taken from the concrete base which supported the reactor tank. The first section of the coring through the pedestals was done with a 4 in. diameter hollow diamond bit and the remainder was done with a 3 in. bit. The core was drilled from the low dose room on a line which passed below the center of the reactor core. The drilling was parallel to the floor of the low dose room and was positioned to pass as close as possible to the bottom of the reactor containment shell without damaging it. The center of the core was 3 in. above the floor of the low dose room. The location of the coring relative to the reactor center line is shown in Figure 46.

The original plan was to drill into the base on an east-west line which passed under the center of the reactor core. However, this would have required coring through one of the aluminum support columns which position the reactor shell over the concrete base. It was decided that the integrity of the reactor support structure could be left intact by shifting the core hole 8 degrees to the south so it would just miss the support column. The core drill alignment was monitored with a laser to assure that selected direction was maintained. A photograph of the horizontal coring in progress is shown in Figure 47. To reach the base of the reactor, it was necessary to core through the 10 in. wide steel encased concrete pedestal which supports the lead wall (on low dose side of the reactor), and through the 10 in. wide encased concrete pedestal which supported the shutter when it was in the down position. Both pedestals are really tanks, made of 1/4" steel, which are filled with magnite high density concrete. There was a gap of about 4 in. between the shutter pedestal and the reactor base. A photograph of the core is shown in Figure 48. A sketch of the core and the selected samples is shown in Figure 49. The exposure rate in the core hole and the core samples and activity concentrations are shown in Table 19.

An interesting sidelight is that the magnite concrete cores from the two pedestals had a fuel oil like smell. A sample of the "smelly" concrete was analyzed for volatile organics but none of the RCRA listed volatile organic compounds was detected. However, five TICs (Tentatively Identified Compounds) were detected. The compound 2-propanone was found at a maximum concentration of 22 $\mu\text{g/kg}$ of concrete. Detailed results of this analysis are given in Appendix K.

Figure 46. Vertical Cross Section Showing Location of Horizontal Core in Concrete Base of Reactor

Figure 47. Horizontal Coring in Progress

Figure 48. Sections of Horizontal Core

Table 19. Activity Concentration from Horizontal Cored Concrete Below Reactor Tank

Distance (feet)	Exposure Rate (μ R/h)		Activity by Radionuclide (pCi/g)				
	Sample	Core Hole	^{60}Co	^{134}Cs	^{152}Eu	^{154}Eu	^{226}Ra
9		20					
8		20					
7½	15		<0.2	<0.2	<0.2	<0.2	0.537 $\pm$ 0.054
7		20					
6		20					
5.1	15		<0.2	<0.2	<0.2	<0.2	<0.2
5		20					
4		30					
3		30					
2		50					
1.8	15		1.26 $\pm$ 0.13	<0.2	4.58 $\pm$ 0.49	0.299 $\pm$ 0.030	<0.2
1		500					
0	30	500	9.49 $\pm$ 0.95	0.289 $\pm$ 0.029	42.9 $\pm$ 4.3	2.08 $\pm$ 0.21	<0.2
-0.9	30		16.5 $\pm$ 1.7	0.260 $\pm$ 0.026	42.9 $\pm$ 4.3	2.95 $\pm$ 0.30	2.30 $\pm$ 0.23
-1		500

Figure 49. Position of Samples in 10 ft Long Horizontal Concrete Core from Base of Reactor

Q. Summary of Hazardous Material Results

All of the samples analyzed for hazardous materials (both indoors and outdoors) were below the regulatory limits specified in 40 CFR 261 which would classify them as a RCRA hazardous waste. All of the hazardous materials analytical results are listed in Appendix J.

R. Summary of Alpha Contamination

Low levels of alpha contamination were found at the following three locations:

- Glove box - 2.0 pCi $^{239/240}\text{Pu}$ /smear was found on one smear from inside the glovebox in room J120.
- Rabbit tube - 0.6 pCi $^{239/240}\text{Pu}$ /smear was found at the deepest end of the upper rabbit tube.
- Low dose room - 100 dpm/100 cm² fixed contamination in a 10 inch diameter discolored spot on the floor of the low dose room. An alpha survey of the entire floor with a floor monitor found no other spots of contamination.

XII. SUMMARY OF AREAS WHICH HAVE POSITIVE RESULTS ABOVE BACKGROUND OR RELEASE CRITERIA

- Except for one small spot of alpha contamination on the floor of the low dose room, no radioactive contamination was found on any walls, ceilings, steps, floor, light fixtures, or electrical panels in the JANUS facility.
- No lead paint was found on walls or ceilings but was found on 7 other items.
- Asbestos was found in 20 locations.
- Low levels of alpha contamination was found in the glovebox in J120.
- Removable contamination (α and $\beta\gamma$) was found in the rabbit tube.
- No induced activity was detected in lead and hardboard which covered the concrete walls in the high dose room. However, activation was found in the concrete to a known depth of at least 6 in. The highest level of activation in concrete at 6 in. deep was in the shield door.
- The highest exposure rate was 175 mR/h at the center of the reactor core.
- Activation was found in pulleys and a shield block above the high dose room.
- Activation was found in concrete just outside the steel shell of the reactor.

- Activation was found in the concrete base (foundation) of the reactor at least 3 feet (maximum of 5 ft) from the center of the reactor.
- Removable contamination was found in primary water piping in the pump room.

XIII. ESTIMATE OF INVENTORY OF RADIONUCLIDES IN REACTOR MATERIALS

The characterization data show that:

- there is essentially no activation of material within the reactor radii greater than about 5 feet from the center of the reactor core and,
- the principal radionuclides in any material are ^{60}Co , ^{152}Eu , and ^{154}Eu . Their half life and gamma dominant energies are

^{60}Co	5.27 year	1173 keV (100%) 1332 keV (100%)
^{152}Eu	13.6 year	344 keV (27%) 789 keV (13%) 1299 keV (36%)
^{154}Eu	8.0 year	723 keV (20%) 1004 keV (18%) 1274 keV (36%)

To estimate the total activity in each type of reactor material, the radionuclide concentrations at a single point of known radius R and vertical distance Z from center of the reactor was assumed to be the same at every location which had the same R and Z values. The locations of samples and measurements in reactor materials are shown in Figures 32, 50 and 51. Exposure rates and sample concentrations and the given positions are listed in Table 20. An estimated inventory of materials in the reactor is listed in Table 21.

Using the previously listed exposure rates, and the concentration of the principal radionuclides (^{60}Co , ^{152}Eu , ^{154}Eu) at known radii from the center of the reactor core, the total inventory of radionuclides in the reactor materials was estimated using Micro Shield Version 4 (reference 9). The estimated activity inventory is given in Table 22.

Figure 50. Cross Section Through Reactor Showing Location of Samples in Reactor Material

Figure 51. Cross Section Through Reactor Showing Dimensions

Table 20. Sample and Measurement Points in Reactor

Location in Figure	Sample #	R distance (feet)	Z distance (feet)	Material	Sample $\mu\text{R/h}$ at contact	Activity (pCi/g)		
						^{60}Co	^{152}Eu	^{154}Eu
1	#1	1.3	3	graphite		35.3 ± 3.5	97.7 ± 9.8	6.2 ± 0.6
2	#2	1.3	$2\frac{1}{2}$	graphite		7.5 ± 0.8	165.4 ± 16.5	10.2 ± 1.0
3	#3	1.3	0	graphite		295 ± 30	3100 ± 310	266 ± 27
4	#4	1.3	$4\frac{1}{2}$	lead		BD	BD	BD
5	J015 -0.9	-0.9	$-4\frac{1}{2}$	concrete	30	16.5 ± 1.7	42.9 ± 4.3	2.95 ± 0.30
6	J015 0	0	$-4\frac{1}{2}$	concrete	30	9.49 ± 0.95	42.9 ± 4.3	2.08 ± 0.21
7	J015 +1.8	1.8	$-4\frac{1}{2}$	concrete	15	1.26 ± 0.13	4.58 ± 0.49	0.299 ± 0.030
8	J015 +5.1	5.1	$-4\frac{1}{2}$	concrete	15	<0.2	<0.2	<0.2
9	J015 +7.5	7.5	$-4\frac{1}{2}$	concrete	15	<0.2	<0.2	<0.2
10	200T -4.0	3.9	-4	rebar	15	10.6 ± 1.0	BD	BD
11	200T -2.5	3.9	$-2\frac{1}{2}$	concrete	25	6.09 ± 0.61	16.4 ± 1.6	1.03 ± 0.10
12	200T 0	3.9	0	concrete	55	44.2 ± 4.4	12.2 ± 1.2	8.35 ± 0.84
13	200T +1.5	3.9	$1\frac{1}{2}$	concrete	40	14.4 ± 1.4	4.03 ± 4.0	2.90 ± 0.29
14	200T +4.5	3.9	$4\frac{1}{2}$	concrete	20	0.155 ± 0.016	0.497 ± 0.05	<0.2
15	200-1	0	$2\frac{1}{3}$	Al clip		165 ± 17	BD	BD
16	200-2	0	$2\frac{1}{3}$	screws, washers		97400 ± 9700	BD	BD

BD Below Detection Levels

Table 21. Estimate of Weight of Materials in Reactor

Item	Material	Total Volume (cubic ft)	Total Weight
Reactor tank	½ in. thick aluminum		1,023 lbs
Core plug	18 in. diameter x 18 in. long steel cylinder		
Reactor shell	½ in. thick steel	16.2	7,945 lbs
Boral sheet around shell	1/8 in. thick boral		1,200 lbs
Lead shield bricks	lead	45	
Graphite bricks	graphite	322	
Concrete shield on west and east fact	concrete	59	
Concrete on north and south between shell and walls of room	concrete	15	
Base (foundation)	concrete	200	
Concrete walls, floor, and ceiling of high dose room	concrete	432	60,480 (per ft thickness)

Table 22. Activity Inventory in Reactor Materials

Material	⁶⁰ Co	¹⁵² Eu	¹⁵⁴ Eu
Lead	*	*	*
Graphite	2.3 mCi	23.0 mCi	1.9 mCi
Concrete	48.9 µCi	81.1 µCi	8.4 µCi
Concrete ** (high dose room)	62 µCi	214 µCi	14 µCi
Aluminum (reactor tank)	84.5 µCi	‡	‡

* No activity was detected in lead samples (see Table 20)

‡ Below detection limit (see Table 20)

** Based on average concentrations given in Table 11 and an assumed activation depth of 2 ft

XIV. LESSONS LEARNED

- The time required to perform the radiation surveys took less time than was estimated. However, the effort required for data documentation and analysis took much more time than was planned for. This component of the survey might have been done more efficiently by using data loggers on the survey instruments or by using scribes with notebook computers to enter the data into spreadsheets as it was collected.
- The preparation, documentation, packaging, and tracking of samples sent to ACL for analyses took much longer than was estimated.
- The small "enhancements" (e.g. full characterization of a known clean office area to use as a background reference, removal of the fuel rod grid plate to collect samples, collection of oil from the gasometer, survey of the crane, in situ gamma ray spectroscopy of instrument packages) which we decided to add to the characterization collectively added up to more time than was expected.
- The decision on how effort was expended may have been different if an extrapolation of the total hours for completion had been done every week.
- The Health Physics effort required to provide health physics support for subcontractors was greater than expected.
- The time required to prepare special procedures and obtain permits was greater than expected.
- The number of some samples and direct measurements (e.g., 70 paint scrapings in one room) might have been reduced significantly by using a statistical basis rather than only an experience or intuitive basis. The fact that all areas were thoroughly scanned to look for "hot spots" before sampling began would have justified statistical sampling to meet a specified release criteria.
- The actual cost for scaffolding was higher than the original estimate.
- Subcontractor costs were reduced by drilling for graphite and some concrete samples ourselves. However, the overall saving was small because our added effort was almost equal to that projected for the contractor.
- Uncertainties associated with all of the field measurements might have been addressed in a general way rather than for each measurement. This might have saved some data processing time.
- Applying the full characterization protocol to a reference area (a known clean area that was never used as a laboratory) for establishing background values was probably unnecessary since all of the results of all of the general areas were less than the MDAs.

- The number and cost of samples analyzed might have been reduced if an iterative process was used to select which samples to analyze. For example, if the activity concentration in a concrete core sample taken 5 feet from the reactor center was less than the instrumentation MDA or some other criteria, analysis of other samples at 6 ft, 8 ft, etc, might not be necessary. An iterative process might also have avoided some information gaps. For example, more information might have been obtained about the depth of concrete activation in the high dose room if one deep core had been analyzed first to determine the depth of activation. Knowing this, it would not have been necessary to analyze so many shallow cores.
- The effort required to review, interpret and summarize the more than 2000 pages of sample analytical results was considerably more than projected.

XV. PHOTOGRAPHIC REPORTS

A large number of photographs were taken during every phase of the characterization but only a very small fraction of these are included in the body of the report. A selected number of the other photographs which show some key characterization activities in given in Appendix L.

XVI. REFERENCES

1. USNRC Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors" 1974
2. DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (1990)
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7. 40 CFR Parts 260-299, Code of Federal Regulations, Protection of Environment (July 1, 1995), U. S. Government Printing Office, Washington
8. "Argonne National Laboratory-East, Site Environmental Report for Calendar Year 1994" by N. W. Golchert and R. G. Kolzow, ANL-95/8, Mag 1995 (UC-607)
9. "The Biological Irradiation Facility (JANUS Reactor) Design Manual," ANL-6745, June 1963
10. "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor) prepared by NES, Inc., November 1995
11. Micro Shield Version 4, Grove Engineering, 1992

APPENDIX A

Spreadsheet of Tasks Performed

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
1	Grounds	Grassy area					
2		2 soil cores, 10ft deep (samp surf, 7ft & 10ft)	drill rig	—	—	8.0	yes
3				soil	hazmat	0.0	yes
4				soil	gamma spe	0.0	yes
5		digging permit	—	—	—	1.0	yes
6		photos,drawing	—	—	—	2.0	yes
7		prep & ship samples	—	soil	—	1.0	yes
8							
9	Cooling tower	Surfaces	PG-2, ASP-1	—	—	1.0	yes
10		general scan	tape, RN	—	—	0.5	yes
11		select 5 points	NE	—	—	0.5	yes
12		5 direct ABG	micro R meter	—	—	0.3	yes
13		5 exposure rate	Tennelec	smear	gross ABG	0.5	yes
14		5 smears				2.5	yes
15		photo,drawing	—	—	—	0.3	yes
16		1 smear	Tennelec	smear	gross ABG	0.5	yes
17		water,sludge	—	liquid	gamma spe	2.0	yes
18		prep & ship sample	—	liquid	—	4.0	yes
19	Building exterior	East & south walls	PG-2,ASP-1	—	—	2.0	yes
20		general scan	tape,RN	—	—	1.0	yes
21		select 5 points/wall	NE	—	—	1.2	yes
22		direct ABG	micro R meter	—	—	0.6	yes
23		exposue rate	Tennelec	smear	gross ABG	1.0	yes
24		5 smears/wall				2.0	yes
25		photos,drawing	—	—	—	1.0	yes
26		general scan	PG-2,ASP-1	—	—	0.2	yes
27		exposure rate	—	—	—	1.0	yes
28		select 10 points				0.9	yes
29		(vents,etc)	tape,RN	—	—	0.5	yes
30		direct ABG	NE	—	—	0.8	yes
31		exposure rate	micro R meter	—	—	2.5	yes
32		10 smears	Tennelec	smear	grossABG	0.5	yes
33		photo, drawing	—	—	—	0.5	yes
34		5 smears	Tennelec	smear	gross ABG		
35							

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
36							
37							
38							
39	High dose						
40	room	6 hour air sample	sampler	filter	gross ABG	0.5	yes
41		4 hour air sample	sampler	filter	lead	0.5	yes
42		Scan entire area	PG-2.ASP-1	—	—	1.0	yes
43		exposure rate	micro R meter	—	—	0.2	yes
44	Walls, ceiling	select 5 points/wall, ceiling	tape, RD	—	—	2.0	yes
45		5 direct ABG/wall, ceiling	Ne	—	—	2.0	yes
46		5 exposure rate/wall, ceiling	micro R meter	—	—	1.3	yes
47		5 smears/wall, ceiling	Tennelec	smears	gross ABG	1.7	yes
48		phot, drawing	—	—	—	2.0	yes
49	Reactor face						
50	(lead wall)	select 5 points	tape, RD	—	—	0.5	yes
51		5 direct ABG	Ne	—	—	0.4	yes
52		5 exposure rate	micro R meter	—	—	0.3	yes
53		6 smears	Tennelec	smears	gross ABG	0.5	yes
54				smear	alpha spec	0.0	yes
55		photo, drawing	—	—	—	1.0	yes
56							
57	Shield door	one 3" x 6" core	coring rig	—	—	2.0	yes
58		slice core	diamond saw	—	—	0.2	yes
59			—	concrete	gamma spe	0.0	yes
60		prep and ship samples	—	—	—	0.5	yes
61		photos, drawing	—	—	—	0.5	yes
62		select 5 points	tape, RD	—	—	0.5	yes
63		5 paint scrapings	vac scraper	filter	gross ABG	1.0	yes
64		5 direct ABG (before & after)	Ne	—	—	0.4	yes
65		5 exposure rate	micro R meter	—	—	0.3	yes
66		5 smears	Tennelec	smears	gross ABG	0.4	yes
67							
68	South wall	one 3" x 14" core					
69		(4" lead, 4" hard board, 6" concrete)	coring rig	—	—	3.0	yes
70		slice cores	diamond saw	—	—	0.2	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
71			—	Pb,Hard board			yes
72				concrete	gamma spe	0.0	yes
73		prep and ship samples	—		—	0.5	yes
74		photos, drawing	—	—	—	0.6	yes
75							
76	West wall	one 3" x 14" core					
77		(4" lead, 4" hard board, 6" concrete)	coring rig		—	3.0	yes
78		slice cores	diamond saw	—	—	0.2	yes
79		prep and ship samples	—	—	—	0.5	yes
80			—	Pb,Hard board		0.0	yes
81				concrete	gamma spe	0.0	yes
82		photos, drawing	—	—	—	0.5	yes
83							
84	Floor	select 5 points	tape,RD	—	—	0.5	yes
85		5 direct ABG	Ne	—	—	0.4	yes
86		5 exposure rate	micro R meter	—	—	0.3	yes
87		5 smears	Tennelec	smears	gross ABG	0.5	yes
88		one 3" x 14" core					
89		(4"lead, 4" hard board, 6" concrete)	coring rig	—	—	3.0	yes
90		slice cores	diamond saw	—	—	0.2	yes
91		prep and ship samples	—	—	—	0.5	yes
92			—	Pb,hardboard			
93				concrete	gamma spe	0.0	yes
94		photo, drawing	—	—	—	0.5	yes
95	Coring water	collect coring rig water	DABRAS	LSA water	gross ABG	1.0	yes
96							
97	Filter housing	full scan ABG	NE	—	—	0.2	yes
98		exposure rate	micro R meter	—	—	0.1	yes
99		2 smears	—	—	—	0.2	yes
100		photos,drawing	—	—	—	0.4	yes
101							
102							
103	Low dose						
104	room	6 hour air sample	sampler	filter	gross ABG	0.5	yes
105		4 hour air sample	sampler	filter	lead	0.1	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
106		Scan entire area	PG-2.ASP-1	—	—	2.0	yes
107		exposure rate	micro R meter	—	—	0.2	yes
108	Walls, ceiling	select 10 points/wall, ceiling	tape, RD	—	—	4.0	yes
109		10 direct ABG/wall, ceiling	Ne	—	—	3.4	yes
110		10 exposure rate/wall, ceiling	micro R meter	—	—	2.0	yes
111		10 smears/wall, ceiling	Tennelec	smears	gross ABG	3.4	yes
112		drawing	CAD	—	—	3.0	yes
113	South wall	one 3" x 6" core (6" concrete)		—	—		
114		cut cores	coring rig	—	—	1.0	yes
115		prep and ship samples	diamond saw	—	—	0.2	yes
116			—	—	—	0.5	yes
117			—	concrete	gamma spe	0.0	yes
118	East wall	one 3" x 6" core (6" concrete)		—	—		
119		slice cores	coring rig	—	—	1.0	yes
120		prep and ship samples	diamond saw	—	—	0.2	yes
121			—	—	—	0.2	yes
122			—	concrete	gamma spe	0.0	yes
123							
124	Lead bricks on north wall						
125		0.5" dia. x 2" drillings (enough for 100 grams)					
126			hand drill	—	—	0.4	yes
127				lead	gamma spe	0.4	yes
128	Concrete bussel (ledge above lead wall)						
129		0.5" dia. x 2" drillings (enough for 100 grams)					
130			hand drill	lead	gamma spe	0.4	yes
131							
132							
133							
134	Reactor foundation						
135		3" x 10' horizontal core	coring rig	—	—	10.0	yes
136		slice cores	diamond saw	—	—	1.0	yes
137		prep and ship samples	—	—	—	0.5	yes
138			—	Fe, concrete	gamma spe	0.0	yes
139		photos, drawing	—	—	—	3.0	yes
140	Coring water	collect coring rig water	DABRAS	LSA water	gross ABG	1.0	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
141							
142	Floor	select 20 points	tape,RD	—	—	2.0	yes
143		20 direct ABG	Ne	—	—	1.7	yes
144		20 exposure rate	micro R meter	—	—	1.0	yes
145		20 smears	Tennelec	smears	gross ABG	1.7	yes
146		drawing	CAD	—	—	0.5	yes
147	Storage pit	exposure rate	micro R meter	—	—	0.1	yes
148		direct ABG	Ne	—	—	0.2	yes
149		2 smears	Tennelec	smear	gross ABG	0.2	yes
150		photo	—	—	—	0.2	yes
151	Door top	exposure rate	micro R meter	—	—	0.1	yes
152		direct ABG	Ne	—	—	0.2	yes
153		2 smears	Tennelec	smear	gross ABG	1.0	yes
154	Filter housing						
155	(in & out)	exposure rate	micro R meter	—	—	0.2	yes
156		direct ABG	Ne	—	—	0.3	yes
157		2 smears	Tennelec	smear	gross ABG	0.2	yes
158		photo	—	—	—	0.2	yes
159	Reactor face						
160	(gamma shield)	select 5 points	tape,RD	—	—	0.5	yes
161		5 direct ABG	Ne	—	—	0.4	yes
162		5 exposure rate	micro R meter	—	—	0.3	yes
163		5 smears	Tennelec	smears	gross ABG	0.4	yes
164		photo, drawing	CAD	—	—	2.0	yes
165							
166							
167	High dose						
168	prep room	6 hour air sample	sampler	filter	gross ABG	0.5	yes
169		Scan entire area	PG-2,ASP-1	—	—	4.0	yes
170		exposure rate	micro R meter	—	—	0.2	yes
171	Walls,ceiling	select 5 points/wall,ceiling	tape,RD	—	—	2.5	yes
172		5 direct ABG/wall,ceiling	Ne	—	—	2.1	yes
173		5 exposure rate/wall,ceiling	micro R meter	—	—	1.3	yes
174		5 paint scrape/wall,ceiling	vac scrape	filter	gross ABG	5.0	yes
175		5 smears/wall,ceiling	Tennelec	smears	gross ABG	2.1	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
176		photo, drawing	CAD	—	—	2.5	yes
177	Floor	select 10 points	tape, RD	—	—	1.0	yes
178		10 direct ABG	Ne	—	—	0.9	yes
179		10 exposure rate	micro R meter	—	—	0.5	yes
180		10 smears	Tennelec	smears	gross ABG	0.9	yes
181		10 paint scrapings	scraper	paint	gross ABG	2.0	yes
182		drawing	CAD	—	—	0.5	yes
183	Door edges	direct ABG	NE	—	—	0.2	yes
184		exposure rate	micro R meter	—	—	0.2	yes
185		4 smears	—	smears	gross ABG	0.4	yes
186	Air vents						
187	(in & out)	direct ABG	NE	—	—	0.3	yes
188		exposure rate	micro R meter	—	—	0.2	yes
189		4 smears	—	smears	gross ABG	0.4	yes
190		photo	—	—	—	0.5	yes
191							
192							
193	Low dose						
194	prep room	6 hour air sample	sampler	filter	gross ABG	0.5	yes
195		Scan entire area	PG-2, ASP-1	—	—	2.0	yes
196		exposure rate	micro R meter	—	—	0.2	yes
197	Walls, ceiling	select 10 points/wall, ceiling	tape, RD	—	—	5.0	yes
198		10 direct ABG/wall, ceiling	Ne	—	—	4.2	yes
199		10 exposure rate/wall, ceiling	micro R meter	—	—	2.5	yes
200		10 paint scrape/wall, ceiling	vac scrape	filter	gross ABG	10.0	yes
201		10 smears/wall, ceiling	Tennelec	smears	gross ABG	4.2	yes
202		drawing, photos	CAD	—	—	2.5	yes
203	Floor	select 20 points	tape, RD	—	—	2.0	yes
204		20 direct ABG	Ne	—	—	1.7	yes
205		20 exposure rate	micro R meter	—	—	1.0	yes
206		20 smears	Tennelec	smears	gross ABG	1.7	yes
207		drawing	CAD	—	—	0.4	yes
208	Sump	direct ABG	NE	—	—	0.2	yes
209		exposure rate	micro R meter	—	—	0.1	yes
210		4 smears	Tennelec	smears	gross ABG	0.1	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
211		collect sludge	—	sludge	gamma spe	0.0	yes
212		collect sludge	—	sludge	hazmzt	0.0	yes
213		prep and ship samples	—	—	—	0.5	yes
214		photo	—	—	—	0.5	yes
215	Sink trap						
216	(inside)	direct ABG	NE	—	—	0.4	yes
217		exposure rate	micro R meter	—	—	0.2	yes
218		2 smears	Tennelec	smears	gross ABG	0.3	yes
219		sludge	—	sludge	gamma spe	0.5	yes
220		photo	—	—	—	0.5	yes
221	Pipe flanges	direct ABG	NE	—	—	0.4	yes
222		exposure rate	micro R meter	—	—	0.1	yes
223		4 smears	Tennelec	smears	gross ABG	0.2	yes
224		sludge	—	sludge	gamma spe	0.5	yes
225		photo	—	—	—	0.5	yes
	Rabbit tube	Remove shield plug	Rigging	—	—	2.0	yes
226		direct ABG	NE	—	—	0.5	yes
227		exposure rate	micro R meter	—	—	0.5	yes
228		8 smears	Tennelec	smears	gross ABG	0.8	yes
229		1 smear	—	smear	alpha spec	0.0	yes
230		photo	—	—	—	1.0	yes
231	Door rails	direct ABG	NE	—	—	0.2	yes
232		exposure rate	micro R meter	—	—	0.1	yes
233		4 smears	Tennelec	smears	gross ABG	0.4	yes
234		photo	—	—	—	0.5	yes
235	Ductwork						
236	(inside)	8 smears	Tennelec	smears	gross ABG	1.0	yes
237	Light fixtures	8 smears	Tennelec	smears	gross ABG	0.8	yes
238	Electrical box	4 smears	Tennelec	smears	gross ABG	0.4	yes
239	Control panel	8 smears	Tennelec	smears	gross ABG	0.8	yes
240							
241							
242	Pump room	6 hour air sample	sampler	filter	gross ABG	0.5	yes
243		Scan entire area	PG-2.ASP-1	—	—	1.0	yes
244		exposure rate	micro R meter	—	—	0.2	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
245		photos	—	—	—	0.5	yes
246	Tanks	exposure rate	micro R meter	—	—	0.5	yes
247		get liquid, sludge	—	sludge	hazmat	1.0	yes
248	Walls, ceiling	select 5 points/wall, ceiling	tape, RD	—	—	2.5	yes
249		5 direct ABG/wall, ceiling	Ne	—	—	2.1	yes
250		5 exposure rate/wall, ceiling	micro R meter	—	—	1.3	yes
251		5 smears/wall, ceiling	Tennelec	smears	gross ABG	2.1	yes
252		photo, drawing	CAD	—	—	2.5	yes
253	Floor	select 10 points	tape, RD	—	—	1.0	yes
254		10 direct ABG	Ne	—	—	0.9	yes
255		10 exposure rate	micro R meter	—	—	0.5	yes
256		10 smears	Tennelec	smears	gross ABG	0.9	yes
257		drawing, photos	CAD	—	—	0.0	yes
258	Pipe joints	10 smears	Tennelec	smears	—	0.9	yes
259	Pumps	open and get sludge	—	sludge	gamma spe	0.2	yes
260	Heat exchanger	open and get sludge	—	—	—	—	—
261	Air Filters	general ABG scan	NE	—	—	0.2	yes
262		exposure rate	micro R meter	—	—	0.1	yes
263		4 smears	Tennelec	smears	gross ABG	0.4	yes
264	Gasometer	photo	—	—	—	0.5	yes
265		sample oil	oil	—	HAZMAT (P)	0.1	yes
266	Heat tape on						
267	helium dryer	sample insulation	—	asbestos	asbestos	0.0	yes
268							
269							
270	Retention	Tanks #5,6,7 &8					
271	tank	(shared with other					
272		areas)					
273		general scan	PG-2, ASP-1	—	—	0.4	yes
274		select 5 points	tape, RD	—	—	0.5	yes
275		5 direct ABG	Ne	—	—	0.4	yes
276		5 exposure rate	micro R meter	—	—	0.3	yes
277		5 smears	Tennelec	smears	gross ABG	0.4	yes
278		photo, drawing	CAD	—	—	0.5	yes
279		open and get sludge	—	sludge	gross ABG	1.0	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
280		open and get sludge	(already done)	sludge	hazmat	1.0	yes
281							
282	Septic tank	Tank from toilets					
283		(outside E024) general scan	PG-2,ASP-1	—	—	0.3	yes
284		1 exposure rate	micro R meter	—	—	0.2	yes
285	Reactor	open and get sludge	—	sludge	hazmat	1.0	yes
286	control	—					
287	room	6 hour air sample	sampler	filter	gross ABG	0.5	yes
288		Scan entire area	PG-2,ASP-1	—	—	0.6	yes
289		Walls,ceiling exposure rate	micro R meter	—	—	0.2	yes
290		select 5 points/wall,ceiling	tape,RD	—	—	2.5	yes
291		5 direct ABG/wall,ceiling	Ne	—	—	2.1	yes
292		5 exposure rate/wall,ceiling	micro R meter	—	—	1.3	yes
293		5 paint scrape/wall,ceiling	vac scrape	filter	gross ABG	5.0	yes
294		5 smears/wall,ceiling	Tennelec	smears	gross ABG	2.1	yes
295	Floor	photo, drawing	CAD	—	—	2.0	yes
296		select 10 points	tape,RD	—	—	1.0	yes
297		10 direct ABG	Ne	—	—	0.8	yes
298		10 exposure rate	micro R meter	—	—	0.5	yes
299		10 smears	Tennelec	smears	gross ABG	0.9	yes
300	Air vents	drawing,photos	CAD	—	—	0.0	yes
301	(in & out)						
302		direct ABG	NE	—	—	0.2	yes
303		exposure rate	micro R meter	—	—	0.1	yes
304		4 smears	Tennelec	smears	gross ABG	0.3	yes
305	Control	photo	—	—	—	0.4	yes
306	panel						
307		direct ABG	NE	—	—	0.5	yes
308		exposure rate	micro R meter	—	—	0.2	yes
309		8 smears	Tennelec	smears	gross ABG	0.7	yes
310		photo	—	—	—	0.4	yes
311							
312	Mechanical						
313	equipment						
314	room	—					

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
315 (J-102)		6 hour air sample	sampler	filter	gross ABG	0.5	yes
316		Scan entire area	PG-2.ASP-1	—	—	1.0	yes
317	Walls, ceiling	exposure rate	micro R meter	—	—	0.2	yes
318		select 5 points/wall, ceiling	tape, RD	—	—	2.5	yes
319		5 direct ABG/wall, ceiling	Ne	—	—	2.1	yes
320		5 exposure rate/wall, ceiling	micro R meter	—	—	1.3	yes
321		5 smears/wall, ceiling	Tennelec	smears	gross ABG	2.1	yes
322	Intake vent and louvers	photo, drawing	CAD	—	—	2.0	yes
323							
324		direct ABG	NE	—	—	0.2	yes
325		exposure rate	micro R meter	—	—	0.1	yes
326		4 smears	Tennelec	smears	gross ABG	0.4	yes
327	Floor	photo	—	—	—	0.4	yes
328		select 10 points	tape, RD	—	—	1.0	yes
329		10 direct ABG	Ne	—	—	0.9	yes
330		10 exposure rate	micro R meter	—	—	0.5	yes
331		10 smears	Tennelec	smears	gross ABG	0.9	yes
332		drawing	CAD	—	—	0.0	yes
333		10 paint scrapings					
334		(floor not painted, remove wax))	—	wax	gross ABG	2.0	yes
335							
336	Ducts						
337		direct ABG	NE	—	—	1.0	yes
338		exposure rate	micro R meter	—	—	0.2	yes
339	Wall fan (does not exist)	4 smears	Tennelec	smears	gross ABG	0.4	yes
340							
341							
342		direct ABG	NE	—	—	0.0	yes
343		exposure rate	micro R meter	—	—	0.0	yes
344		4 smears	Tennelec	—	—	0.0	yes
345	Doors tops	photo	—	—	—	0.0	yes
346		direct ABG	NE	—	—	0.3	yes
347		exposure rate	micro R meter	—	—	0.1	yes
348		4 smears	Tennelec	smears	gross ABG	0.3	yes
349							

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TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
350	Final						
351	filter						
352	room J101	6 hour air sample	sampler	filter	gross ABG	0.5	yes
353	Walls,ceiling	Scan entire area	PG-2.ASP-1	—	—	1.0	yes
354		exposure rate	micro R meter	—	—	0.2	yes
355		select 5 points/wall,ceiling	tape,RD	—	—	2.5	yes
356		5 direct ABG/wall,ceiling	Ne	—	—	2.1	yes
357		5 exposure rate/wall,ceiling	micro R meter	—	—	1.3	yes
358	Floor	5 smears/wall,ceiling	Tennelec	smears	gross ABG	2.1	yes
359		photo, drawing	CAD	—	—	2.5	yes
360		select 10 points	tape,RD	—	—	1.0	yes
361		10 direct ABG	Ne	—	—	0.9	yes
362		10 exposure rate	micro R meter	—	—	0.5	yes
363		10 smears	Tennelec	smears	gross ABG	0.9	yes
364	Ductwork	drawing	CAD	—	—	0.0	yes
365		10 paint scrapings	scraper	—	—	2.0	yes
366		direct ABG	NE	—	—	1.0	yes
367		exposure rate	micro R meter	—	—	0.3	yes
368	Outside door	5 upstream smears	Tennelec	smears	gross ABG	0.4	yes
369	(no outside door present)	5 downstream smears	Tennelec	smears	gross ABG	0.4	yes
370							
371							
372		direct ABG	NE	—	—	0.0	yes
373	Doors tops	exposure rate	micro R meter	—	—	0.0	yes
374		1 smear	Tennelec	smears	—	0.0	yes
375		direct ABG	NE	—	—	0.4	yes
376		exposure rate	micro R meter	—	—	0.2	yes
377		2 smears	Tennelec	smears	gross ABG	0.4	yes
378							
379	Equipment room J118						
380	(west end of						
381	high bay) Walls,ceiling	Scan entire area	PG-2.ASP-1	—	—	1.0	yes
382		exposure rate	micro R meter	—	—	0.2	yes
383		select 5 points/wall,ceiling	tape,RD	—	—	2.5	yes
384		5 direct ABG/wall,ceiling	Ne	—	—	2.1	yes

JANUS REACTOR CHARACTERIZATION TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
385	Floor	5 exposure rate/wall, ceiling	micro R meter	—	—	1.3	yes
386		5 smears/wall, ceiling	Tennelec	smears	gross ABG	2.1	yes
387		photo, drawing	CAD	—	—	2.5	yes
388		select 10 points	tape, RD	—	—	1.0	yes
389		10 direct ABG	Ne	—	—	0.9	yes
390		10 exposure rate	micro R meter	—	—	0.5	yes
391		10 smears	Tennelec	smears	gross ABG	0.9	yes
392							
393							
394	Reactor						
395	room						
396	(high bay)	6 hour air sample	sampler	filter	gross ABG	0.5	yes
397	Walls, ceiling	Scan entire area	PG-2.ASP-1	—	—	6.0	yes
398		exposure rate	micro R meter	—	—	0.2	yes
399		select 20 points/wall, ceiling	tape, RD	—	—	2.0	yes
400		20 direct ABG/wall, ceiling	Ne	—	—	1.7	yes
401		20 exposure rate/wall, ceiling	micro R meter	—	—	1.0	yes
402		20 paint scrape/wall, ceiling	vac scrape	filter	gross ABG	4.0	yes
403	Floor	20 smears/wall, ceiling	Tennelec	smears	gross ABG	1.7	yes
404		photo, drawing	CAD	—	—	3.0	yes
405		select 40 points	tape, RD	—	—	4.0	yes
406		40 direct ABG	Ne	—	—	3.3	yes
407		40 exposure rate	micro R meter	—	—	2.0	yes
408		40 smears	Tennelec	smears	gross ABG	3.3	yes
409		photo, drawing	CAD	—	—	0.0	yes
410	Ductwork, inside	10 paint scrapings	scraper	—	gross ABG	2.0	yes
411	(none present)						
412	Source						
413	storage tubes	direct ABG	NE	—	—	0.0	yes
414		exposure rate	micro R meter	—	—	0.0	yes
415		4 smears	Tennelec	smears	—	0.0	yes
416	Shield plugs over						

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
417	dose rooms	direct ABG	NE	—	—	0.8	yes
418		exposure rate	micro R meter	—	—	3.0	yes
419		4 smears/tube	Tennelec	smears	gross ABG	0.7	yes
420							
421							
422		direct ABG	NE	—	—	0.5	yes
423	Crane and	exposure rate	micro R meter	—	—	0.2	yes
424	rails	10 smears	Tennelec	smears	gross ABG	0.8	yes
425							
426		general scan	PG-2,ASP-1	—	—	1.0	yes
427		select 10 points	tape,RN	—	—	0.5	yes
428		10 direct ABG	NE	—	—	1.2	yes
429		10 exposure rate	micro R meter	—	—	0.6	yes
430		10 smears	Tennelec	smear	gross ABG	1.0	yes
431							
432	Shield blocks						
433	Reactor						
434	top	remove 2, north side	crane	—	—	0.0	yes
435	—	smear all sides of block	Tennelec	smears	gross ABg	5.0	yes
436		1 hour air sample	sampler	filter	gross ABG	0.5	yes
437	Reactor tank top,	exposure rate	micro R meter	—	—	0.5	yes
438	pipes, flanges,						
439	etc.						
440							
441		select 10 points	tape,RD	—	—	1.0	yes
442		10 direct ABG	Ne	—	—	0.8	yes
443		10 exposure rate	micro R meter	—	—	0.5	yes
444		10 smears	Tennelec	smears	gross ABG	0.8	yes
445	Reactor tank	photos,drawing	CAD	—	—	2.0	yes
446							
447		remove fuel rod cover	crane	—	—	4.0	yes
448		4 smears inside tank	smear pole	smears	gross ABG	2.0	yes
449		exposure rate inside tank	GM	—	—	1.0	yes
450		photo (inside)	—	—	—	2.0	yes
451		remove grid plate	crane	—	—	1.0	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
452		cut out 100g piece for analysis	hack saw	aluminum	gamma spe	4	yes
453				aluminum	alpha spec	0.1	yes
454							
455							
456							
457	Containment						
458	cylinder	3 inch x 9 ft. vertical					
459		core in concrete	coring rig	concrete	—	9.0	yes
460		slice cores	diamond saw	concrete	—	1.0	yes
461		direct ABG	NE	—	—	0.2	yes
462		prep and ship samples	—	concrete	—	1.0	yes
463			—	concrete	gamma spe	0.0	yes
464		exposure rate in hole	GM	—	—	0.5	yes
465							
466	Graphite	3 inch x 3 ft. core	coring rig	graphite	—	2.0	yes
467		slice cores	diamond saw	graphite	—	0.5	yes
468		prep and ship samples	—	graphite	gamma spe	0.6	yes
469			—	graphite	alpha spec	0.0	yes
470	Thimbles	exposure rate	—	—	—	2.0	yes
471							
472	Glovebox						
473	room	6 hour air sample	sampler	filter	gross ABG	0.5	yes
474		Scan entire area	PG-2.ASP-1	—	—	1.0	yes
475		exposure rate	micro R meter	—	—	0.4	yes
476		select 5 points/wall,ceiling	tape,RD	—	—	2.5	yes
477		5 direct ABG/wall,ceiling	Ne	—	—	2.1	yes
478		5 exposure rate/wall,ceiling	micro R meter	—	—	1.3	yes
479		5 paint scrape/wall,ceiling	vac scrape	filter	gross ABG	5.0	yes
480	Floor	5 smears/wall,ceiling	Tennelec	smears	gross ABG	2.1	yes
481		photo, drawing	CAD	—	—	2.0	yes
482		select 10 points	tape,RD	—	—	1.0	yes
483		10 direct ABG	Ne	—	—	0.8	yes
484		10 exposure rate	micro R meter	—	—	0.5	yes
485		10 smears	Tennelec	smears	gross ABG	0.8	yes
486	glovebox	drawing	CAD	—	—	0.0	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
487		10 paint scrapings	scraper	—	—	2.0	yes
488		10 smears	Tennelec	smears	gross ABG	0.4	yes
489		—	—	smear	gamma spe	0.1	yes
490		—	—	smear	alpha spec	0.1	yes
491		sample unknown containers					
492		for biological & HAZMAT ?					
493		(No containers present)	—	smears ?	gross ABG	0.0	yes
494	glovebox exhaust sys		—	smears ?	HAZMAT	0.0	yes
495							
496							
497		6 smears	Tennelec	smears	gross ABG	0.4	yes
498				smears	gamma spe	0.1	yes
499				smears	alpha spec	0.1	yes
500							
501							
502	Stairwell	Scan entire area	PG-2.ASP-1	—	—	0.5	yes
503		exposure rate	micro R meter	—	—	0.2	yes
504		select 5 points/wall,ceiling,	tape,RD				
505		steps, floor		—	—	0.5	yes
506		5 direct ABG/wall,ceiling,					
507		steps,floor	Ne	—	—	0.4	yes
508		5 exposure rate/wall,					
509		ceiling,steps,floor	micro R meter	—	—	0.3	yes
510		5 smears/wall,ceiling,					
511		steps,floor	Tennelec	smears	gross ABG	0.4	yes
512		5 paint scrapings/wall,					
513		ceiling,steps,floor	scraper,Tenn	paint	gross ABG	1.0	yes
514		5 direct ABG (after scrape)/					
515		wall,ceiling,steps,floor	NE	—		0.4	yes
516		photo, drawing	CAD	—	—	2.0	yes
517							
518	Floor drain						
519							
520		direct ABG	Ne	—	—	0.3	yes
521		exposure rate	micro R meter	—	—	0.1	yes

JANUS REACTOR CHARACTERIZATION **TASKS DESCRIPTION AND EFFORT**

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
522		2 smears	Tennelec	smears	gross ABG	0.2	yes
523		photo, drawing	CAD	—	—	1.0	yes
524							
525							
526	Corridor						
527	J108	Walls, ceiling	Scan entire area	PG-2.ASP-1	—	0.2	yes
528			exposure rate	micro R meter	—	0.4	yes
529			select 5 points/wall, ceiling	tape, RD	—	2.5	yes
530			5 direct ABG/wall, ceiling	Ne	—	2.1	yes
531			5 exposure rate/wall, ceiling	micro R meter	—	1.3	yes
532			5 paint scrape/wall, ceiling	vac scrape	gross ABG	5.0	yes
533	Floor		5 smears/wall, ceiling	Tennelec	gross ABG	2.1	yes
534			photo, drawing	CAD	—	2.0	yes
535			select 10 points	tape, RD	—	1.0	yes
536			10 direct ABG	Ne	—	0.8	yes
537			10 exposure rate	micro R meter	—	0.5	yes
538			10 smears	Tennelec	gross ABG	0.8	yes
539			drawing	CAD	—	0.0	yes
540							
541							
542							
543	Exhaust						
544	stack		Scan access areas	Pg-2.ASP-1	—	0.4	yes
545			exposure rate	micro R meter	—	0.2	yes
546			select 3 points	tape, RD	—	0.6	yes
547			3 direct ABG	Ne	—	0.3	yes
548			3 exposure rate	micro R meter	—	0.3	yes
549			3 smears	Tennelec	gross ABG	0.3	yes
550			drawing, photo	CAD	—	0.0	yes
551							
552	Outside exhaust ducts from						
553	low dose an						
554	high dose						
555	rooms		General scan	Pg-2.ASP-1	—	0.4	yes
556	soil pit/well		exposure rate	micro R meter	—	0.4	yes

JANUS REACTOR CHARACTERIZATION

TASKS DESCRIPTION AND EFFORT

LOCATION	ITEM or AREA	TASK or MEASUREMENT	INSTRUMENT/ EQUIPMENT	TYPE SAMPLE	TYPE of ANALYSES	HP EST. HOURS	TASK DONE
557		(get key to unlock					
558		cover)					
559							
560		General scan	Pg-2,ASP-1	—	—	0.4	yes
561		exposure rate	micro R meter	—	—	0.1	yes
562		4 smears	Tennelec	smears	gross ABG	0.3	yes
563		Scoop soil	scoop	soil	gamma spe	0.4	yes
564		Sample borax in downspouts	—	borax	gross ABG	0.2	yes
565	All areas	Insulation on		borax	gamma spe	0.0	yes
566		ducts,etc.		insulation	asbestos	0.0	yes
567							
568							
569							
570	All areas	Paint on walls		paint	lead	0.0	yes
571							
572	All areas	Air samples	—	filter	gross ABG	0.5	yes
573			—	filter	lead	0.5	yes
574		Tritium sample in pump room	—	liquid	tritium	0.5	yes
575							
576	Background reference						
577	R103 (Was always an						
578	office area)	—	—	—	—	6.0	yes

APPENDIX B

Field Data Forms

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLES DATA

1Room/Area # _____ Date _____
 PG-2/PRMS Set # _____ BKG _____ cpm NE Electra Set # _____ BKG _____ dpm α /100 cm², _____ dpm β /100 cm²
 Micro R Meter Set # _____ BKG _____ μ R/h Tenelec Set # _____ BKG _____ dpm α , _____ dpm β
 *PG-2 Gen Scan _____ Max CPM ^bMICRO R _____ Max μ R/h ⁴(A)Air Sample _____ dpm α /m³, _____ dpm β /m³, P# _____

[illegible]

1. First element of sample ID # (e.g. 102 is Fan Room J102)
2. Second element of sample ID# (e.g. W is west wall, first floor)
3. Third element of sample ID #
4. Fourth element of sample ID #

Signatures:

PG2/PRM5 Set # _____ BKG _____ CPM: _____ Gen Scan _____ MAX CPM at (location) _____
 Micro R Meter Set # _____ BKG _____ μ R/h: _____ Gen Scan _____ MAX μ R/h at (location) _____
 Smears (wide area) P# _____ Sample # _____: _____ dpm α /100 cm² _____ dpm β /m³
 Air Sample P# _____ Sample # _____: _____ dpm α /m³ _____ dpm β /m³

Thimble #1 Smear P# _____	Sample # _____:	_____ dpm α /100 cm ² _____	_____ dpm β /100 cm ² _____
Thimble #2 Smear P# _____	Sample # _____:	_____ dpm α /100 cm ² _____	_____ dpm β /100 cm ² _____
Thimble #3 Smear P# _____	Sample # _____:	_____ dpm α /100 cm ² _____	_____ dpm β /100 cm ² _____
Thimble # _____ Smear P# _____	Sample # _____:	_____ dpm α /100 cm ² _____	_____ dpm β /100 cm ² _____

[illegible]

Date _____

[illegible]

- 1 Pictorial location of samples shown in Figure _____
 2 Cylindrical Coordinates (see Figure ____): R = radial distance in plane of floor from reactor core vertical center line to sample center
 θ = angular distance to sample measured clockwise (in plane of floor) from a west pointing line which passes through vertical center line of reactor core
 Z = vertical distance above (+) or below (-) horizontal centerline of reactor core
 3 At "contact" measured with _____ μR meter
 4 Exposure rate measured at position where sample was removed measured with energy compensated GM/ASP-1

APPENDIX C

Compiled Field Data

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint			Exposure μR/h	Smear Spot counted on Tennelec			Paint Spot counted on Tennelec			NE after removal of paint		
			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	
J-000	ceiling 01	2,4,5	9.9 ± 23.1	-209.0 ± 169.1	-1	-0.9 ± 0.4	-21.0 ± 14.6	-0.9 ± 0.4	6.4 ± 18.4	10.4 ± 21.7	-102 ± 171				
J-000	ceiling 02	6,5,1.5	-1.7 ± 2.8	-391.0 ± 153.6	-1	-0.9 ± 0.4	4.0 ± 18.1	-0.9 ± 0.4	1.7 ± 17.8	0 ± 0.0	-257 ± 158				
J-000	ceiling 03	10,4,5	21.4 ± 32.4	-340.0 ± 158.1	0	-0.9 ± 0.4	-21.0 ± 14.6	-0.9 ± 0.4	-18.6 ± 15.0	21 ± 30.8	-271 ± 157				
J-000	ceiling 04	12,5,1.5	-1.7 ± 2.8	-347.0 ± 157.5	-1	-0.9 ± 0.4	-13.8 ± 15.7	-0.9 ± 0.4	-9.0 ± 16.4	0 ± 0.0	-246 ± 159				
J-000	ceiling 05	13,5,5.6	-1.7 ± 2.8	-376.0 ± 154.9	0	-0.9 ± 0.4	2.9 ± 17.9	1.2 ± 4.1	-4.3 ± 17.0	0 ± 0.0	-261 ± 157				
J-000	floor 01	1,5,1	-4.7 ± 4.6	-320.0 ± 175.4	-4	1.2 ± 4.1	-1.9 ± 17.3	-0.9 ± 0.4	-16.2 ± 15.3	9.4 ± 20.6	61 ± 183				
J-000	floor 02	4,5,4	4.7 ± 21.1	-226.0 ± 182.6	-2	-0.9 ± 0.4	-24.5 ± 14.0	3.3 ± 5.8	-4.3 ± 17.0	9.4 ± 20.6	20 ± 180				
J-000	floor 03	11,2,5	23.6 ± 36.1	-218.0 ± 183.2	-2	-0.9 ± 0.4	-11.4 ± 16.0	-0.9 ± 0.4	-4.3 ± 17.0	9.4 ± 20.6	169 ± 191				
J-000	floor 04	15,5,5	-4.7 ± 4.6	-266.0 ± 179.6	0	-0.9 ± 0.4	-9.0 ± 16.4	1.2 ± 4.1	-10.2 ± 16.2	0 ± 0.0	54 ± 183				
J-000	floor 05	18,5,1	-4.7 ± 4.6	-151.0 ± 188.1	0	-0.9 ± 0.4	8.8 ± 18.7	-0.9 ± 0.4	5.2 ± 18.2	9.4 ± 20.6	-41 ± 176				
J-000	stairs 01	2,5,2.5	14.2 ± 29.6	-429.0 ± 166.6	-2	-0.9 ± 0.4	2.9 ± 17.9	-0.9 ± 0.4	-13.8 ± 15.7	18.9 ± 29.2	-144 ± 167				
J-000	stairs 02	1,5,6	42.5 ± 46.4	-361.0 ± 172.1	-4	-0.9 ± 0.4	-7.9 ± 16.5	-0.9 ± 0.4	-0.7 ± 17.5	18.9 ± 29.2	-61 ± 174				
J-000	stairs 03	4,8	14.2 ± 29.6	-368.0 ± 171.6	-2	-0.9 ± 0.4	18.3 ± 19.8	-0.9 ± 0.4	-5.5 ± 16.8	9.4 ± 20.6	-95 ± 171				
J-000	stairs 04	6,9,5	51.9 ± 50.8	-374.0 ± 171.1	-4	-0.9 ± 0.4	11.2 ± 19.0	-0.9 ± 0.4	-10.2 ± 16.2	37.7 ± 41.3	-75 ± 173				
J-000	stairs 05	3,14,5	4.7 ± 21.1	-273.0 ± 179.0	-2	-0.9 ± 0.4	-6.7 ± 16.7	-0.9 ± 0.4	-12.6 ± 15.8	18.9 ± 29.2	61 ± 183				
J-000	Wall E 01	0,5,16,5	14.2 ± 29.6	73.0 ± 203.8	2	-0.9 ± 0.4	2.9 ± 17.9	1.2 ± 4.1	11.2 ± 19.0	0 ± 0.0	167 ± 191				
J-000	Wall E 02	1,5,23	4.7 ± 21.1	412.0 ± 225.5	2	1.2 ± 4.1	-0.7 ± 17.5	1.2 ± 4.1	-6.7 ± 16.7	11.6 ± 22.9	536 ± 216				
J-000	Wall E 03	4,5,21	14.2 ± 29.6	500.0 ± 230.8	4	1.2 ± 4.1	-13.8 ± 15.7	3.3 ± 5.8	-6.7 ± 16.7	0 ± 0.0	536 ± 216				
J-000	Wall E 04	0,5,4,5	14.2 ± 29.6	-463.0 ± 163.8	-6	-0.9 ± 0.4	-9.0 ± 16.4	-0.9 ± 0.4	17.1 ± 19.7	0 ± 0.0	-210 ± 162				
J-000	Wall E 05	4,5,10	14.2 ± 29.6	-381.0 ± 170.5	-4	5.3 ± 7.1	-4.3 ± 17.0	1.2 ± 4.1	-3.1 ± 17.2	23.1 ± 32.3	-275 ± 156				
J-000	Wall E 06	4,5,1,5	4.7 ± 21.1	-340.0 ± 173.8	-4	-0.9 ± 0.4	8.8 ± 18.7	1.2 ± 4.1	0.5 ± 17.6	0 ± 0.0	-145 ± 167				
J-000	Wall N 01	1,21	23.6 ± 36.1	61.0 ± 203.0	-2	1.2 ± 4.1	-6.7 ± 16.7	-0.9 ± 0.4	-13.8 ± 15.7	0 ± 0.0	232 ± 196				
J-000	Wall N 02	4,5,18,5	-4.7 ± 4.6	87.0 ± 204.8	-2	-0.9 ± 0.4	0.5 ± 17.6	-0.9 ± 0.4	-6.7 ± 16.7	11.6 ± 22.9	239 ± 196				
J-000	Wall N 03	9,5,21	-4.7 ± 4.6	-56.0 ± 194.9	1	-0.9 ± 0.4	7.6 ± 18.5	-0.9 ± 0.4	-4.3 ± 17.0	0 ± 0.0	297 ± 200				
J-000	Wall N 04	9,5,15	-4.7 ± 4.6	222.0 ± 213.6	0	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	5.2 ± 18.2	11.6 ± 22.9	7 ± 179				
J-000	Wall N 05	16,22,5	14.2 ± 29.6	53.0 ± 202.5	-2	-0.9 ± 0.4	1.7 ± 17.8	1.2 ± 4.1	-13.8 ± 15.7	11.6 ± 22.9	29 ± 181				
J-000	Wall N 06	4,5,13,5	4.7 ± 21.1	-273.0 ± 179.0	-4	1.2 ± 4.1	-9.0 ± 16.4	-0.9 ± 0.4	6.4 ± 18.4	0 ± 0.0	-109 ± 170				
J-000	Wall N 07	7,2,5	23.6 ± 36.1	-415.0 ± 167.8	-2	-0.9 ± 0.4	-6.7 ± 16.7	1.2 ± 4.1	-1.9 ± 17.3	11.6 ± 22.9	-181 ± 164				
J-000	Wall N 08	9,5,10	33.0 ± 41.5	-218.0 ± 183.2	-4	-0.9 ± 0.4	-1.9 ± 17.3	-0.9 ± 0.4	2.9 ± 17.9	0 ± 0.0	-167 ± 165				
J-000	Wall N 09	15,7	-4.7 ± 4.6	-490.0 ± 161.5	-4	1.2 ± 4.1	-3.1 ± 17.2	-0.9 ± 0.4	-0.7 ± 17.5	0 ± 0.0	-297 ± 154				
J-000	Wall N 10	18,5,10	14.2 ± 29.6	-320.0 ± 175.4	-2	-0.9 ± 0.4	-9.0 ± 16.4	1.2 ± 4.1	1.7 ± 17.8	11.6 ± 22.9	-413 ± 144				
J-000	Wall S 01	0,5,20,5	14.2 ± 29.6	80.0 ± 204.3	-2	-0.9 ± 0.4	-1.9 ± 17.3	1.2 ± 4.1	-10.2 ± 16.2	23.1 ± 32.3	7 ± 179				
J-000	Wall S 02	3,5,22,5	-4.7 ± 4.6	-212.0 ± 183.6	2	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	4.0 ± 18.1	0 ± 0.0	-87 ± 172				
J-000	Wall S 03	5,5,14,5	4.7 ± 21.1	-110.0 ± 191.1	0	-0.9 ± 0.4	-17.4 ± 15.1	-0.9 ± 0.4	-9.0 ± 16.4	11.6 ± 22.9	-275 ± 156				
J-000	Wall S 04	11,5,16,5	4.7 ± 21.1	12.0 ± 199.7	0	-0.9 ± 0.4	-1.9 ± 17.3	-0.9 ± 0.4	-7.9 ± 16.5	11.6 ± 22.9	159 ± 191				
J-000	Wall S 05	13,5,23	23.6 ± 36.1	32.0 ± 201.0	1	1.2 ± 4.1	-1.9 ± 17.3	1.2 ± 4.1	6.4 ± 18.4	11.6 ± 22.9	254 ± 197				
J-000	Wall S 06	10,10,5	-4.7 ± 4.6	-144.0 ± 188.7	-2	-0.9 ± 0.4	-10.2 ± 16.2	1.2 ± 4.1	-11.4 ± 16.0	11.6 ± 22.9	-210 ± 162				
J-000	Wall S 07	2,10	-4.7 ± 4.6	-354.0 ± 172.7	-4	-0.9 ± 0.4	-0.7 ± 17.5	1.2 ± 4.1	-3.1 ± 17.2	0 ± 0.0	-58 ± 174				
J-000	Wall S 08	3,5,5	4.7 ± 21.1	-388.0 ± 170.0	-6	-0.9 ± 0.4	1.7 ± 17.8	1.2 ± 4.1	-10.2 ± 16.2	0 ± 0.0	-217 ± 161				
J-000	Wall S 09	7,8,5	-4.7 ± 4.6	-361.0 ± 172.1	-4	-0.9 ± 0.4	19.5 ± 20.0	1.2 ± 4.1	6.4 ± 18.4	0 ± 0.0	-304 ± 154				
J-000	Wall S 10	14,5,5	4.7 ± 21.1	-374.0 ± 171.1	-6	-0.9 ± 0.4	14.8 ± 19.4	-0.9 ± 0.4	-15.0 ± 15.5	0 ± 0.0	-152 ± 167				
J-000	Wall W 01	18,5,4,5	14.2 ± 29.6	60.0 ± 202.9	-6	-0.9 ± 0.4	2.9 ± 17.9	-0.9 ± 0.4	-6.7 ± 16.7	0 ± 0.0	0 ± 179				
J-000	Wall W 02	4,15	14.2 ± 29.6	-117.0 ± 190.6	-2	-0.9 ± 0.4	-12.6 ± 15.8	-0.9 ± 0.4	4.0 ± 18.1	23.1 ± 32.3	65 ± 184				
J-000	Wall W 03	2,12,5	23.6 ± 36.1	-273.0 ± 179.0	-2	-0.9 ± 0.4	-12.6 ± 15.8	-0.9 ± 0.4	1.7 ± 17.8	0 ± 0.0	-232 ± 160				
J-000	Wall W 04	1,5,7	9.4 ± 20.6	143.0 ± 171.7	-4	1.2 ± 4.1	-6.7 ± 16.7	-0.9 ± 0.4	-5.5 ± 16.8	0 ± 0.0	-152 ± 167				
J-000	Wall W 05	5,4	9.4 ± 20.6	89.0 ± 167.4	-4	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	-17.4 ± 15.1	0 ± 0.0	-254 ± 158				
J-000	Wall W 06	2,5,4	0.0 ± 0.0	34.0 ± 162.8	-4	-0.9 ± 0.4	-6.7 ± 16.7	-0.9 ± 0.4	-13.8 ± 15.7	0 ± 0.0	-145 ± 167				
Average			9.3	21.1	-171.9	181.8	-2.0	-0.4	1.2	-3.4	17.1	-0.1	1.8	-4.2	17.0
Stand Dev			12.8	13.4	230.6	17.9	2.3	1.2	1.6	9.5	1.3	1.2	1.9	8.0	1.1
Maximum			51.9	50.8	500.0	230.8	4	5.3	7.1	19.5	20.0	3.3	5.8	17.1	19.7
Minimum			-4.7	0.0	-490.0	153.6	-6	-0.9	0.4	-24.5	14.0	-0.9	0.4	-18.6	15.0

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)				
Count			47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	
J-002	air vents 1	12,13,5,12	-11.4 ± 25.1	-50.0 ± 162.5	-1	3.3 ± 5.8	19.5 ± 20.0	*											
J-002	air vents 2	15,14,12,5	12.0 ± 41.1	15.0 ± 167.9	0	3.3 ± 5.8	-21.0 ± 14.6	*											
J-002	air vents 3	10,5,17,10	0.0 ± 33.8	-253.0 ± 144.3	0	-0.9 ± 0.4	-5.5 ± 16.8	*											
J-002	air vents 4	3,14,11	-11.0 ± 25.4	-297.0 ± 140.1	1	-0.9 ± 0.4	-7.9 ± 16.5	*											
J-002	ceiling 01	4,4	0.0 ± 15.3	-178.0 ± 164.3							-0.9 ± 0.4	11.2 ± 19.0		5 ± 21.4		-9 ± 178			
J-002	ceiling 02	3,20	4.7 ± 21.1	-39.0 ± 175.5							-0.9 ± 0.4	-12.6 ± 15.8		9.5 ± 25.7		120 ± 188			
J-002	ceiling 03	8,16	4.7 ± 21.1	80.0 ± 184.6							-0.9 ± 0.4	1.7 ± 17.8		18.9 ± 33.0		76 ± 184			
J-002	ceiling 04	12,9	14.2 ± 29.6	120.0 ± 187.5							-0.9 ± 0.4	-1.9 ± 17.3		4.7 ± 21.1		90 ± 185			
J-002	ceiling 05	13,14,5	4.7 ± 21.1	191.0 ± 192.7							-0.9 ± 0.4	-7.9 ± 16.5		-4.7 ± 4.6		110 ± 187			
J-002	door edge	1	2.4 ± 18.5	-111.0 ± 171.5	4	-0.9 ± 0.4	-1.9 ± 17.3	*											
J-002	door edge	2	-4.7 ± 4.6	-99.0 ± 172.4	0	-0.9 ± 0.4	-15.0 ± 15.5	*											
J-002	door edge	3	23.6 ± 38.1	-44.0 ± 176.7	-2	1.2 ± 4.1	7.6 ± 18.5	*											
J-002	door edge	4	4.7 ± 21.1	-268.0 ± 158.4	0	5.3 ± 7.1	-11.4 ± 16.0	*											
J-002	door top E 1	2,7			4	1.2 ± 4.1	0.5 ± 17.6	*											
J-002	door top N 2	9,7			0	-0.9 ± 0.4	18.3 ± 19.8	*											
J-002	door top N 3	2,7			-2	1.2 ± 4.1	-1.9 ± 17.3	*											
J-002	door top N 4	5,7			0	-0.9 ± 0.4	-6.7 ± 16.7	*											
J-002	floor 01	1,2	-11.0 ± 25.4	-72.0 ± 160.6	0	-0.9 ± 0.4	5.2 ± 18.2		1.2 ± 4.1	13.6 ± 19.3	6.6 ± 23.1	-214 ± 161							
J-002	floor 02	3,5	-23.0 ± 10.2	-21.0 ± 164.9	0	1.2 ± 4.1	1.7 ± 17.8		-0.9 ± 0.4	4.0 ± 18.1	0.9 ± 16.6	-135 ± 168							
J-002	floor 03	2,10	-11.0 ± 25.4	37.0 ± 169.7	0	-0.9 ± 0.4	4.0 ± 18.1		1.2 ± 4.1	-12.6 ± 15.8	-4.7 ± 4.6	-77 ± 173							
J-002	floor 04	15,3	12.0 ± 41.1	51.0 ± 170.8	0	-0.9 ± 0.4	12.4 ± 19.1		1.2 ± 4.1	1.7 ± 17.8	12.2 ± 28.0	-77 ± 173							
J-002	floor 05	3,22	12.0 ± 41.1	-101.0 ± 158.1	0	-0.9 ± 0.4	-15.0 ± 15.5		-0.9 ± 0.4	7.6 ± 18.5	6.6 ± 23.1	71 ± 184							
J-002	floor 06	10,19	0.0 ± 33.8	-7.0 ± 166.1	0	1.2 ± 4.1	-4.3 ± 17.0		1.2 ± 4.1	2.9 ± 17.9	12.2 ± 28.0	40 ± 182							
J-002	floor 07	13,17	0.0 ± 33.8	58.0 ± 171.3	0	-0.9 ± 0.4	-0.7 ± 17.5		-0.9 ± 0.4	0.5 ± 17.6	0.9 ± 16.6	-94 ± 171							
J-002	floor 08	14,10	12.0 ± 41.1	109.0 ± 175.4	0	1.2 ± 4.1	-4.3 ± 17.0		-0.9 ± 0.4	-21.0 ± 14.6	-4.7 ± 4.6	-87 ± 172							
J-002	floor 09	14,12	0.0 ± 33.8	-7.0 ± 166.1	0	3.3 ± 5.8	-11.4 ± 16.0		-0.9 ± 0.4	-9.0 ± 16.4	0.9 ± 16.6	-94 ± 171							
J-002	floor 10	12,10	-23.0 ± 10.2	-79.0 ± 160.0	-1	-0.9 ± 0.4	0.5 ± 17.6		-0.9 ± 0.4	5.2 ± 18.2	12.2 ± 28.0	-321 ± 152							
J-002	shield dr. 1	2,6	11.4 ± 22.7	-138.0 ± 160.6	2	-0.9 ± 0.4	-5.5 ± 16.8		-0.9 ± 0.4	-0.7 ± 17.5	0 ± 0.0	-52 ± 168							
J-002	shield dr. 2	3,5,1	11.4 ± 22.7	-235.0 ± 152.1	2	-0.9 ± 0.4	2.9 ± 17.9		3.3 ± 5.8	-9.0 ± 16.4	34.1 ± 39.3	-145 ± 160							
J-002	shield dr. 3	7,5,5,5	22.7 ± 32.0	-84.0 ± 165.2	0	-0.9 ± 0.4	4.0 ± 18.1		-0.9 ± 0.4	7.6 ± 18.5	0 ± 0.0	-4 ± 172							
J-002	shield dr. 4	1,5,6,5	0.0 ± 0.0	-172.0 ± 157.7	0	-0.9 ± 0.4	4.0 ± 18.1		-0.9 ± 0.4	-6.7 ± 16.7	0 ± 0.0	-125 ± 162							
J-002	shield dr. 5	5,3,5	0.0 ± 0.0	-91.0 ± 164.6	0	-0.9 ± 0.4	-3.1 ± 17.2		-0.9 ± 0.4	-0.7 ± 17.5	0 ± 0.0	-226 ± 153							
J-002	Wall E 01	1,5,5	23.5 ± 32.6	28.6 ± 176.0	0	-0.9 ± 0.4	16.0 ± 19.5		-0.9 ± 0.4	-5.5 ± 16.8	12.2 ± 28.0	-166 ± 165							
J-002	Wall E 02	6,7,5	23.5 ± 32.6	-85.7 ± 166.8	0	-0.9 ± 0.4	-3.1 ± 17.2		-0.9 ± 0.4	-11.4 ± 16.0	6.6 ± 23.1	-197 ± 163							
J-002	Wall E 03	11,2	0.0 ± 0.0	78.6 ± 179.8	1	-0.9 ± 0.4	-17.4 ± 15.1		-0.9 ± 0.4	-15.0 ± 15.5	23.5 ± 36.0	-218 ± 161							
J-002	Wall E 04	12,5,6	11.8 ± 23.1	64.3 ± 178.7	0	-0.9 ± 0.4	-5.5 ± 16.8		-0.9 ± 0.4	-6.7 ± 16.7	6.6 ± 23.1	-307 ± 153							
J-002	Wall E 05	15,5,9,5	0.0 ± 0.0	-78.6 ± 167.4	0	1.2 ± 4.1	2.9 ± 17.9		-0.9 ± 0.4	-21.0 ± 14.6	-4.7 ± 4.6	-276 ± 156							
J-002	Wall N 01	2,5,10	23.5 ± 32.6	14.3 ± 174.9	-1	-0.9 ± 0.4	-4.3 ± 17.0		-0.9 ± 0.4	2.9 ± 17.9	23.5 ± 36.0	-176 ± 164							
J-002	Wall N 02	3,5,8,5	47.1 ± 46.1	135.7 ± 184.1	-2	5.3 ± 7.1	-9.0 ± 16.4		-0.9 ± 0.4	-4.3 ± 17.0	6.6 ± 23.1	-262 ± 157							
J-002	Wall N 03	7,3,5	11.8 ± 23.1	-107.1 ± 165.1	0	-0.9 ± 0.4	-10.2 ± 16.2		-0.9 ± 0.4	11.2 ± 19.0	17.9 ± 32.3	-238 ± 159							
J-002	Wall N 04	12,5	11.8 ± 23.1	157.1 ± 185.7	-1	1.2 ± 4.1	-5.5 ± 16.8		-0.9 ± 0.4	-6.7 ± 16.7	12.2 ± 28.0	-118 ± 169							
J-002	Wall N 05	15,9	35.3 ± 39.9	128.6 ± 183.6	1	1.2 ± 4.1	-12.6 ± 15.8		-0.9 ± 0.4	19.5 ± 20.0	23.5 ± 36.0	-197 ± 163							
J-002	Wall S 01	12,7	-23.0 ± 10.2	66.0 ± 172.0	0	-0.9 ± 0.4	-7.9 ± 16.5		1.2 ± 4.1	-12.6 ± 15.8	J-002 ± 29.6	-107 ± 170							
J-002	Wall S 02	15,2	12.0 ± 41.1	-7.0 ± 166.1	-1	1.2 ± 4.1	-17.4 ± 15.1		-0.9 ± 0.4	7.6 ± 18.5	J-002 ± 4.6	-164 ± 165							
J-002	Wall S 03	8,8	-11.0 ± 25.4	-21.0 ± 164.9	0	-0.9 ± 0.4	4.0 ± 18.1		-0.9 ± 0.4	2.9 ± 17.9	J-002 ± 21.1	-76 ± 173							
J-002	Wall S 04	6,10	0.0 ± 33.8	22.0 ± 168.4	1	1.2 ± 4.1	-3.1 ± 17.2		1.2 ± 4.1	-0.7 ± 17.5	J-002 ± 29.6	-93 ± 171							
J-002	Wall S 05	3,8	23.0 ± 46.7	-43.0 ± 163.1	0	-0.9 ± 0.4	1.7 ± 17.8		1.2 ± 4.1	10.0 ± 18.8	J-002 ± 33.0	-49 ± 175							
J-002	Wall W 01	7,6,5	23.5 ± 32.6	7.1 ± 174.3	0	1.2 ± 4.1	8.8 ± 18.7		-0.9 ± 0.4	-12.6 ± 15.8	0.9 ± 16.6	-235 ± 159							
J-002	Wall W 02	14,5,8	0.0 ± 0.0	42.9 ± 177.1	0	-0.9 ± 0.4	-3.1 ± 17.2		-0.9 ± 0.4	5.2 ± 18.2	12.2 ± 28.0	-238 ± 159							

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint		Exposure μR/h	Smear Spot counted on Tennelec		Paint Spot counted on Tennelec		NE after removal of paint	
			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)
J-002	Wall W 03	19,0,4	11.8 ± 23.1	128.6 ± 183.6	0	-0.9 ± 0.4	-0.7 ± 17.5	1.2 ± 4.1	-7.9 ± 16.5	17.9 ± 32.3	-245 ± 159
J-002	Wall W 04	4,6	30.3 ± 40.0	-186.0 ± 163.6	0	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	14.8 ± 19.4	6.6 ± 23.1	-214 ± 161
J-002	Wall W 05	10,22,5	11.8 ± 23.1	-50.0 ± 169.7	1	1.2 ± 4.1	-19.8 ± 14.8	1.2 ± 4.1	-1.9 ± 17.3	23.5 ± 36.0	-214 ± 161
	Average		6.2 ± 25.3	-26.7 ± 169.3	0.1	0.2 ± 2.0	-2.7 ± 17.2	-0.3 ± 1.4	-1.5 ± 17.3	5.8 ± 21.5	-95.1 ± 167.6
	Stand Dev		14.1 ± 12.8	109.5 ± 10.4	1.1	1.7 ± 2.2	9.2 ± 1.2	1.0 ± 1.7	9.6 ± 1.3	8.8 ± 11.7	114.7 ± 9.6
	Maximum		47.1 ± 46.7	191.0 ± 192.7	4	5.3 ± 7.1	19.5 ± 20.0	3.3 ± 5.8	19.5 ± 20.0	34.1 ± 39.3	120.0 ± 187.5
	Minimum		-23.0 ± 0.0	-297.0 ± 140.1	-2	-0.9 ± 0.4	-21.0 ± 14.6	-0.9 ± 0.4	-21.0 ± 14.6	-4.7 ± 0.0	-321.0 ± 151.9
	Count		52 ± 48	52 ± 48	47	47 ± 47	47 ± 47	40 ± 40	40 ± 40	52 ± 40	52 ± 40
J-007	ceiling 01	0,5,14	11.3 ± 22.6	-1574.0 ± 157.6	-5	-0.9 ± 0.4	-3.1 ± 17.2				
J-007	ceiling 02	5,5,12	33.9 ± 39.1	-1780.0 ± 138.5	-5	-0.9 ± 0.4	4.0 ± 18.1				
J-007	ceiling 03	2,7	11.3 ± 22.6	-1457.0 ± 167.5	-5	7.4 ± 8.2	2.9 ± 17.9				
J-007	ceiling 04	1,2,5	11.3 ± 22.6	-1759.0 ± 140.6	-6	1.2 ± 4.1	-5.5 ± 16.8				
J-007	ceiling 05	5,2	22.6 ± 32.0	-657.0 ± 223.6	-2	3.3 ± 5.8	-9.0 ± 16.4				
J-007	rx floor 01	6,12	11.3 ± 22.6	633.0 ± 292.2	-1	-0.9 ± 0.4	0.5 ± 17.6				
J-007	rx floor 02	1,10	22.6 ± 32.0	-508.0 ± 232.6	3	-0.9 ± 0.4	-22.1 ± 14.4				
J-007	rx floor 03	4,7	11.3 ± 22.6	832.0 ± 301.4	8	-0.9 ± 0.4	-0.7 ± 17.5				
J-007	rx floor 04	6,5,2	0.0 ± 0.0	138.0 ± 268.0	0	3.3 ± 5.8	-10.2 ± 16.2				
J-007	rx floor 05	2,5,2,5	0.0 ± 0.0	-481.0 ± 234.2	5	-0.9 ± 0.4	5.2 ± 18.2				
J-007	rx lead w/ 1	1,5,5	11.3 ± 22.6	8546.0 ± 550.0	58	-0.9 ± 0.4	10.0 ± 18.8				
J-007	rx lead w/ 2	1,2	11.3 ± 22.6	17846.0 ± 746.8	63	1.2 ± 4.1	-0.7 ± 17.5				
J-007	rx lead w/ 3	4,4,5	22.6 ± 32.0	19346.0 ± 773.9	113	-0.9 ± 0.4	-3.1 ± 17.2				
J-007	rx lead w/ 4	8,5,3	22.6 ± 32.0	15346.0 ± 699.4	78	-0.9 ± 0.4	0.5 ± 17.6				
J-007	rx lead w/ 5	11,3,5	0.0 ± 0.0	7569.0 ± 525.1	43	-0.9 ± 0.4	-0.7 ± 17.5				
J-007	rx Wall S	1				1.2 ± 4.1	5.2 ± 18.2				
J-007	rx Wall S	2				-0.9 ± 0.4	-1.9 ± 17.3				
J-007	rx Wall S	3				-0.9 ± 0.4	-0.7 ± 17.5				
J-007	rx Wall S	4				1.2 ± 4.1	-4.3 ± 17.0				
J-007	rx Wall S	5				1.2 ± 4.1	-6.7 ± 16.7				
J-007	shield dor 01	2,6,5	33.9 ± 39.1	1059.0 ± 311.6	18	1.2 ± 4.1	1.7 ± 17.8				
J-007	shield dor 02	3,5,1	22.6 ± 32.0	641.0 ± 292.6	18	-0.9 ± 0.4	-3.1 ± 17.2				
J-007	shield dor 03	7,5,5	22.6 ± 31.9	-951.0 ± 204.8	2	-0.9 ± 0.4	-5.5 ± 16.8				
J-007	shield dor 04	1,5,7	22.6 ± 32.0	-1237.0 ± 184.6	2	7.4 ± 8.2	-3.1 ± 17.2				
J-007	shield dor 05	5,3,5	11.3 ± 22.6	-1670.0 ± 149.0	2	-0.9 ± 0.4	-15.0 ± 15.5				
J-007	Wall E 01	1,4	45.2 ± 45.2	3561.0 ± 407.1	16	-0.9 ± 0.4	-4.3 ± 17.0				
J-007	Wall E 02	2,6	0.0 ± 0.0	-1903.0 ± 125.8	-5	1.2 ± 4.1	-10.2 ± 16.2				
J-007	Wall E 03	5,1	11.3 ± 22.6	433.0 ± 282.7	19	-0.9 ± 0.4	-11.4 ± 16.0				
J-007	Wall E 04	11,6	11.3 ± 22.6	-1890.0 ± 127.2	-5	1.2 ± 4.1	-3.1 ± 17.2				
J-007	Wall E 05	14,5	0.0 ± 0.0	3148.0 ± 393.0	18	-0.9 ± 0.4	-12.6 ± 15.8				
J-007	Wall N 01	1,6	11.3 ± 22.6	-1807.0 ± 135.8	-4	1.2 ± 4.1	18.3 ± 19.8				
J-007	Wall N 02	4,5	0.0 ± 0.0	-1539.0 ± 160.6	-3	-0.9 ± 0.4	-0.7 ± 17.5				
J-007	Wall N 03	4,2	11.3 ± 22.6	-708.0 ± 220.5	2	7.4 ± 8.2	6.4 ± 18.4				
J-007	Wall N 04	6,6	0.0 ± 0.0	-1196.0 ± 187.7	-4	3.3 ± 5.8	-16.2 ± 15.3				
J-007	Wall N 05	7,4	33.9 ± 39.1	186.0 ± 270.4	2	-0.9 ± 0.4	-1.9 ± 17.3				
J-007	Wall S 01	1,6	11.3 ± 22.6	-1354.0 ± 175.7	-5	1.2 ± 4.1	-9.0 ± 16.4				
J-007	Wall S 02	1,3	22.6 ± 32.0	76.0 ± 264.8	4	7.4 ± 8.2	-13.8 ± 15.7				
J-007	Wall S 03	4,6	0.0 ± 0.0	-1794.0 ± 137.1	-5	3.3 ± 5.8	-21.0 ± 14.6				
J-007	Wall S 04	2,7	22.6 ± 32.0	-1003.0 ± 201.3	-2	3.3 ± 5.8	-3.1 ± 17.2				
J-007	Wall S 05	6,5	11.3 ± 22.6	-1869.0 ± 129.4	-5	1.2 ± 4.1	19.5 ± 20.0				
J-007	Wall W 01	1,6	22.6 ± 32.0	-1890.0 ± 127.2	-6	1.2 ± 4.1	-6.7 ± 16.7				
J-007	Wall W 02	2,2	0.0 ± 0.0	-1264.0 ± 182.6	-2	-0.9 ± 0.4	-7.9 ± 16.5				

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
J-007	Wall W 03	7,6	22.6 ± 32.0	-1897.0 ± 126.4			-5	-0.9 ± 0.4	4.0 ± 18.1							*	±	•	±
J-007	Wall W 04	9,3	0.0 ± 0.0	-1072.0 ± 198.5			-1	9.5 ± 9.1	-3.1 ± 17.2							*	±	•	±
J-007	Wall W 05	13,4	0.0 ± 0.0	-1580.0 ± 157.1			-3	5.3 ± 7.1	-11.4 ± 16.0							*	±	*	±
	Average		13.8	20.8	1,113	265.1	9.9	1.2	3.0	-3.4	17.1								
	Stand Dev		11.4	13.9	5,216	168.3	25.6	2.8	2.9	8.4	1.1								
	Maximum		45.2	45.2	19,346	773.9	113	9.5	9.1	19.5	20.0								
	Minimum		0.0	0.0	-1903	125.8	-6	-0.9	0.4	-22.1	14.4								
	Count		40	40	40	40	40	45	45	45	45								
J-010	ceiling 01	2,4	-2.4 ± 21.9	-270.0 ± 176.1			2	-0.9 ± 0.4	-9.0 ± 16.4							*	±	•	±
J-010	ceiling 02	8,5	2.4 ± 26.4	12.0 ± 198.9			2	1.2 ± 4.1	-6.7 ± 16.7							*	±	•	±
J-010	ceiling 03	4,7	7.1 ± 30.1	-59.0 ± 191.8			4	-0.9 ± 0.4	-3.1 ± 17.2							*	±	*	±
J-010	ceiling 04	8,9	7.1 ± 30.1	36.0 ± 198.5			4	-0.9 ± 0.4	0.5 ± 17.6							*	±	*	±
J-010	ceiling 05	7.5,13.5	2.4 ± 26.4	-226.0 ± 179.5			2	-0.9 ± 0.4	7.6 ± 18.5							*	±	*	±
J-010	cw23-3	6.5,9.5,1	*	±	*	±		-0.9 ± 0.4	-17.4 ± 15.1							*	±	•	±
J-010	cw23-4	6.5,9.5,1	*	±	•	±		-0.9 ± 0.4	-13.8 ± 15.7							*	±	•	±
J-010	cw24-1	7,15,1	*	±	•	±		3.3 ± 5.8	-4.3 ± 17.0							*	±	*	±
J-010	cw24-2	7,15,1	*	±	•	±		-0.9 ± 0.4	-10.2 ± 16.2							*	±	*	±
J-010	floor 01	2,2.5	-35.3 ± 27.3	21.4 ± 167.9			-1	1.2 ± 4.1	-18.6 ± 15.0	-0.9 ± 0.4	-15.0 ± 15.5	-5.7 ± 17.4	-49 ± 168						
J-010	floor 02	8,3	-23.5 ± 35.7	121.4 ± 175.9			-1	-0.9 ± 0.4	1.7 ± 17.8	-0.9 ± 0.4	-0.7 ± 17.5	0 ± 23.7	-111 ± 163						
J-010	floor 03	5.5,6.5	-47.1 ± 14.6	121.4 ± 175.9			-1	3.3 ± 5.8	-4.3 ± 17.0	-0.9 ± 0.4	-6.7 ± 16.7	-11.3 ± 7.1	-1 ± 172						
J-010	floor 04	8,11.5	-35.3 ± 27.3	78.6 ± 172.5			-2	1.2 ± 4.1	13.6 ± 19.3	-0.9 ± 0.4	-21.0 ± 14.6	11.3 ± 32.7	-66 ± 167						
J-010	floor 05	2.5,9	-35.3 ± 27.3	121.4 ± 175.9			-1	1.2 ± 4.1	-13.8 ± 15.7	-0.9 ± 0.4	-11.4 ± 16.0	-11.3 ± 7.1	-8 ± 172						
J-010	floor 06	5,1	-47.1 ± 14.6	71.4 ± 171.9			0	1.2 ± 4.1	8.8 ± 18.7	-0.9 ± 0.4	2.9 ± 17.9	-5.7 ± 17.4	68 ± 178						
J-010	floor 07	8.5,8	-47.1 ± 14.6	35.7 ± 169.0			-1	7.4 ± 8.2	-15.0 ± 15.5	-0.9 ± 0.4	-5.5 ± 16.8	5.6 ± 28.5	-53 ± 168						
J-010	floor 08	13.5,9.5	-35.3 ± 27.3	242.9 ± 185.1			-1	-0.9 ± 0.4	0.5 ± 17.6	-0.9 ± 0.4	-10.2 ± 16.2	-5.7 ± 17.4	-77 ± 166						
J-010	floor 09	5,10.5	-35.3 ± 27.3	57.1 ± 170.8			-2	1.2 ± 4.1	12.4 ± 19.1	-0.9 ± 0.4	-1.9 ± 17.3	0 ± 23.7	-5 ± 172						
J-010	floor 10	2.5,5.5	-35.3 ± 27.3	150.0 ± 178.1			-1	5.3 ± 7.1	-10.2 ± 16.2	-0.9 ± 0.4	4.0 ± 18.1	5.6 ± 28.5	54 ± 177						
J-010	heat x 01	filter 1	*	±	•	±		1.2 ± 4.1	8.8 ± 18.7			*	±	•	±				
J-010	heat x 02	filter 2	*	±	•	±		5.3 ± 7.1	19.5 ± 20.0			*	±	•	±				
J-010	heat x 03	filter 3	*	±	*	±		-0.9 ± 0.4	5.2 ± 18.2			*	±	•	±				
J-010	heat x 04	outs filter	*	±	•	±		-0.9 ± 0.4	-4.3 ± 17.0			*	±	*	±				
J-010	pipe joints 01	1	*	±	*	±		3.3 ± 5.8	-11.4 ± 16.0			*	±	*	±				
J-010	pipe joints 02	2	*	±	*	±		1.2 ± 4.1	-0.7 ± 17.5			*	±	•	±				
J-010	pipe joints 03	3	*	±	•	±		1.2 ± 4.1	-7.9 ± 16.5			*	±	*	±				
J-010	pipe joints 04	4	*	±	•	±		1.2 ± 4.1	-5.5 ± 16.8			*	±	•	±				
J-010	pipe joints 05	5	*	±	*	±		3.3 ± 5.8	-7.9 ± 16.5			*	±	•	±				
J-010	pipe joints 06	6	*	±	•	±		-0.9 ± 0.4	-1.9 ± 17.3			*	±	*	±				
J-010	pipe joints 07	7	*	±	•	±		3.3 ± 5.8	-7.9 ± 16.5			*	±	•	±				
J-010	pipe joints 08	8	*	±	•	±		1.2 ± 4.1	8.8 ± 18.7			*	±	•	±				
J-010	pipe joints 09	9	*	±	*	±		1.2 ± 4.1	4.0 ± 18.1			*	±	*	±				
J-010	pipe joints 10	10	*	±	•	±		-0.9 ± 0.4	2.9 ± 17.9			*	±	•	±				
J-010	ret tank 1	4.5,5.4	9.4 ± 20.6	-265.0 ± 159.6			8	1.2 ± 4.1	-6.7 ± 16.7			*	±	•	±				
J-010	ret tank 2	3,6,1.5	0.0 ± 0.0	-271.0 ± 159.1			8	-0.9 ± 0.4	6.4 ± 18.4			*	±	*	±				
J-010	ret tank 3	1.5,6.5,10	9.4 ± 20.6	-332.0 ± 153.8			6	-0.9 ± 0.4	1.7 ± 17.8			*	±	*	±				
J-010	ret tank 4	2,4,5,10.5	0.0 ± 0.0	-366.0 ± 150.7			6	3.3 ± 5.8	-18.6 ± 15.0			*	±	*	±				
J-010	ret tank 5	3,4,5,1.5	37.5 ± 41.2	-143.0 ± 169.8			4	1.2 ± 4.1	-1.9 ± 17.3			*	±	*	±				
J-010	rh28	8.5,1,8	*	±	*	±		-0.9 ± 0.4	-28.1 ± 13.4			*	±	•	±				
J-010	rh32	8.5,1,8	*	±	*	±		-0.9 ± 0.4	-6.7 ± 16.7			*	±	•	±				
J-010	sump pit 09	6.5,15.5	*	±	*	±		-0.9 ± 0.4	-1.9 ± 17.3			*	±	•	±				
J-010	sump pit 10	6.5,15.5	*	±	•	±		-0.9 ± 0.4	0.5 ± 17.6			*	±	*	±				

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate xyz	NE before removal of paint alpha (dis/min) beta (dis/min)		Exposure µR/h	Smear Spot counted on Tennelec alpha (dis/min) beta (dis/min)		Paint Spot counted on Tennelec alpha (dis/min) beta (dis/min)		NE after removal of paint alpha (dis/min) beta (dis/min)									
J-010	Wall E 01	1.7,7	0.0 ±	24.2	64.3 ±	164.9	-1	-0.9 ±	0.4	-17.4 ±	15.1	*	±	*	±				
J-010	Wall E 02	4.5,2	23.5 ±	40.6	50.0 ±	163.7	-1	1.2 ±	4.1	-4.3 ±	17.0	*	±	*	±				
J-010	Wall E 03	7.8,7	58.8 ±	57.0	150.0 ±	171.9	-1	-0.9 ±	0.4	8.8 ±	18.7	*	±	*	±				
J-010	Wall E 04	9.5,10.5	23.5 ±	40.6	0.0 ±	159.5	0	1.2 ±	4.1	-3.1 ±	17.2	*	±	*	±				
J-010	Wall E 05	13.5	-11.4 ±	7.2	108.0 ±	174.4	1	-0.9 ±	0.4	-4.3 ±	17.0	*	±	*	±				
J-010	Wall N 01	1.7	-11.8 ±	7.3	257.1 ±	180.3	1	-0.9 ±	0.4	-4.3 ±	17.0	*	±	*	±				
J-010	Wall N 02	3.5,2	23.5 ±	40.6	71.4 ±	165.5	-1	1.2 ±	4.1	-0.7 ±	17.5	*	±	*	±				
J-010	Wall N 03	3,10.5	23.5 ±	40.6	135.7 ±	170.8	-1	1.2 ±	4.1	-6.7 ±	16.7	*	±	*	±				
J-010	Wall N 04	6.5,5	-11.8 ±	7.3	64.3 ±	164.9	0	-0.9 ±	0.4	-6.7 ±	16.7	*	±	*	±				
J-010	Wall N 05	8.5,9.5	0.0 ±	24.2	178.6 ±	174.2	-1	-0.9 ±	0.4	-11.4 ±	16.0	*	±	*	±				
J-010	Wall S 01	0.5,3	0.0 ±	24.2	-7.1 ±	158.9	-2	-0.9 ±	0.4	-9.0 ±	16.4	*	±	*	±				
J-010	Wall S 02	2.1	23.5 ±	40.6	71.4 ±	165.5	-1	1.2 ±	4.1	-5.5 ±	16.8	*	±	*	±				
J-010	Wall S 03	5.7,5	11.8 ±	33.4	-50.0 ±	155.1	-1	1.2 ±	4.1	-15.0 ±	15.5	*	±	*	±				
J-010	Wall S 04	7.5,5	58.8 ±	57.0	-14.9 ±	146.7	-1	-0.9 ±	0.4	0.5 ±	17.6	*	±	*	±				
J-010	Wall S 05	11.5,9	11.8 ±	33.4	-114.3 ±	149.3	-2	-0.9 ±	0.4	4.0 ±	18.1	*	±	*	±				
J-010	Wall W 01	1.5,5	-11.8 ±	7.3	-14.2 ±	146.7	-1	1.2 ±	4.1	-17.4 ±	15.1	*	±	*	±				
J-010	Wall W 02	5.5,10.5	11.8 ±	33.4	257.1 ±	180.3	-1	-0.9 ±	0.4	-19.8 ±	14.8	*	±	*	±				
J-010	Wall W 03	8.2,5	-11.8 ±	7.3	150.0 ±	171.9	0	-0.9 ±	0.4	6.4 ±	18.4	*	±	*	±				
J-010	Wall W 04	11.5,8	0.0 ±	24.2	192.9 ±	175.3	1	3.3 ±	5.8	4.0 ±	18.1	*	±	*	±				
J-010	Wall W 05	14.5,3.5	23.5 ±	40.6	157.1 ±	172.5	1	-0.9 ±	0.4	6.4 ±	18.4	*	±	*	±				
J-010	Average		-1.1	26.3	12.9	170.2	0.6	0.6	2.6	-3.7	17.0	-0.9	0.4	-6.5	16.7	-0.3	20.4	-4.0	170.3
	Stand Dev		21.1	13.5	129.0	11.5	2.7	1.9	2.3	9.2	1.3	0.0	0.0	7.6	1.1	2.9	8.3	23.6	4.3
	Maximum		58.8	57.0	257.1	198.5	8.0	7.4	8.2	19.5	20.0	-0.9	0.4	4.0	18.1	11.3	32.7	68.0	177.7
	Minimum		-47.1	0.0	-366.0	146.7	-2.0	-0.9	0.4	-28.1	13.4	-0.9	0.4	-21.0	14.6	-11.3	7.1	-111.0	163.3
Count			62	40	62	40	40	62	62	62	62	10	10	10	10	62	10	62	10
J-010	flowmeter in	7.5,2.5,3.5	*	±	*	±		-0.9 ±	0.4	35.0 ±	21.7	*	±	*	±	*	±	*	±
J-010	flowmeter out	7.5,2.5,5	*	±	*	±		-0.9 ±	0.4	76.7 ±	25.7	*	±	*	±	*	±	*	±
J-010	H2O store Tank	6.2,5,1.5	*	±	*	±		1.2 ±	4.1	91.0 ±	26.9	*	±	*	±	*	±	*	±
J-010	primary	6.5,9.1	*	±	*	±		-0.9 ±	0.4	323.1 ±	42.3	*	±	*	±	*	±	*	±
J-010	pw24-5	7.5,7.5,1	*	±	*	±		3.3 ±	5.8	449.3 ±	48.6	*	±	*	±	*	±	*	±
J-010	pw24-6	7.5,7.5,1	*	±	*	±		3.3 ±	5.8	545.7 ±	53.0	*	±	*	±	*	±	*	±
J-010	pw25-7	7.5,8.5,1	*	±	*	±		3.3 ±	5.8	1001.7 ±	69.9	*	±	*	±	*	±	*	±
J-010	pw25-8	7.5,8.5,1	*	±	*	±		-0.9 ±	0.4	806.4 ±	63.2	*	±	*	±	*	±	*	±
J-010	skimmer	7.1,5.3	*	±	*	±		-0.9 ±	0.4	239.8 ±	37.5	*	±	*	±	*	±	*	±
Average								0.7	2.6	396.5	43.2								
Stand Dev								1.9	2.5	319.0	16.0								
Maximum								3.3	5.8	1001.7	69.9								
Minimum								-0.9	0.4	35.0	21.7								
Count								9	9	9	9								
J-014	ceiling 01	1,16	33.0 ±	36.6	146.0 ±	188.7	-2	-0.9 ±	0.4	-3.1 ±	17.2	1.2 ±	4.1	2.9 ±	17.9	9.4 ±	20.6	133 ±	188
J-014	ceiling 02	8.5,16	9.4 ±	20.6	119.0 ±	186.7	0	-0.9 ±	0.4	-3.1 ±	17.2	1.2 ±	4.1	11.2 ±	18.0	0 ±	0.0	295 ±	189
J-014	ceiling 03	6.5,11	23.6 ±	32.7	465.0 ±	210.6	0	-0.9 ±	0.4	-12.6 ±	15.8	-0.9 ±	0.4	14.8 ±	19.4	18.9 ±	29.2	356 ±	203
J-014	ceiling 04	10.5,7	4.7 ±	14.6	177.0 ±	190.9	-3	-0.9 ±	0.4	-1.7 ±	17.8	-0.9 ±	0.4	-1.9 ±	17.3	9.4 ±	20.6	116 ±	187
J-014	ceiling 05	1.5,14.5	9.4 ±	20.6	143.0 ±	188.5	0	-0.9 ±	0.4	-25.7 ±	13.8	-0.9 ±	0.4	-7.9 ±	16.5	14.2 ±	25.3	82 ±	184
J-014	ceiling 06	17.4	18.9 ±	29.2	-10.0 ±	177.0	4	-0.9 ±	0.4	2.9 ±	17.9	-0.9 ±	0.4	-7.9 ±	16.5	9.4 ±	20.6	129 ±	187
J-014	ceiling 07	22.7	9.4 ±	20.6	102.0 ±	185.5	0	-0.9 ±	0.4	1.7 ±	17.8	1.2 ±	4.1	-3.1 ±	17.2	28.3 ±	35.8	163 ±	190
J-014	ceiling 08	19.5,1	4.7 ±	14.6	-23.0 ±	176.0	2	-0.9 ±	0.4	-11.4 ±	16.0	-0.9 ±	0.4	-4.3 ±	17.0	4.7 ±	14.6	289 ±	199
J-014	ceiling 09	22.1,4	14.2 ±	25.3	129.0 ±	187.5	2	1.2 ±	4.1	-4.3 ±	17.0	1.2 ±	4.1	-17.4 ±	15.1	16.9 ±	29.2	10 ±	177
J-014	ceiling 10	29.1,7	0.0 ±	0.0	184.0 ±	191.4	0	-0.9 ±	0.4	13.6 ±	19.3	-0.9 ±	0.4	-19.8 ±	14.8	4.7 ±	14.6	184 ±	191

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint		Exposure μR/h	Smear Spot counted on Tennelec		Paint Spot counted on Tennelec		NE after removal of paint	
			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)
J-014	cont panel 01	9,5,1,2	11.8 ± 23.1	-721.4 ± 162.3	1	-0.9 ± 0.4	-12.6 ± 15.8	1.2 ± 4.1	-3.1 ± 17.2	18.9 ± 29.2	190 ± 181
J-014	cont panel 02	9,5,5,6,5	23.5 ± 32.6	-678.6 ± 165.9	1	1.2 ± 4.1	-12.6 ± 15.8	1.2 ± 4.1	-9.0 ± 16.4	9.4 ± 20.6	55 ± 170
J-014	cont panel 03	9,5,6,5,7,5	23.5 ± 32.6	-571.4 ± 174.5	1	-0.9 ± 0.4	-0.7 ± 17.5	-0.9 ± 0.4	2.9 ± 17.9	18.9 ± 29.2	299 ± 189
J-014	cont panel 04	10,9,5,4,5	11.8 ± 23.1	-728.6 ± 161.7	1	1.2 ± 4.1	-4.3 ± 17.0	1.2 ± 4.1	6.4 ± 18.4	18.9 ± 29.2	360 ± 193
J-014	cont panel 05	11,5,6,4,5	11.8 ± 23.1	-750.0 ± 159.9	1	-0.9 ± 0.4	14.8 ± 19.4	-0.9 ± 0.4	-12.6 ± 15.8	0 ± 0.0	55 ± 170
J-014	cont panel 06	10,4,5	0.0 ± 0.0	-592.9 ± 172.8	1	-0.9 ± 0.4	-6.7 ± 16.7	-0.9 ± 0.4	-4.3 ± 17.0	18.9 ± 29.2	312 ± 190
J-014	cont panel 07	11,5,2,3,5	0.0 ± 0.0	-714.3 ± 162.9	1	-0.9 ± 0.4	-11.4 ± 16.0	-0.9 ± 0.4	2.9 ± 17.9	0 ± 0.0	129 ± 176
J-014	cont panel 08	11,5,3,5,7	0.0 ± 0.0	-785.7 ± 156.8	1	-0.9 ± 0.4	1.7 ± 17.8	-0.9 ± 0.4	0.5 ± 17.6	0 ± 0.0	163 ± 179
J-014	door rails 01	25,3	58.8 ± 51.6	-364.3 ± 190.1	1	-0.9 ± 0.4	6.4 ± 18.4	-0.9 ± 0.4	-4.3 ± 17.0	18.9 ± 29.2	177 ± 180
J-014	door rails 02	27,3	23.5 ± 32.6	-778.6 ± 157.4	1	-0.9 ± 0.4	-9.0 ± 16.4	-0.9 ± 0.4	-13.8 ± 15.7	47.2 ± 46.2	251 ± 185
J-014	door rails 03	25,12	0.0 ± 0.0	-457.1 ± 183.3	1	-0.9 ± 0.4	5.2 ± 18.2	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	door rails 04	27,10	0.0 ± 0.0	-792.9 ± 156.1	1	1.2 ± 4.1	-19.8 ± 14.8	-0.9 ± 0.4	1.7 ± 17.8	28.3 ± 35.8	89 ± 173
J-014	door top 1	5,7	± ± ±	± ± ±	0	1.2 ± 4.1	7.6 ± 18.5	-0.9 ± 0.4	8.8 ± 18.7	47.2 ± 46.2	143 ± 177
J-014	door top 2	7,7	± ± ±	± ± ±	0	3.3 ± 5.8	-4.3 ± 17.0	-0.9 ± 0.4	-1.9 ± 17.3	28.3 ± 35.8	163 ± 179
J-014	ductwork 01	inside	± ± ±	± ± ±	0	-0.9 ± 0.4	2.9 ± 17.9	-0.9 ± 0.4	8.8 ± 18.7	47.2 ± 46.2	204 ± 182
J-014	ductwork 02	inside	± ± ±	± ± ±	0	5.3 ± 7.1	-3.1 ± 17.2	-0.9 ± 0.4	-12.6 ± 15.8	18.9 ± 29.2	265 ± 186
J-014	ductwork 03	inside	± ± ±	± ± ±	0	-0.9 ± 0.4	2.9 ± 17.9	-0.9 ± 0.4	1.7 ± 17.8	28.3 ± 35.8	333 ± 191
J-014	ductwork 04	inside	± ± ±	± ± ±	0	-0.9 ± 0.4	1.7 ± 17.8	-0.9 ± 0.4	-6.7 ± 16.7	0 ± 0.0	204 ± 182
J-014	ductwork 05	inside	± ± ±	± ± ±	0	5.3 ± 7.1	-9.0 ± 16.4	-0.9 ± 0.4	-11.4 ± 16.0	47.2 ± 46.2	184 ± 180
J-014	ductwork 06	inside	± ± ±	± ± ±	0	3.3 ± 5.8	13.6 ± 19.3	-0.9 ± 0.4	0.5 ± 17.6	0 ± 0.0	± ± ±
J-014	ductwork 07	inside	± ± ±	± ± ±	0	1.2 ± 4.1	1.7 ± 17.8	-0.9 ± 0.4	1.2 ± 4.1	± ± ±	± ± ±
J-014	ductwork 08	inside	± ± ±	± ± ±	0	1.2 ± 4.1	-4.3 ± 17.0	-0.9 ± 0.4	1.2 ± 4.1	± ± ±	± ± ±
J-014	elec box 01	1,14,5,4	0.0 ± 0.0	-721.4 ± 162.3	1	-0.9 ± 0.4	-19.8 ± 14.8	-0.9 ± 0.4	-4.3 ± 17.0	18.9 ± 29.2	177 ± 180
J-014	elec box 02	1,5,13,6,5	23.5 ± 32.6	-857.1 ± 150.4	1	1.2 ± 4.1	-1.9 ± 17.3	-0.9 ± 0.4	-4.3 ± 17.0	0 ± 0.0	177 ± 180
J-014	elec box 03	1,5,12,6	11.8 ± 23.1	-757.1 ± 159.3	1	-0.9 ± 0.4	10.0 ± 18.8	-0.9 ± 0.4	-13.8 ± 15.7	47.2 ± 46.2	251 ± 185
J-014	elec box 04	1,12,5,2,5	0.0 ± 0.0	-714.3 ± 162.9	1	1.2 ± 4.1	-7.9 ± 16.5	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 01	29,2	-35.3 ± 27.3	300.0 ± 189.3	1	1.2 ± 4.1	1.2 ± 4.1	-0.9 ± 0.4	1.7 ± 17.8	28.3 ± 35.8	89 ± 173
J-014	floor 02	21,5	-35.3 ± 27.3	250.0 ± 185.6	1	1.2 ± 4.1	-1.9 ± 17.3	-0.9 ± 0.4	-4.3 ± 17.0	18.9 ± 29.2	143 ± 177
J-014	floor 03	31,15	-47.1 ± 14.6	342.9 ± 192.4	0	1.2 ± 4.1	-5.5 ± 16.8	-0.9 ± 0.4	-13.8 ± 15.7	47.2 ± 46.2	204 ± 182
J-014	floor 04	23,14	-47.1 ± 14.6	592.9 ± 209.4	0	3.3 ± 5.8	-7.9 ± 16.5	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 05	23,10	-35.3 ± 27.3	178.6 ± 180.3	1	1.2 ± 4.1	-9.0 ± 16.4	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 06	16,14	-47.1 ± 14.6	607.1 ± 210.4	1	1.2 ± 4.1	-3.1 ± 17.2	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 07	13,4	-35.3 ± 27.3	207.1 ± 182.4	0	-0.9 ± 0.4	-5.5 ± 16.8	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 08	11,10	-35.3 ± 27.3	157.1 ± 178.6	0	1.2 ± 4.1	-18.6 ± 15.0	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 09	11,16	-47.1 ± 14.6	357.1 ± 193.4	0	3.3 ± 5.8	20.7 ± 20.1	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 10	4,2	-35.3 ± 27.3	228.6 ± 184.0	0	-0.9 ± 0.4	4.0 ± 18.1	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 11	2,6	-47.1 ± 14.6	50.0 ± 170.2	1	-0.9 ± 0.4	6.4 ± 18.4	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 12	7,8	-47.1 ± 14.6	264.3 ± 186.7	0	-0.9 ± 0.4	8.8 ± 18.7	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 13	4,11	-47.1 ± 14.6	121.4 ± 175.9	1	-0.9 ± 0.4	14.8 ± 19.4	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 14	3,15	-47.1 ± 14.6	85.7 ± 173.1	-1	-0.9 ± 0.4	4.0 ± 18.1	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 15	1,16	-11.8 ± 42.5	284.3 ± 186.7	0	1.2 ± 4.1	5.2 ± 18.2	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 16	6,18	-35.3 ± 27.3	385.7 ± 195.4	-1	-0.9 ± 0.4	-26.9 ± 13.6	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 17	16,18	-35.3 ± 27.3	371.4 ± 194.4	1	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 18	26,15	-47.1 ± 14.6	185.7 ± 180.8	0	-0.9 ± 0.4	-1.9 ± 17.3	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 19	19,8	-11.8 ± 42.5	385.7 ± 195.4	1	1.2 ± 4.1	-1.9 ± 17.3	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	floor 20	26,2	-47.1 ± 14.6	300.0 ± 189.3	1	-0.9 ± 0.4	4.0 ± 18.1	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	light fixt		± ± ±	± ± ±	1	-0.9 ± 0.4	8.8 ± 18.7	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	light fixt		± ± ±	± ± ±	2	-0.9 ± 0.4	1.7 ± 17.8	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	light fixt		± ± ±	± ± ±	3	-0.9 ± 0.4	1.2 ± 4.1	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	light fixt		± ± ±	± ± ±	4	-0.9 ± 0.4	-1.9 ± 17.3	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175
J-014	light fixt		± ± ±	± ± ±	5	-0.9 ± 0.4	-3.1 ± 17.2	-0.9 ± 0.4	-15.0 ± 15.5	9.4 ± 20.6	116 ± 175

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint		Exposure μR/h	Smear Spot counted on Tennelec		Paint Spot counted on Tennelec		NE after removal of paint	
			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)
J-014	light fixt	6 *	±	±		-0.9 ±	0.4	-26.9 ±	13.6	±	±
J-014	light fixt	7 *	±	±		5.3 ±	7.1	-7.9 ±	16.5	±	±
J-014	light fixt	8 *	±	±		-0.9 ±	0.4	-5.5 ±	16.8	±	±
J-014	pipe flang	1	57.0 ±	56.3	-137.0 ±	165.9	1	-0.9 ±	0.4	-3.1 ±	17.2
J-014	pipe flang	2	-12.0 ±	7.4	-464.0 ±	136.2	-1	-0.9 ±	0.4	8.8 ±	18.7
J-014	pipe flang	3	0.0 ±	24.4	-261.0 ±	155.3	-1	-0.9 ±	0.4	2.9 ±	17.9
J-014	pipe flang	4	11.0 ±	33.1	-377.0 ±	144.7	1	-0.9 ±	0.4	-10.2 ±	16.2
J-014	pump 1	external	18.9 ±	36.4	89.0 ±	172.8	0	-0.9 ±	0.4	13.6 ±	19.3
J-014	pump 2	internal	-9.4 ±	6.5	102.0 ±	173.8	0	1.2 ±	4.1	0.5 ±	17.6
J-014	sink traps	1	-9.4 ±	6.5	28.0 ±	167.9	2	1.2 ±	4.1	-4.3 ±	17.0
J-014	sink traps	2 *	±	±	±	±	2	-0.9 ±	0.4	14.8 ±	19.4
J-014	sump 01	outside	11.0 ±	33.1	-369.0 ±	145.4	-1	-0.9 ±	0.4	-4.3 ±	17.0
J-014	sump 02	inside	-0.4 ±	24.1	-579.0 ±	124.0	-1	-0.9 ±	0.4	-7.9 ±	16.5
J-014	sump 03	outside	-0.4 ±	24.1	-355.0 ±	146.7	-1	1.2 ±	4.1	-3.1 ±	17.2
J-014	sump 04	inside	-0.4 ±	24.1	-565.0 ±	125.6	-1	-0.9 ±	0.4	-10.2 ±	16.2
J-014	Wall E 01	2,7	70.6 ±	56.5	264.3 ±	231.1	0	-0.9 ±	0.4	-6.7 ±	16.7
J-014	Wall E 02	5,4	11.8 ±	23.1	275.0 ±	231.7	0	1.2 ±	4.1	-15.0 ±	15.5
J-014	Wall E 03	8,1	11.8 ±	23.1	314.3 ±	234.0	1	-0.9 ±	0.4	-10.2 ±	16.2
J-014	Wall E 04	8,9	35.3 ±	39.9	400.0 ±	239.0	1	-0.9 ±	0.4	-9.0 ±	16.4
J-014	Wall E 05	10,7	58.8 ±	51.6	200.0 ±	227.2	1	-0.9 ±	0.4	-6.7 ±	16.7
J-014	Wall E 06	11,8	58.8 ±	51.6	92.9 ±	220.6	1	-0.9 ±	0.4	-16.2 ±	15.3
J-014	Wall E 07	12,4	35.3 ±	39.9	235.7 ±	229.4	1	-0.9 ±	0.4	2.9 ±	17.9
J-014	Wall E 08	14,1	94.1 ±	65.2	1007.1 ±	271.6	2	-0.9 ±	0.4	-6.7 ±	16.7
J-014	Wall E 09	14,6	94.1 ±	65.2	807.1 ±	261.3	2	-0.9 ±	0.4	-3.1 ±	17.2
J-014	Wall E 10	15,9	58.8 ±	51.6	250.0 ±	230.2	1	-0.9 ±	0.4	-6.7 ±	16.7
J-014	Wall N 01	1,3	35.3 ±	39.9	292.9 ±	232.8	1	-0.9 ±	0.4	7.6 ±	18.5
J-014	Wall N 02	5,7	58.8 ±	51.6	357.1 ±	236.5	2	-0.9 ±	0.4	-4.3 ±	17.0
J-014	Wall N 03	9,10	23.5 ±	32.6	71.4 ±	219.3	1	-0.9 ±	0.4	-0.7 ±	17.5
J-014	Wall N 04	14,6	23.5 ±	32.6	128.6 ±	222.9	1	-0.9 ±	0.4	-0.7 ±	17.5
J-014	Wall N 05	17,3	35.3 ±	39.9	178.6 ±	225.9	2	1.2 ±	4.1	0.5 ±	17.6
J-014	Wall N 06	18,7	35.3 ±	39.9	164.3 ±	225.0	3	-0.9 ±	0.4	-12.6 ±	15.8
J-014	Wall N 07	20,10	0.0 ±	0.0	78.6 ±	219.8	2	-0.9 ±	0.4	2.9 ±	17.9
J-014	Wall N 08	24,4	105.9 ±	69.2	-164.3 ±	204.0	1	-0.9 ±	0.4	-7.9 ±	16.5
J-014	Wall N 09	25,8	58.8 ±	51.6	71.4 ±	219.3	1	-0.9 ±	0.4	-9.0 ±	16.4
J-014	Wall N 10	26,5	35.3 ±	39.9	-50.0 ±	211.6	1	-0.9 ±	0.4	-3.1 ±	17.2
J-014	Wall S 01	1,8	70.6 ±	56.5	221.4 ±	228.5	0	-0.9 ±	0.4	7.6 ±	18.5
J-014	Wall S 02	3,10	35.3 ±	39.9	85.7 ±	220.2	0	5.3 ±	7.1	6.4 ±	18.4
J-014	Wall S 03	6,7	23.5 ±	32.6	21.4 ±	216.2	1	-0.9 ±	0.4	4.0 ±	18.1
J-014	Wall S 04	8,4	58.8 ±	51.6	221.4 ±	228.5	1	-0.9 ±	0.4	4.0 ±	18.1
J-014	Wall S 05	13,4	11.8 ±	23.1	135.7 ±	223.3	0	-0.9 ±	0.4	-7.9 ±	16.5
J-014	Wall S 06	16,7	35.3 ±	39.9	128.6 ±	222.9	0	-0.9 ±	0.4	-12.6 ±	15.8
J-014	Wall S 07	20,8	35.3 ±	39.9	307.1 ±	233.6	1	-0.9 ±	0.4	4.0 ±	18.1
J-014	Wall S 08	21,4	23.5 ±	32.6	35.7 ±	217.1	1	1.2 ±	4.1	2.9 ±	17.9
J-014	Wall S 09	24,6	11.8 ±	23.1	200.0 ±	227.2	1	3.3 ±	5.8	-10.2 ±	16.2
J-014	Wall S 10	28,5	58.8 ±	51.6	321.4 ±	234.4	0	1.2 ±	4.1	-5.5 ±	16.8
J-014	Wall W 01	1,5	35.3 ±	39.9	178.6 ±	225.9	0	-0.9 ±	0.4	-1.9 ±	17.3
J-014	Wall W 02	2,2	0.0 ±	0.0	121.4 ±	222.4	0	-0.9 ±	0.4	-7.9 ±	16.5
J-014	Wall W 03	3,6	35.3 ±	39.9	242.9 ±	229.8	1	1.2 ±	4.1	-12.6 ±	15.8
J-014	Wall W 04	6,8	58.8 ±	51.6	28.6 ±	216.6	0	1.2 ±	4.1	-16.2 ±	15.3
J-014	Wall W 05	7,4	11.8 ±	23.1	185.7 ±	226.4	0	1.2 ±	4.1	-11.4 ±	16.0
J-014	Wall W 06	8,7	58.8 ±	51.6	100.0 ±	221.1	1	-0.9 ±	0.4	2.9 ±	17.9
								9.5 ±	9.1	-11.4 ±	16.0
										-14.1 ±	8.0
										14 ±	165
										233 ±	143

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

		coordinate	NE before removal of paint				Exposure	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
room #	direction	x,y,z	alpha (dis/min)		beta (dis/min)		μR/h	alpha (dis/min)		beta (dis/min)		alpha (dis/min)		beta (dis/min)		alpha (dis/min)		beta (dis/min)	
J-014	Wall W 07	10,9	23.5 ±	32.6	271.4 ±	231.5	0	-0.9 ±	0.4	-15.0 ±	15.5	1.2 ±	4.1	2.9 ±	17.9	-2.8 ±	24.0	104 ±	173
J-014	Wall W 08	12,2	94.1 ±	65.2	92.9 ±	220.6	0	-0.9 ±	0.4	-1.9 ±	17.3	3.3 ±	5.8	-0.7 ±	17.5	31.1 ±	45.9	-6 ±	164
J-014	Wall W 09	15,4	58.8 ±	51.6	-42.9 ±	212.0	0	1.2 ±	4.1	8.8 ±	18.7	1.2 ±	4.1	7.6 ±	18.5	-2.8 ±	24.0	28 ±	167
J-014	Wall W 10	18,7	35.3 ±	39.9	150.0 ±	224.2	0	-0.9 ±	0.4	-9.0 ±	16.4	-0.9 ±	0.4	-17.4 ±	15.1	19.8 ±	39.9	-164 ±	150
Average			11.5	29.6	10.1	196.0	0.6	-0.0	1.8	-3.0	17.1	0.7	2.5	-2.3	17.2	5.4	21.3	53.6	172.5
Stand Dev			33.6	17.2	356.4	30.7	1.0	1.5	2.1	8.9	1.2	2.3	2.6	8.8	1.2	11.4	13.2	133.7	15.1
Maximum			105.9	69.2	1007.1	271.6	4.0	5.3	7.1	20.7	20.1	9.5	9.1	14.8	19.4	47.2	46.2	698.0	216.8
Minimum			-47.1	0.0	-857.1	124.0	-3.0	-0.9	0.4	-26.9	13.6	-0.9	0.4	-21.0	14.6	-14.1	0.0	-233.0	141.3
Count			116	97	116	97	100	116	116	116	116	70	70	70	70	116	70	116	70
J-014'	rabbit tube	0-02'-1	*	±	*	±	0	3.3 ±	5.8	12.4 ±	19.1					*	±	*	±
J-014'	rabbit tube	0-02'-2	*	±	*	±		-0.9 ±	0.4	6.4 ±	18.4					*	±	*	±
J-014'	rabbit tube	0-02'-3	*	±	*	±	0	-0.9 ±	0.4	-22.1 ±	14.4					*	±	*	±
J-014'	rabbit tube	0-04'-4	*	±	*	±	0	-0.9 ±	0.4	-9.0 ±	16.4					*	±	*	±
J-014'	rabbit tube	0-04'-5	*	±	*	±		-0.9 ±	0.4	17.1 ±	19.7					*	±	*	±
J-014'	rabbit tube	0-04'-6	*	±	*	±	10	-0.9 ±	0.4	-9.0 ±	16.4					*	±	*	±
J-014'	rabbit tube	0-06'-7	*	±	*	±	10	-0.9 ±	0.4	-4.3 ±	17.0					*	±	*	±
J-014'	rabbit tube	0-06'-8	*	±	*	±		-0.9 ±	0.4	-0.7 ±	17.5					*	±	*	±
J-014'	rabbit tube	0-06'-9	*	±	*	±	40	1.2 ±	4.1	2.9 ±	17.9					*	±	*	±
J-014'	rabbit tube	0-08'-10	*	±	*	±	40	1.2 ±	4.1	1.7 ±	17.8					*	±	*	±
J-014'	rabbit tube	0-08'-11	*	±	*	±		1.2 ±	4.1	-13.8 ±	15.7					*	±	*	±
J-014'	rabbit tube	0-08'-12	*	±	*	±	70	1.2 ±	4.1	-0.7 ±	17.5					*	±	*	±
J-014'	rabbit tube	0-10'-13	*	±	*	±	70	-0.9 ±	0.4	-10.2 ±	16.2					*	±	*	±
J-014'	rabbit tube	0-10'-14	*	±	*	±		5.3 ±	7.1	24.3 ±	20.5					*	±	*	±
J-014'	rabbit tube	0-10'-15	*	±	*	±	490	-0.9 ±	0.4	13.6 ±	19.3					*	±	*	±
J-014'	rabbit tube	0-12'-16	*	±	*	±	1,500	-0.9 ±	0.4	38.6 ±	22.0					*	±	*	±
J-014'	rabbit tube	0-12'-17	*	±	*	±		-0.9 ±	0.4	-5.5 ±	16.8					*	±	*	±
J-014'	rabbit tube	0-12'-18	*	±	*	±	12,000	-0.9 ±	0.4	11.2 ±	19.0					*	±	*	±
J-014'	rabbit tube	0-14' center 1	*	±	*	±	50,000	-0.9 ±	0.4	121.9 ±	29.4					*	±	*	±
J-014'	rabbit tube	0-14' center 2	*	±	*	±		-0.9 ±	0.4	92.1 ±	27.0					*	±	*	±
J-014'	rabbit tube	0-14' center 3	*	±	*	±	100,000	1.2 ±	4.1	1.7 ±	17.8					*	±	*	±
J-014'	rabbit tube	0-15' elbow 1	*	±	*	±		3.3 ±	5.8	148.1 ±	31.4					*	±	*	±
J-014'	rabbit tube	0-15' elbow 2	*	±	*	±	150,000	1.2 ±	4.1	254.0 ±	38.3					*	±	*	±
J-014'	rabbit tube	0-15' elbow 3	*	±	*	±		-0.9 ±	0.4	150.5 ±	31.6					*	±	*	±
J-014'	rabbit tube	inside cov	*	±	*	±		-0.9 ±	0.4	217.1 ±	36.1					*	±	*	±
J-014'	rabbit tube	Inside Top Tube 3	*	±	*	±		1.2 ±	4.1	1832.6 ±	93.2					*	±	*	±
J-014'	rabbit tube	Inside Top Tube 4	*	±	*	±		1.2 ±	4.1	1986.2 ±	96.9					*	±	*	±
J-014'	rabbit tube	out Cover Plate 1	*	±	*	±		3.3 ±	5.8	4200.5 ±	139.7					*	±	*	±
J-014'	rabbit tube	out Cover Plate 2	*	±	*	±		-0.9 ±	0.4	3325.5 ±	124.6					*	±	*	±
J-014'	rabbit tube	1	*	±	*	±	1	1.2 ±	4.1	-22.1 ±	14.4					*	±	*	±
J-014'	rabbit tube	2	*	±	*	±	-3	-0.9 ±	0.4	13.6 ±	19.3					*	±	*	±
J-014'	rabbit tube	3	*	±	*	±	-2	1.2 ±	4.1	2.9 ±	17.9					*	±	*	±
J-014'	rabbit tube	4	*	±	*	±	0	3.3 ±	5.8	-1.9 ±	17.3					*	±	*	±
Average							16,538	0.4	2.4	375	32.0								
Stand Dev							39,703	1.7	2.3	978	31.6								
Maximum							150,000	5.3	7.1	4,200	139.7								
Minimum							-3.0	-0.9	0.4	-22.1	14.4								
Count							19	33	33	33	33								
J-015	ceiling 01	15,6	31.1 ±	39.3	234.0 ±	169.8	0	-0.9 ±	0.4	5.2 ±	18.2					*	±	*	±
J-015	ceiling 02	21,16	-2.8 ±	3.6	117.0 ±	160.0	0	1.2 ±	4.1	-9.0 ±	16.4					*	±	*	±

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint		Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint	
			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)
J-015	ceiling 03	16,16	8.5 ±	22.9	197.0 ±	166.7	-1	-0.9 ±	0.4	8.8 ±	18.7			±	*
J-015	ceiling 04	16,21	-2.8 ±	3.6	200.0 ±	167.0	0	1.2 ±	4.1	-13.8 ±	15.7			±	*
J-015	ceiling 05	6,20	8.5 ±	22.9	-89.0 ±	141.3	-1	-0.9 ±	0.4	4.0 ±	18.1			±	*
J-015	ceiling 06	7,10	-2.8 ±	3.6	83.0 ±	157.1	0	3.3 ±	5.8	-5.5 ±	16.8			±	*
J-015	ceiling 07	3,3	8.5 ±	22.9	392.0 ±	182.1	0	7.4 ±	8.2	11.2 ±	19.0			±	*
J-015	ceiling 08	21,3	-2.8 ±	3.6	255.0 ±	171.4	-1	-0.9 ±	0.4	-16.2 ±	15.3			±	*
J-015	ceiling 09	18,20	19.8 ±	32.2	220.0 ±	168.6	0	-0.9 ±	0.4	-11.4 ±	16.0			±	*
J-015	ceiling 10	20,24	19.8 ±	32.2	227.0 ±	169.2	0	1.2 ±	4.1	2.9 ±	17.9			±	*
J-015	door top 01	1	0.0 ±	0.0	27.0 ±	178.1	0	-0.9 ±	0.4	0.5 ±	17.6			±	*
J-015	door top 02	2	0.0 ±	0.0	136.0 ±	186.3	0	1.2 ±	4.1	-0.7 ±	17.5			±	*
J-015	door tops	1	0.0 ±	0.0	27.0 ±	178.1	1	5.3 ±	7.1	-4.3 ±	17.0			±	*
J-015	door tops	2	0.0 ±	0.0	136.0 ±	186.3	1	3.3 ±	5.8	6.4 ±	18.4			±	*
J-015	filter hous 01	12,5,2,8	9.4 ±	20.6	-507.0 ±	152.6	3	-0.9 ±	0.4	-16.2 ±	15.3			±	*
J-015	filter hous 02	11,1,5,6,5	9.4 ±	20.6	-249.0 ±	174.2	7	-0.9 ±	0.4	-9.0 ±	16.4			±	*
J-015	floor 01	2,2	9.4 ±	20.6	111.0 ±	184.3	1	1.2 ±	4.1	-6.7 ±	16.7			±	*
J-015	floor 02	3,7	0.0 ±	0.0	176.0 ±	189.0	0	-0.9 ±	0.4	-10.2 ±	16.2			±	*
J-015	floor 03	7,14	16.0 ±	26.9	108.0 ±	184.0	0	-0.9 ±	0.4	-16.2 ±	15.3			±	*
J-015	floor 04	1,22	0.0 ±	0.0	-21.0 ±	174.2	0	1.2 ±	4.1	0.5 ±	17.6			±	*
J-015	floor 05	11,22	0.0 ±	0.0	346.0 ±	201.0	0	1.2 ±	4.1	-3.1 ±	17.2			±	*
J-015	floor 06	16,11	9.4 ±	20.6	43.0 ±	179.1	1	-0.9 ±	0.4	6.4 ±	18.4			±	*
J-015	floor 07	19,3	0.0 ±	0.0	54.0 ±	180.0	0	1.2 ±	4.1	-0.7 ±	17.5			±	*
J-015	floor 08	24,6	0.0 ±	0.0	-34.0 ±	173.1	0	-0.9 ±	0.4	-23.3 ±	14.2			±	*
J-015	floor 09	21,16	0.0 ±	0.0	20.0 ±	177.4	1	-0.9 ±	0.4	-0.7 ±	17.5			±	*
J-015	floor 10	22,33	9.4 ±	20.6	91.0 ±	182.8	1	1.2 ±	4.1	-0.7 ±	17.5			±	*
J-015	floor 11	16,21	15.9 ±	26.8	46.0 ±	179.4	1	1.2 ±	4.1	-22.1 ±	14.4			±	*
J-015	floor 12	16,16	0.0 ±	0.0	116.0 ±	184.6	0	-0.9 ±	0.4	-12.6 ±	15.8			±	*
J-015	floor 13	15,6	0.0 ±	0.0	142.0 ±	186.6	0	-0.9 ±	0.4	0.5 ±	17.6			±	*
J-015	floor 14	15,2	18.9 ±	29.2	32.0 ±	178.3	0	1.2 ±	4.1	-4.3 ±	17.0			±	*
J-015	floor 15	10,4	18.9 ±	29.2	59.0 ±	180.4	1	1.2 ±	4.1	-1.9 ±	17.3			±	*
J-015	floor 16	10,12	9.4 ±	20.6	279.0 ±	196.4	1	-0.9 ±	0.4	-4.3 ±	17.0			±	*
J-015	floor 17	10,20	98.9 ±	66.9	213.0 ±	191.7	0	-0.9 ±	0.4	-1.9 ±	17.3			±	*
J-015	floor 18	6,20	9.4 ±	20.6	165.0 ±	188.2	0	1.2 ±	4.1	-12.6 ±	15.8			±	*
J-015	floor 19	7,10	18.9 ±	29.2	208.0 ±	191.4	1	-0.9 ±	0.4	-22.1 ±	14.4			±	*
J-015	floor 20	6,4	9.4 ±	20.6	294.0 ±	197.4	0	-0.9 ±	0.4	5.2 ±	18.2			±	*
J-015	rad shield 01	gam shield	19.8 ±	32.2	-192.0 ±	130.9	-2	-0.9 ±	0.4	8.8 ±	18.7			±	*
J-015	rad shield 02	gam shield	8.5 ±	22.9	-137.0 ±	136.5	-3	3.3 ±	5.8	-1.9 ±	17.3			±	*
J-015	rad shield 03	gam shield	8.5 ±	22.9	-282.0 ±	121.1	-3	3.3 ±	5.8	-6.7 ±	16.7			±	*
J-015	rad shield 04	gam shield	19.8 ±	32.2	-151.0 ±	135.1	-3	-0.9 ±	0.4	-4.3 ±	17.0			±	*
J-015	rad shield 05	gam shield	-2.8 ±	3.6	-268.0 ±	122.6	-3	3.3 ±	5.8	-3.1 ±	17.2			±	*
J-015	stor pit 01	bottom	0.0 ±	24.0	252.0 ±	170.5	0	7.4 ±	8.2	10.0 ±	18.8			±	*
J-015	stor pit 01	sides	0.0 ±	24.0	-111.0 ±	138.2	0	3.3 ±	5.8	-9.0 ±	16.4			±	*
J-015	Wall E 01	1,4	-2.8 ±	3.6	-55.0 ±	144.5	-1	1.2 ±	4.1	0.5 ±	17.6			±	*
J-015	Wall E 02	4,6	19.8 ±	32.2	-41.0 ±	145.8	0	5.3 ±	7.1	-11.4 ±	16.0			±	*
J-015	Wall E 03	8,9	42.4 ±	45.3	186.0 ±	165.8	-1	1.2 ±	4.1	-3.1 ±	17.2			±	*
J-015	Wall E 04	10,1	8.5 ±	22.9	117.0 ±	160.0	-1	1.2 ±	4.1	-3.1 ±	17.2			±	*
J-015	Wall E 05	12,6	19.8 ±	32.2	145.0 ±	162.4	1	1.2 ±	4.1	4.0 ±	18.1			±	*
J-015	Wall E 06	15,3,5	-2.8 ±	3.6	62.0 ±	155.2	-1	-0.9 ±	0.4	-9.0 ±	16.4			±	*
J-015	Wall E 07	17,8	-2.8 ±	3.6	158.0 ±	163.5	0	-0.9 ±	0.4	-5.5 ±	16.8			±	*
J-015	Wall E 08	20,2	8.5 ±	22.9	252.0 ±	171.2	0	-0.9 ±	0.4	-3.1 ±	17.2			±	*
J-015	Wall E 09	22,11	-2.8 ±	3.6	69.0 ±	155.9	0	1.2 ±	4.1	-6.7 ±	16.7			±	*
J-015	Wall E 10	23,6	8.5 ±	22.9	131.0 ±	161.2	0	3.3 ±	5.8	1.7 ±	17.8			±	*

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint		Exposure μR/h	Smear Spot counted on Tennelec		Paint Spot counted on Tennelec		NE after removal of paint	
			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)
J-015	Wall N 01	1,8	-2.8 ± 3.6	83.0 ± 157.1	-1	1.2 ± 4.1	4.0 ± 18.1	4.1 ± 17.6	17.6	+	+
J-015	Wall N 02	5,4	-2.8 ± 3.6	35.0 ± 152.8	-1	-0.9 ± 4.1	0.5 ± 16.5	0.5 ± 16.5	16.5	+	+
J-015	Wall N 03	10,2	8.5 ± 22.9	-34.0 ± 146.5	-1	1.2 ± 4.1	-7.9 ± 18.4	-7.9 ± 18.4	18.4	+	+
J-015	Wall N 04	12,6	19.8 ± 32.2	103.0 ± 158.8	0	3.3 ± 5.8	6.4 ± 18.1	6.4 ± 18.1	18.1	+	+
J-015	Wall N 05	14,4	31.1 ± 39.3	193.0 ± 166.4	0	3.3 ± 5.8	4.0 ± 14.4	4.0 ± 14.4	14.4	+	+
J-015	Wall N 06	17,8	8.5 ± 22.9	-7.0 ± 149.0	1	-0.9 ± 4.1	-22.1 ± 17.5	-22.1 ± 17.5	17.5	+	+
J-015	Wall N 07	20,1	8.5 ± 22.9	165.0 ± 164.1	0	1.2 ± 4.1	-8.0 ± 16.4	-8.0 ± 16.4	16.4	+	+
J-015	Wall N 08	23,6	8.5 ± 22.9	170.0 ± 164.5	0	3.3 ± 5.8	-0.7 ± 17.5	-0.7 ± 17.5	17.5	+	+
J-015	Wall N 09	26,3	-2.8 ± 3.6	-20.0 ± 147.8	0	1.2 ± 4.1	-6.7 ± 16.7	-6.7 ± 16.7	16.7	+	+
J-015	Wall N 10	28,9	19.8 ± 32.2	7.0 ± 150.3	0	1.2 ± 4.1	-4.3 ± 17.0	-4.3 ± 17.0	17.0	+	+
J-015	Wall S 01	1,3,5	8.5 ± 22.9	186.0 ± 165.8	0	1.2 ± 4.1	14.8 ± 19.4	14.8 ± 19.4	19.4	+	+
J-015	Wall S 02	3,7	-2.8 ± 3.6	151.0 ± 162.9	0	-0.9 ± 4.1	-12.6 ± 15.8	-12.6 ± 15.8	15.8	+	+
J-015	Wall S 03	6,1	31.1 ± 39.3	76.0 ± 158.5	-1	1.2 ± 4.1	-15.0 ± 15.5	-15.0 ± 15.5	15.5	+	+
J-015	Wall S 04	8,10	31.1 ± 39.3	42.0 ± 153.5	1	-0.9 ± 4.1	0.5 ± 17.6	0.5 ± 17.6	17.6	+	+
J-015	Wall S 05	11,5,5,5	8.5 ± 22.9	28.0 ± 152.2	0	-0.9 ± 4.1	13.6 ± 19.3	13.6 ± 19.3	19.3	+	+
J-015	Wall S 06	15,11	42.4 ± 45.3	69.0 ± 155.9	0	3.3 ± 5.8	5.2 ± 18.2	5.2 ± 18.2	18.2	+	+
J-015	Wall S 07	17,5,1	19.8 ± 32.2	42.0 ± 153.5	-1	3.3 ± 5.8	-3.1 ± 17.2	-3.1 ± 17.2	17.2	+	+
J-015	Wall S 08	20,5,4,5	31.1 ± 39.3	124.0 ± 160.6	-1	1.2 ± 4.1	1.7 ± 17.8	1.7 ± 17.8	17.8	+	+
J-015	Wall S 09	23,8	19.8 ± 32.2	124.0 ± 160.6	1	-0.9 ± 4.1	6.4 ± 18.4	6.4 ± 18.4	18.4	+	+
J-015	Wall S 10	25,5	-2.8 ± 3.6	28.0 ± 152.2	-1	-0.9 ± 4.1	-4.3 ± 17.0	-4.3 ± 17.0	17.0	+	+
J-015	Wall W 01	1,3	53.7 ± 50.7	131.0 ± 161.2	-1	1.2 ± 4.1	-9.0 ± 16.4	-9.0 ± 16.4	16.4	+	+
J-015	Wall W 02	3,9	8.5 ± 22.9	117.0 ± 160.0	-2	-0.9 ± 4.1	6.4 ± 18.4	6.4 ± 18.4	18.4	+	+
J-015	Wall W 03	5,6	8.5 ± 22.9	193.0 ± 166.4	-1	1.2 ± 4.1	-11.4 ± 16.0	-11.4 ± 16.0	16.0	+	+
J-015	Wall W 04	7,6	19.8 ± 32.2	96.0 ± 158.2	-1	3.3 ± 5.8	5.2 ± 18.2	5.2 ± 18.2	18.2	+	+
J-015	Wall W 05	12,1	-2.8 ± 3.6	-68.0 ± 143.3	0	5.3 ± 7.1	8.8 ± 18.7	8.8 ± 18.7	18.7	+	+
J-015	Wall W 06	14,9	19.8 ± 32.2	-82.0 ± 141.9	0	-0.9 ± 4.1	2.9 ± 17.9	2.9 ± 17.9	17.9	+	+
J-015	Wall W 07	18,2	19.8 ± 32.2	-213.0 ± 128.7	-2	-0.9 ± 4.1	1.7 ± 17.8	1.7 ± 17.8	17.8	+	+
J-015	Wall W 08	20,7	-2.8 ± 3.6	69.0 ± 155.9	-1	1.2 ± 4.1	-5.5 ± 16.8	-5.5 ± 16.8	16.8	+	+
J-015	Wall W 09	23,4	8.5 ± 22.9	35.0 ± 152.8	-2	1.2 ± 4.1	0.5 ± 17.6	0.5 ± 17.6	17.6	+	+
J-015	Wall W 10	24,6	8.5 ± 22.9	48.0 ± 154.0	-1	1.2 ± 4.1	0.5 ± 17.6	0.5 ± 17.6	17.6	+	+
Average			11.1	19.8	70.8	163.9	-0.2	0.9	3.0	-3.1	17.1
Stand Dev			15.4	14.7	146.7	17.3	1.3	2.0	2.4	8.3	1.1
Maximum			98.9	66.9	392.0	201.0	7	7.4	8.2	14.8	19.4
Minimum			-2.8	0.0	-507.0	121.1	-3	-0.9	0.4	-23.3	14.2
Count			83	83	83	83	83	83	83	83	83
J-101	air ducts 0	downstream	47.0 ± 51.0	53.0 ± 200.9	0	-0.9 ± 4.1	-0.7 ± 17.5	-0.7 ± 17.5	17.5	+	+
J-101	air ducts 1	downstream	47.0 ± 51.0	202.0 ± 210.8	0	1.2 ± 4.1	-4.3 ± 17.0	-4.3 ± 17.0	17.0	+	+
J-101	air ducts 2	downstream	47.0 ± 51.0	101.0 ± 204.2	0	-0.9 ± 4.1	-11.4 ± 16.0	-11.4 ± 16.0	16.0	+	+
J-101	air ducts 3	downstream	29.3 ± 42.4	213.0 ± 211.5	0	-0.9 ± 4.1	-9.0 ± 16.4	-9.0 ± 16.4	16.4	+	+
J-101	air ducts 4	downstream	29.3 ± 42.4	13.0 ± 198.2	0	-0.9 ± 4.1	-17.4 ± 15.1	-17.4 ± 15.1	15.1	+	+
J-101	air ducts 5	upstrm N	28.1 ± 41.8	13.0 ± 198.2	0	1.2 ± 4.1	14.8 ± 19.4	14.8 ± 19.4	19.4	+	+
J-101	air ducts 6	upstrm N high	9.3 ± 30.0	138.0 ± 206.6	0	13.7 ± 10.8	6.4 ± 18.4	6.4 ± 18.4	18.4	+	+
J-101	air ducts 7	upstrm center	28.1 ± 41.8	2.0 ± 197.4	0	1.2 ± 4.1	-5.5 ± 16.8	-5.5 ± 16.8	16.8	+	+
J-101	air ducts 8	upstrm center hi	28.1 ± 41.8	302.0 ± 217.2	0	-0.9 ± 4.1	17.1 ± 19.7	17.1 ± 19.7	19.7	+	+
J-101	air ducts 9	upstrm S	28.1 ± 41.8	21.0 ± 198.7	0	-0.9 ± 4.1	-0.7 ± 17.5	-0.7 ± 17.5	17.5	+	+
J-101	ceiling 01	6,14	17.6 ± 40.9	-153.6 ± 168.7	1	3.3 ± 5.8	11.2 ± 19.0	11.2 ± 19.0	19.0	+	+
J-101	ceiling 02	7,4,5	29.4 ± 47.0	60.7 ± 185.3	1	-0.9 ± 4.1	2.9 ± 17.9	2.9 ± 17.9	17.9	+	+
J-101	ceiling 03	2,2	-17.6 ± 8.9	210.7 ± 196.1	1	-0.9 ± 4.1	-22.1 ± 14.4	-22.1 ± 14.4	14.4	+	+
J-101	ceiling 04	4,8	41.2 ± 52.3	-82.1 ± 174.4	1	-0.9 ± 4.1	-11.4 ± 16.0	-11.4 ± 16.0	16.0	+	+
J-101	ceiling 05	0,5,13	29.4 ± 47.0	-203.6 ± 164.6	1	5.3 ± 7.1	-9.0 ± 16.4	-9.0 ± 16.4	16.4	+	+

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
J-101	door top e 01	5,7	0.0 ±	0.0	-14.3 ±	196.5	1	-0.9 ±	0.4	-5.5 ±	16.8					*	±	*	±
J-101	door top e 02	3,7	35.3 ±	39.9	42.9 ±	200.5	1	-0.9 ±	0.4	-9.0 ±	16.4					*	±	*	±
J-101	floor 01	0,14	5.9 ±	33.8	203.6 ±	195.6	0	3.3 ±	5.8	-5.5 ±	16.8	1.2 ±	4.1	-7.9 ±	16.5	*	±	*	±
J-101	floor 02	2,11	-17.6 ±	8.9	253.6 ±	199.1	0	-0.9 ±	0.4	-9.0 ±	16.4	1.2 ±	4.1	-12.6 ±	15.8	*	±	*	±
J-101	floor 03	4,7	-17.6 ±	8.9	325.0 ±	203.9	0	-0.9 ±	0.4	-13.8 ±	15.7	1.2 ±	4.1	-7.9 ±	16.5	*	±	*	±
J-101	floor 04	0.5,2.5	17.6 ±	40.9	296.4 ±	202.0	0	1.2 ±	4.1	8.8 ±	18.7	1.2 ±	4.1	-15.0 ±	15.5	*	±	*	±
J-101	floor 05	4,2	-17.6 ±	8.9	203.6 ±	195.6	1	-0.9 ±	0.4	2.9 ±	17.9	-0.9 ±	0.4	-3.1 ±	17.2	*	±	*	±
J-101	floor 06	8,2	17.6 ±	40.9	275.0 ±	200.5	0	-0.9 ±	0.4	-15.0 ±	15.5	3.3 ±	5.8	-7.9 ±	16.5	*	±	*	±
J-101	floor 07	7,7	-5.9 ±	24.7	239.3 ±	198.1	1	-0.9 ±	0.4	1.7 ±	17.8	-0.9 ±	0.4	-4.3 ±	17.0	*	±	*	±
J-101	floor 08	10,9	29.4 ±	47.0	167.9 ±	193.1	0	3.3 ±	5.8	-0.7 ±	17.5	-0.9 ±	0.4	-3.1 ±	17.2	*	±	*	±
J-101	floor 09	5.5,12	-17.6 ±	8.9	53.6 ±	184.8	0	-0.9 ±	0.4	2.9 ±	17.9	-0.9 ±	0.4	1.7 ±	17.8	*	±	*	±
J-101	floor 10	7,15	5.9 ±	33.8	160.7 ±	192.5	0	-0.9 ±	0.4	0.5 ±	17.6	1.2 ±	4.1	4.0 ±	18.1	*	±	*	±
J-101	vent 1	Exh T2-1 up	*	±	*	±		1.2 ±	4.1	10.0 ±	18.8					*	±	*	±
J-101	vent 2	Exh T2-2 up	*	±	*	±		1.2 ±	4.1	5.2 ±	18.2					*	±	*	±
J-101	vent 3	Exh T2-3 up	*	±	*	±		3.3 ±	5.8	21.9 ±	20.2					*	±	*	±
J-101	vent 4	Exh T2-3 up	*	±	*	±		-0.9 ±	0.4	12.4 ±	19.1					*	±	*	±
J-101	vent 5	Exh T2-1 up	*	±	*	±		5.3 ±	7.1	-1.9 ±	17.3					*	±	*	±
J-101	Wall E 01	14,6	5.9 ±	33.8	67.9 ±	185.8	1	-0.9 ±	0.4	-3.1 ±	17.2					*	±	*	±
J-101	Wall E 02	12,3	5.9 ±	33.8	-46.4 ±	177.2	1	-0.9 ±	0.4	-0.7 ±	17.5					*	±	*	±
J-101	Wall E 03	4,7	-5.9 ±	24.7	717.9 ±	228.8	1	1.2 ±	4.1	-4.3 ±	17.0					*	±	*	±
J-101	Wall E 04	8,5	-17.6 ±	8.9	239.3 ±	198.1	1	-0.9 ±	0.4	-11.4 ±	16.0					*	±	*	±
J-101	Wall E 05	1,1	-17.6 ±	8.9	110.7 ±	188.9	1	-0.9 ±	0.4	-0.7 ±	17.5					*	±	*	±
J-101	Wall N 01	9,6,5	17.6 ±	40.9	139.3 ±	191.0	1	1.2 ±	4.1	-17.4 ±	15.1					*	±	*	±
J-101	Wall N 02	7,3	17.6 ±	40.9	46.4 ±	184.2	1	1.2 ±	4.1	-0.7 ±	17.5					*	±	*	±
J-101	Wall N 03	5,5	29.4 ±	47.0	196.4 ±	195.1	1	1.2 ±	4.1	-4.3 ±	17.0					*	±	*	±
J-101	Wall N 04	3,5,7	17.6 ±	40.9	239.3 ±	198.1	1	-0.9 ±	0.4	-16.2 ±	15.3					*	±	*	±
J-101	Wall N 05	1,3,5	-5.9 ±	24.7	203.6 ±	195.6	1	-0.9 ±	0.4	-4.3 ±	17.0					*	±	*	±
J-101	Wall S 01	9,5	17.6 ±	40.9	117.9 ±	189.5	1	1.2 ±	4.1	-0.7 ±	17.5					*	±	*	±
J-101	Wall S 02	7,2	5.9 ±	33.8	-139.3 ±	169.8	1	-0.9 ±	0.4	-13.8 ±	15.7					*	±	*	±
J-101	Wall S 03	5,4,5	-5.9 ±	24.7	210.7 ±	196.1	1	-0.9 ±	0.4	-6.7 ±	16.7					*	±	*	±
J-101	Wall S 04	2,5,7	23.5 ±	44.1	325.0 ±	203.9	1	-0.9 ±	0.4	-9.0 ±	16.4					*	±	*	±
J-101	Wall S 05	1,4,5	23.5 ±	44.1	332.1 ±	204.4	1	1.2 ±	4.1	-6.7 ±	16.7					*	±	*	±
J-101	Wall W 01	14,6	5.9 ±	33.8	203.6 ±	195.6	1	1.2 ±	4.1	-13.8 ±	15.7					*	±	*	±
J-101	Wall W 02	9,3	-17.6 ±	8.9	739.3 ±	230.1	3	-0.9 ±	0.4	-6.7 ±	16.7					*	±	*	±
J-101	Wall W 03	7,1	29.4 ±	47.0	267.9 ±	200.0	1	-0.9 ±	0.4	-5.5 ±	16.8					*	±	*	±
J-101	Wall W 04	4,5	17.6 ±	40.9	203.6 ±	195.6	1	-0.9 ±	0.4	-0.7 ±	17.5					*	±	*	±
J-101	Wall W 05	1,7,5	5.9 ±	33.8	296.4 ±	202.0	1	-0.9 ±	0.4	-13.8 ±	15.7					*	±	*	±
Average			11.7	33.7	145.6	196.3	0.7	0.4	2.2	-3.3	17.1	0.5	2.8	-5.6	16.8				
Stand Dev			18.7	14.3	175.1	12.7	0.6	2.5	2.5	9.3	1.2	1.3	2.0	5.6	0.8				
Maximum			47.0	52.3	739.3	230.1	3	13.7	10.8	21.9	20.2	3.3	5.8	4.0	18.1				
Minimum			-17.6	0.0	-203.6	164.6	0	-0.9	0.4	-22.1	14.4	-0.9	0.4	-15.0	15.5				
Count			52	47	52	47	42	52	52	52	52	10	10	10	10				
J-102	ceiling 01	5.5,16	-23.5 ±	43.1	28.6 ±	221.0	0	-0.9 ±	0.4	-30.5 ±	13.0					*	±	*	±
J-102	ceiling 02	16.5,9.5	11.8 ±	58.8	42.9 ±	221.9	1	-0.9 ±	0.4	-0.7 ±	17.5					*	±	*	±
J-102	ceiling 03	5.5,10	-23.5 ±	43.1	64.3 ±	223.3	0	3.3 ±	5.8	-1.9 ±	17.3					*	±	*	±
J-102	ceiling 04	10.5,5	0.0 ±	54.1	164.3 ±	229.3	0	3.3 ±	5.8	-23.3 ±	14.2					*	±	*	±
J-102	ceiling 05	5.5,4.5	-47.1 ±	28.2	271.4 ±	235.6	-1	-0.9 ±	0.4	-9.0 ±	16.4					*	±	*	±
J-102	door tops 01	7,9,5	*	±	*	±		1.2 ±	4.1	6.4 ±	18.4					*	±	*	±
J-102	door tops 02	7,11	*	±	*	±		-0.9 ±	0.4	-1.9 ±	17.3					*	±	*	±
J-102	door tops 03	7,7	*	±	*	±		-0.9 ±	0.4	-3.1 ±	17.2					*	±	*	±

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #		direction	coordinate x,y,z	NE before removal of paint alpha (dis/min) beta (dis/min)				Exposure μR/h	Smear Spot counted on Tennelec alpha (dis/min) beta (dis/min)				Paint Spot counted on Tennelec alpha (dis/min) beta (dis/min)				NE after removal of paint alpha (dis/min) beta (dis/min)				
J-102	door tops 04		7,8,5	*	±	*	±		1.2 ±	4.1	-7.9 ±	16.5			*	±	*	±			
J-102	ducts 01			1	-23.5 ±	43.1	78.6 ±	224.1	0	9.5 ±	9.1	12.4 ±	19.1		*	±	*	±			
J-102	ducts 02			2	58.8 ±	74.7	14.3 ±	220.2	0	1.2 ±	4.1	2.9 ±	17.9		*	±	*	±			
J-102	ducts 03			3	-11.8 ±	48.9	-114.3 ±	212.0	0	-0.9 ±	0.4	-11.4 ±	16.0		*	±	*	±			
J-102	ducts 04			4	11.8 ±	58.8	200.0 ±	231.4	0	5.3 ±	7.1	-10.2 ±	16.2		*	±	*	±			
J-102	floor 01		9,18		-11.8 ±	7.3	292.9 ±	205.2	0	-0.9 ±	0.4	-0.7 ±	17.5	1.2 ±	4.1	-4.3 ±	17.0	-14.1 ±	8.0	79 ±	201
J-102	floor 02		16,18		0.0 ±	24.2	214.3 ±	199.9	0	-0.9 ±	0.4	-6.7 ±	16.7	-0.9 ±	0.4	11.2 ±	19.0	31.1 ±	45.9	-127 ±	187
J-102	floor 03		15,11,5		11.8 ±	33.4	407.1 ±	212.7	-1	1.2 ±	4.1	-4.3 ±	17.0	1.2 ±	4.1	-1.9 ±	17.3	31.1 ±	45.9	120 ±	204
J-102	floor 04		16,5		-11.8 ±	7.3	0.0 ±	184.6	-1	1.2 ±	4.1	6.4 ±	18.4	-0.9 ±	0.4	2.9 ±	17.9	19.8 ±	39.9	65 ±	200
J-102	floor 05		11,9		-11.8 ±	7.3	92.9 ±	191.3	-1	3.3 ±	5.8	1.7 ±	17.8	-0.9 ±	0.4	-16.2 ±	15.3	-2.8 ±	24.0	230 ±	211
J-102	floor 06		5,9		0.0 ±	24.2	207.1 ±	199.4	0	-0.9 ±	0.4	-4.3 ±	17.0	1.2 ±	4.1	-6.7 ±	16.7	-14.1 ±	8.0	-51 ±	192
J-102	floor 07		2,5,4		-11.8 ±	7.3	314.3 ±	206.6	0	5.3 ±	7.1	-13.8 ±	15.7	-0.9 ±	0.4	-5.5 ±	16.8	19.8 ±	39.9	-31 ±	193
J-102	floor 08		6,1		0.0 ±	24.2	221.4 ±	200.4	0	-0.9 ±	0.4	0.5 ±	17.6	-0.9 ±	0.4	-13.8 ±	15.7	8.5 ±	32.9	45 ±	199
J-102	floor 09		8,4,5		11.8 ±	33.4	300.0 ±	205.7	0	-0.9 ±	0.4	6.4 ±	18.4	-0.9 ±	0.4	-7.9 ±	16.5	-2.8 ±	24.0	65 ±	200
J-102	floor 10		13,2		11.8 ±	33.4	100.0 ±	191.9	-1	-0.9 ±	0.4	-1.9 ±	17.3	-0.9 ±	0.4	6.4 ±	18.4	42.4 ±	51.2	-161 ±	184
J-102	intake vent		inside 01		-35.3 ±	36.5	292.9 ±	236.9	0	-0.9 ±	0.4	-4.3 ±	17.0			*	±	*	±		
J-102	intake vent		inside 02		-47.1 ±	28.2	385.7 ±	242.2	0	5.3 ±	7.1	-5.5 ±	16.8			*	±	*	±		
J-102	intake vent		inside 03		-11.8 ±	48.9	107.1 ±	225.9	0	-0.9 ±	0.4	-1.9 ±	17.3			*	±	*	±		
J-102	intake vent		inside 04		-23.5 ±	43.1	200.0 ±	231.4	0	1.2 ±	4.1	-15.0 ±	15.5			*	±	*	±		
J-102	Wall E 01		1,5,4,5		0.0 ±	24.2	0.0 ±	184.6	0	1.2 ±	4.1	-5.5 ±	16.8			*	±	*	±		
J-102	Wall E 02		7,5,7		35.3 ±	46.7	-100.0 ±	177.0	0	-0.9 ±	0.4	1.7 ±	17.8			*	±	*	±		
J-102	Wall E 03		6,1,5		11.8 ±	33.4	-78.6 ±	178.6	0	1.2 ±	4.1	-0.7 ±	17.5			*	±	*	±		
J-102	Wall E 04		14,6		23.5 ±	40.6	257.1 ±	202.8	0	1.2 ±	4.1	-4.3 ±	17.0			*	±	*	±		
J-102	Wall E 05		17,2		35.3 ±	46.7	50.0 ±	188.2	0	-0.9 ±	0.4	2.9 ±	17.9			*	±	*	±		
J-102	Wall N 01		3,1		0.0 ±	24.2	242.9 ±	201.8	0	-0.9 ±	0.4	-11.4 ±	16.0			*	±	*	±		
J-102	Wall N 02		6,3,5		0.0 ±	24.2	257.1 ±	202.8	0	1.2 ±	4.1	-0.7 ±	17.5			*	±	*	±		
J-102	Wall N 03		3,8		35.3 ±	46.7	50.0 ±	188.2	0	-0.9 ±	0.4	-9.0 ±	16.4			*	±	*	±		
J-102	Wall N 04		7,12		11.8 ±	33.4	28.6 ±	186.7	0	-0.9 ±	0.4	-4.3 ±	17.0			*	±	*	±		
J-102	Wall N 05		2,5,17,5		-11.8 ±	7.3	121.4 ±	193.4	-1	-0.9 ±	0.4	-3.1 ±	17.2			*	±	*	±		
J-102	Wall S 01		3,6,5		-11.8 ±	7.3	-35.7 ±	181.9	0	-0.9 ±	0.4	0.5 ±	17.6			*	±	*	±		
J-102	Wall S 02		5,3		0.0 ±	24.2	-178.6 ±	170.8	0	-0.9 ±	0.4	-3.1 ±	17.2			*	±	*	±		
J-102	Wall S 03		9,5		23.5 ±	40.6	35.7 ±	187.2	0	-0.9 ±	0.4	-6.7 ±	16.7			*	±	*	±		
J-102	Wall S 04		12,6		-11.8 ±	7.3	128.6 ±	193.9	0	-0.9 ±	0.4	-6.7 ±	16.7			*	±	*	±		
J-102	Wall S 05		16,4		23.5 ±	40.6	28.6 ±	186.7	0	1.2 ±	4.1	-3.1 ±	17.2			*	±	*	±		
J-102	Wall W 01		1,4,5		0.0 ±	24.2	292.9 ±	205.2	0	-0.9 ±	0.4	7.6 ±	18.5			*	±	*	±		
J-102	Wall W 02		5,5,6		23.5 ±	40.6	271.4 ±	203.7	0	1.2 ±	4.1	-4.3 ±	17.0			*	±	*	±		
J-102	Wall W 03		11,4		0.0 ±	24.2	-28.6 ±	182.4	0	1.2 ±	4.1	-7.9 ±	16.5			*	±	*	±		
J-102	Wall W 04		16,7		47.1 ±	52.1	214.3 ±	199.9	0	-0.9 ±	0.4	-16.2 ±	15.3			*	±	*	±		
J-102	Wall W 05		17,3		11.8 ±	33.4	278.6 ±	204.2	0	1.2 ±	4.1	-3.1 ±	17.2			*	±	*	±		
Average					1.5	33.3	121.7	204.0	-0.1	0.6	2.4	-4.2	17.0	-0.3	1.5	-3.6	17.1	2.5	32.0	5.0	197.1
Stand Dev					21.5	16.0	139.7	18.1	0.4	2.2	2.5	7.6	1.1	1.0	1.7	8.1	1.1	10.0	14.7	52.3	7.8
Maximum					58.8	74.7	407.1	242.2	1	9.5	9.1	12.4	19.1	1.2	4.1	11.2	19.0	42.4	51.2	230.0	211.2
Minimum					-47.1	7.3	-178.6	170.8	-1	-0.9	0.4	-30.5	13.0	-0.9	0.4	-16.2	15.3	-14.1	8.0	-161.0	184.0
Count					47	43	47	43	43	47	47	47	47	10	10	10	10	47	10	47	10
J-105	ceiling 01		3,5,23,5		11.6 ±	22.9	-111.0 ±	170.6	-2	3.3 ±	5.8	8.8 ±	18.7	-0.9 ±	0.4	0.5 ±	17.6	0 ±	0.0	-22 ±	178
J-105	ceiling 02		4,16,5		0.0 ±	0.0	-116.0 ±	170.2	-2	-0.9 ±	0.4	-11.4 ±	16.0	-0.9 ±	0.4	7.6 ±	18.5	0 ±	0.0	-58 ±	175
J-105	ceiling 03		3,5,11,5		0.0 ±	0.0	0.0 ±	179.3	-2	-0.9 ±	0.4	-15.0 ±	15.5	1.2 ±	4.1	-16.2 ±	15.3	0 ±	0.0	-203 ±	163
J-105	ceiling 04		1,9		23.1 ±	32.3	-101.0 ±	171.4	-2	-0.9 ±	0.4	-5.5 ±	16.8	-0.9 ±	0.4	-11.4 ±	16.0	0 ±	0.0	-65 ±	174
J-105	ceiling 05		27,5,8		0.0 ±	0.0	-215.0 ±	179.8	12	-0.9 ±	0.4	-18.6 ±	15.0	-0.9 ±	0.4	-6.7 ±	16.7	34.7 ±	39.6	-244 ±	178
J-105	ceiling 06		16,8		0.0 ±	0.0	-208.0 ±	180.3	4	-0.9 ±	0.4	-1.9 ±	17.3	-0.9 ±	0.4	2.9 ±	17.9	0 ±	0.0	-302 ±	173

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
J-105	ceiling 07	17,12	11.6 ± 22.9	-273.0 ± 175.3			6	-0.9 ± 0.4	-1.9 ± 17.3			-0.9 ± 0.4	-12.6 ± 15.8			23.1 ± 32.3	-396 ± 165		
J-105	ceiling 08	16,17.5	0.0 ± 0.0	-280.0 ± 174.7			8	1.2 ± 4.1	32.6 ± 21.4			-0.9 ± 0.4	-17.4 ± 15.1			11.6 ± 22.9	-266 ± 176		
J-105	ceiling 09	16,21	0.0 ± 0.0	-302.0 ± 173.0			10	-0.9 ± 0.4	-3.1 ± 17.2			1.2 ± 4.1	-1.9 ± 17.3			0 ± 0.0	-360 ± 168		
J-105	ceiling 10	25.5,12	11.6 ± 22.9	-251.0 ± 177.0			6	1.2 ± 4.1	-3.1 ± 17.2			1.2 ± 4.1	1.7 ± 17.8			23.1 ± 32.3	-223 ± 179		
J-105	ceiling 11	24.5,17.5	11.6 ± 22.9	-280.0 ± 174.7			8	1.2 ± 4.1	-6.7 ± 16.7			1.2 ± 4.1	8.8 ± 18.7			0 ± 0.0	-99 ± 188		
J-105	ceiling 12	30.5,21	11.6 ± 22.9	-179.0 ± 182.5			10	-0.9 ± 0.4	11.2 ± 19.0			-0.9 ± 0.4	0.5 ± 17.6			0 ± 0.0	-259 ± 176		
J-105	ceiling 13	39,7	6.8 ± 20.9	-126.0 ± 198.0			8	-0.9 ± 0.4	-12.6 ± 15.8			1.2 ± 4.1	-12.6 ± 15.8			16.3 ± 29.4	-336 ± 183		
J-105	ceiling 14	32,12	34.6 ± 46.3	-92.0 ± 195.2			0	-0.9 ± 0.4	-6.7 ± 16.7			1.2 ± 4.1	-3.1 ± 17.2			34.6 ± 46.3	-165 ± 190		
J-105	ceiling 15	45,4	-8.7 ± 6.3	464.0 ± 193.4			0	-0.9 ± 0.4	10.0 ± 18.8			-0.9 ± 0.4	5.2 ± 18.2			0.7 ± 21.5	379 ± 187		
J-105	ceiling 16	41,8	11.6 ± 22.9	-56.0 ± 191.5			10	-0.9 ± 0.4	-5.5 ± 16.8			-0.9 ± 0.4	-9.0 ± 16.4			0 ± 0.0	-143 ± 185		
J-105	ceiling 17	30,2.5	0.0 ± 0.0	-280.0 ± 174.7			10	3.3 ± 5.8	-13.8 ± 15.7			3.3 ± 5.8	-0.7 ± 17.5			23.1 ± 32.3	-78 ± 190		
J-105	ceiling 18	39,12	0.0 ± 24.0	-165.0 ± 190.0			0	-0.9 ± 0.4	-7.9 ± 16.5			-0.9 ± 0.4	-3.1 ± 17.2			0 ± 24.0	-155 ± 191		
J-105	ceiling 19	45,12.5	0.0 ± 24.0	-13.0 ± 200.7			0	-0.9 ± 0.4	-3.1 ± 17.2			-0.9 ± 0.4	-24.5 ± 14.0			-11.6 ± 7.2	-136 ± 192		
J-105	ceiling 20	37.5,17.5	0.0 ± 24.0	-223.0 ± 185.8			0	-0.9 ± 0.4	-4.3 ± 17.0			-0.9 ± 0.4	-0.7 ± 17.5			-11.6 ± 7.2	-411 ± 171		
J-105	crane 01	hook 1	-2.9 ± 3.6	-333.0 ± 135.7			-4	-0.9 ± 0.4	-1.9 ± 17.3										
J-105	crane 02	pendulum 2	20.2 ± 32.5	-427.0 ± 125.9			-4	-0.9 ± 0.4	-11.4 ± 16.0										
J-105	crane 03	trolley 3,11	8.7 ± 23.2	102.0 ± 174.2			-4	-0.9 ± 0.4	2.9 ± 17.9										
J-105	crane 04	4,1.2	-2.9 ± 3.6	-116.0 ± 156.1			-4	1.2 ± 4.1	-10.2 ± 16.2										
J-105	crane 05	1.5,0	-2.9 ± 3.6	-348.0 ± 134.2			-5	-0.9 ± 0.4	-6.7 ± 16.7										
J-105	crane 06	38,11	8.7 ± 23.2	94.0 ± 173.6			0	1.2 ± 4.1	4.0 ± 18.1										
J-105	crane 07	27,11	-2.9 ± 3.6	-297.0 ± 139.3			2	-0.9 ± 0.4	20.7 ± 20.1										
J-105	crane 08	7,11	-2.9 ± 3.6	-58.0 ± 161.1			2	1.2 ± 4.1	2.9 ± 17.9										
J-105	crane 09	15,11	8.7 ± 23.2	-29.0 ± 163.6			2	-0.9 ± 0.4	-10.2 ± 16.2										
J-105	crane 10	35,11	-2.9 ± 3.6	-87.0 ± 158.7			0	-0.9 ± 0.4	-6.7 ± 16.7										
J-105	floor 01	3,24	5.7 ± 23.2	-73.0 ± 183.3			0	3.3 ± 5.8	0.5 ± 17.6			-0.9 ± 0.4	25.5 ± 20.6			17 ± 32.4	98 ± 196		
J-105	floor 02	2,18	-5.6 ± 5.0	-87.0 ± 182.3			0	1.2 ± 4.1	-6.7 ± 16.7			-0.9 ± 0.4	-7.9 ± 16.5			-5.6 ± 5.0	-101 ± 181		
J-105	floor 03	7,7	16.4 ± 31.9	-115.0 ± 180.2			0	-0.9 ± 0.4	-10.2 ± 16.2			1.2 ± 4.1	10.0 ± 18.8			5.4 ± 22.9	-376 ± 159		
J-105	floor 04	7,6	5.4 ± 22.9	-32.0 ± 186.4			0	-0.9 ± 0.4	-12.6 ± 15.8			-0.9 ± 0.4	-18.6 ± 15.0			-5.6 ± 5.0	50 ± 192		
J-105	floor 05	11,8	5.7 ± 23.2	-259.0 ± 168.8			0	-0.9 ± 0.4	8.8 ± 18.7			1.2 ± 4.1	-0.7 ± 17.5			-5.6 ± 5.0	-314 ± 164		
J-105	floor 06	18,5	5.7 ± 23.2	-39.0 ± 185.9			0	-0.9 ± 0.4	8.8 ± 18.7			-0.9 ± 0.4	4.0 ± 18.1			5.7 ± 23.2	126 ± 198		
J-105	floor 07	19,16	5.7 ± 23.2	-87.0 ± 182.3			3	-0.9 ± 0.4	-4.3 ± 17.0			-0.9 ± 0.4	0.5 ± 17.6			-5.6 ± 5.0	71 ± 194		
J-105	floor 08	13,15	17.0 ± 32.4	-328.0 ± 163.1			4	-0.9 ± 0.4	4.0 ± 18.1			-0.9 ± 0.4	-0.7 ± 17.5			-5.6 ± 5.0	-204 ± 173		
J-105	floor 09	11,20	-5.6 ± 5.0	-87.0 ± 182.3			6	-0.9 ± 0.4	10.0 ± 18.8			-0.9 ± 0.4	6.4 ± 18.4			17 ± 32.4	98 ± 196		
J-105	floor 10	18,25	-5.6 ± 5.0	167.0 ± 200.5			8	1.2 ± 4.1	5.2 ± 18.2			1.2 ± 4.1	-12.6 ± 15.8			-5.6 ± 5.0	153 ± 200		
J-105	floor 11	18,20.5	5.7 ± 23.2	43.0 ± 191.8			4	-0.9 ± 0.4	0.5 ± 17.6			-0.9 ± 0.4	-7.9 ± 16.5			5.7 ± 23.2	85 ± 195		
J-105	floor 12	22,23	5.7 ± 23.2	78.0 ± 194.3			2	-0.9 ± 0.4	2.9 ± 17.9			-0.9 ± 0.4	10.0 ± 18.8			5.7 ± 23.2	9 ± 189		
J-105	floor 13	22,15.5	-5.6 ± 5.0	-156.0 ± 177.0			0	1.2 ± 4.1	17.1 ± 19.7			-0.9 ± 0.4	7.6 ± 18.5			5.7 ± 23.2	-32 ± 186		
J-105	floor 14	23,11	17.0 ± 32.4	-101.0 ± 181.2			2	-0.9 ± 0.4	6.4 ± 18.4			-0.9 ± 0.4	8.8 ± 18.7			-5.6 ± 5.0	-259 ± 169		
J-105	floor 15	21,9	-5.6 ± 5.0	-266.0 ± 168.3			0	-0.9 ± 0.4	0.5 ± 17.6			-0.9 ± 0.4	4.0 ± 18.1			5.7 ± 23.2	-135 ± 179		
J-105	floor 16	25,8.5	5.7 ± 23.2	146.0 ± 199.1			4	-0.9 ± 0.4	-9.0 ± 16.4			-0.9 ± 0.4	5.2 ± 18.2			5.7 ± 23.2	153 ± 200		
J-105	floor 17	23,5	-5.6 ± 5.0	16.0 ± 189.9			4	1.2 ± 4.1	12.4 ± 19.1			-0.9 ± 0.4	-17.4 ± 15.1			-5.6 ± 5.0	50 ± 192		
J-105	floor 18	26,4	17.0 ± 32.4	78.0 ± 194.3			6	-0.9 ± 0.4	-12.6 ± 15.8			-0.9 ± 0.4	10.0 ± 18.8			-5.6 ± 5.0	167 ± 200		
J-105	floor 19	24,5,1	5.7 ± 23.2	133.0 ± 198.2			2	1.2 ± 4.1	-7.9 ± 16.5			-0.9 ± 0.4	13.6 ± 19.3			-5.6 ± 5.0	222 ± 204		
J-105	floor 20	28,3	-5.6 ± 5.0	256.0 ± 206.5			6	-0.9 ± 0.4	6.4 ± 18.4			-0.9 ± 0.4	-9.0 ± 16.4			-5.6 ± 5.0	126 ± 198		
J-105	floor 21	28,5,5	-5.6 ± 5.0	470.0 ± 220.3			4	-0.9 ± 0.4	-10.2 ± 16.2			-0.9 ± 0.4	-11.4 ± 16.0			-5.6 ± 5.0	442 ± 219		
J-105	floor 22	27,11.5	-5.6 ± 5.0	50.0 ± 192.3			4	-0.9 ± 0.4	4.0 ± 18.1			-0.9 ± 0.4	-12.6 ± 15.8			5.7 ± 23.2	160 ± 200		
J-105	floor 23	26,5,16	-5.6 ± 5.0	291.0 ± 208.8			6	-0.9 ± 0.4	2.9 ± 17.9			1.2 ± 4.1	-15.0 ± 15.5			5.7 ± 23.2	185 ± 202		
J-105	floor 24	25,21	-5.6 ± 5.0	256.0 ± 206.5			4	3.3 ± 5.8	2.9 ± 17.9			-0.9 ± 0.4	11.2 ± 19.0			-5.6 ± 5.0	181 ± 201		
J-105	floor 25	31,23	5.7 ± 23.2	-238.0 ± 170.5			2	-0.9 ± 0.4	13.6 ± 19.3			-0.9 ± 0.4	-3.1 ± 17.2			17 ± 32.4	-170 ± 176		
J-105	floor 26	32,17	5.7 ± 23.2	-39.0 ± 185.9			4	-0.9 ± 0.4	4.0 ± 18.1			-0.9 ± 0.4	-15.0 ± 15.5			5.7 ± 23.2	201 ± 203		
J-105	floor 27	32,5,13	-5.6 ± 5.0	23.0 ± 190.4			6	-0.9 ± 0.4	-7.9 ± 16.5			-0.9 ± 0.4	0.5 ± 17.6			5.7 ± 23.2	250 ± 206		

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint		Exposure $\mu R/h$	Smear Spot counted on Tennelec		Paint Spot counted on Tennelec		NE after removal of paint	
			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)
J-105	floor 28	33.8	-5.6 ± 5.0	243.0 ± 205.6	8	-0.9 ± 0.4	-12.6 ± 15.8	-0.9 ± 0.4	11.2 ± 19.0	5.7 ± 23.2	440 ± 218
J-105	floor 29	35.4	5.7 ± 23.2	360.0 ± 213.3	4	3.3 ± 5.8	13.6 ± 19.3	-0.9 ± 0.4	-4.3 ± 17.0	5.7 ± 23.2	350 ± 213
J-105	floor 30	39.2,6	-5.6 ± 5.0	353.0 ± 212.8	6	1.2 ± 4.1	8.8 ± 18.7	-0.9 ± 0.4	-4.3 ± 17.0	-5.6 ± 5.0	174 ± 201
J-105	floor 31	38.1,0	5.7 ± 23.2	761.0 ± 237.7	8	-0.9 ± 0.4	4.0 ± 18.1	-0.9 ± 0.4	-1.9 ± 17.3	6 ± 23.4	559 ± 228
J-105	floor 32	37.1,2	-5.6 ± 5.0	586.0 ± 227.4	8	1.2 ± 4.1	-3.1 ± 17.2	-0.9 ± 0.4	1.7 ± 17.8	6 ± 23.4	711 ± 235
J-105	floor 33	38.2,3	17.0 ± 32.4	655.0 ± 231.5	14	3.3 ± 5.8	2.9 ± 17.9	-0.9 ± 0.4	-9.0 ± 16.4	6 ± 23.4	175 ± 202
J-105	floor 34	41.1,6.5	-5.6 ± 5.0	1425.0 ± 273.3	14	-0.9 ± 0.4	12.4 ± 19.1	-0.9 ± 0.4	-5.5 ± 16.8	-5.6 ± 5.0	190 ± 204
J-105	floor 35	41.5,13	5.7 ± 23.2	683.0 ± 233.1	8	3.3 ± 5.8	-6.7 ± 16.7	1.2 ± 4.1	7.6 ± 18.5	-5.6 ± 5.0	226 ± 204
J-105	floor 36	44.6	5.7 ± 23.2	37.0 ± 191.4	6	-0.9 ± 0.4	-11.4 ± 16.0	-0.9 ± 0.4	-1.9 ± 17.3	-5.6 ± 5.0	66 ± 193
J-105	floor 37	48.3	-5.6 ± 5.0	9.0 ± 199.4	6	-0.9 ± 0.4	1.7 ± 17.8	-0.9 ± 0.4	-5.5 ± 16.8	-5.6 ± 5.0	110 ± 197
J-105	floor 38	47.5,15	5.7 ± 23.2	153.0 ± 199.5	-4	-0.9 ± 0.4	2.9 ± 17.9	-0.9 ± 0.4	-1.9 ± 17.3	6 ± 23.4	110 ± 197
J-105	floor 39	47.5,15	-5.6 ± 5.0	263.0 ± 207.0	-3	-0.9 ± 0.4	0.5 ± 17.6	-0.9 ± 0.4	-13.8 ± 15.7	17.5 ± 32.7	-35 ± 186
J-105	floor 40	48.2,3	-5.6 ± 5.0	-122.0 ± 179.6	-4	-0.9 ± 0.4	-6.7 ± 16.7	-0.9 ± 0.4	-10.2 ± 16.2	-5.6 ± 5.0	139 ± 199
J-105	hi dose plug	bottom 1/2 B	± ± ±	± ± ±		-0.9 ± 0.4	-4.3 ± 17.0				
J-105	hi dose plug	bottom 1/2 E	± ± ±	± ± ±		-0.9 ± 0.4	-10.2 ± 16.2				
J-105	hi dose plug	bottom 1/2 N	± ± ±	± ± ±		-0.9 ± 0.4	-5.5 ± 16.8				
J-105	hi dose plug	bottom 1/2 S	± ± ±	± ± ±		1.2 ± 4.1	10.0 ± 18.8				
J-105	hi dose plug	bottom 1/2 T	± ± ±	± ± ±		-0.9 ± 0.4	19.5 ± 20.0				
J-105	hi dose plug	bottom 1/2 W	± ± ±	± ± ±		-0.9 ± 0.4	11.2 ± 19.0				
J-105	hi dose plug	top 1/2 B	± ± ±	± ± ±		1.2 ± 4.1	-15.0 ± 15.5				
J-105	hi dose plug	top 1/2 E	± ± ±	± ± ±		-0.9 ± 0.4	-3.1 ± 17.2				
J-105	hi dose plug	top 1/2 N	± ± ±	± ± ±		-0.9 ± 0.4	30.2 ± 21.1				
J-105	hi dose plug	top 1/2 S	± ± ±	± ± ±		-0.9 ± 0.4	-6.7 ± 16.7				
J-105	hi dose plug	top 1/2 W	± ± ±	± ± ±		-0.9 ± 0.4	-5.5 ± 16.8				
J-105	Lo Dose plug	bottom	-9.6 ± 6.6	1658.0 ± 272.5	20	-0.9 ± 0.4	-1.9 ± 17.3				
J-105	Lo Dose plug	bottom 1/2 E	9.3 ± 30.0	-321.0 ± 141.2	0	-0.9 ± 0.4	13.6 ± 19.3	1.2 ± 4.1	-1.9 ± 17.3	0 ± 23.7	84 ± 176
J-105	Lo Dose plug	bottom 1/2 N	18.7 ± 36.4	-362.0 ± 137.1	0	-0.9 ± 0.4	0.5 ± 17.6	-0.9 ± 0.4	-7.9 ± 16.5	28 ± 42.7	-150 ± 156
J-105	Lo Dose plug	bottom 1/2 S	-0.2 ± 21.6	-166.0 ± 155.5	0	-0.9 ± 0.4	-13.8 ± 15.7	-0.9 ± 0.4	11.2 ± 19.0	11.3 ± 32.7	139 ± 180
J-105	Lo Dose plug	bottom 1/2 W	-9.6 ± 6.6	-281.0 ± 145.0	0	1.2 ± 4.1	6.4 ± 18.4	-0.9 ± 0.4	-9.0 ± 16.4	33.9 ± 45.8	-143 ± 157
J-105	Lo Dose plug	bottom/top	-9.6 ± 6.6	-247.0 ± 148.2	0	-0.9 ± 0.4	-11.4 ± 16.0	-0.9 ± 0.4	5.2 ± 18.2	0 ± 23.7	-129 ± 158
J-105	Lo Dose plug	top 1/2 E	18.7 ± 36.4	-362.0 ± 137.1	0	-0.9 ± 0.4	2.9 ± 17.9	-0.9 ± 0.4	0.5 ± 17.6	11.3 ± 32.7	56 ± 174
J-105	Lo Dose plug	top 1/2 N	18.7 ± 36.4	-288.0 ± 144.3	0	3.3 ± 5.8	-5.5 ± 16.8	-0.9 ± 0.4	10.0 ± 18.8	0 ± 23.7	-47 ± 165
J-105	Lo Dose plug	top 1/2 S	-9.6 ± 6.6	-152.0 ± 156.7	0	-0.9 ± 0.4	-6.7 ± 16.7	-0.9 ± 0.4	4.0 ± 18.1	45.2 ± 51.0	160 ± 182
J-105	Lo Dose plug	top 1/2 W	-0.2 ± 21.6	-321.0 ± 141.2	0	-0.9 ± 0.4	13.6 ± 19.3	-0.9 ± 0.4	7.6 ± 18.5	22.6 ± 39.8	235 ± 187
J-105	Wall E 01	2.5	23.5 ± 32.6	57.1 ± 166.3	0	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	-9.0 ± 16.4	11.3 ± 32.7	166 ± 182
J-105	Wall E 02	4.2	23.5 ± 32.6	-50.0 ± 157.2	0	-0.9 ± 0.4	-9.0 ± 16.4	1.2 ± 4.1	-12.6 ± 15.8	7.3 ± 30.1	-46 ± 192
J-105	Wall E 03	6.7	11.8 ± 23.1	221.4 ± 179.3	0	-0.9 ± 0.4	4.0 ± 18.1	-0.9 ± 0.4	8.8 ± 18.7	16.3 ± 29.4	-336 ± 183
J-105	Wall E 04	8.4	35.3 ± 39.9	-35.7 ± 158.5	0	1.2 ± 4.1	-6.7 ± 16.7	-0.9 ± 0.4	-1.9 ± 17.3	7.3 ± 30.1	-12 ± 195
J-105	Wall E 05	11.2	11.8 ± 23.1	-71.4 ± 155.3	0	-0.9 ± 0.4	-11.4 ± 16.0	-0.9 ± 0.4	-16.2 ± 15.3	16.7 ± 36.5	-222 ± 179
J-105	Wall E 06	13.8	23.5 ± 32.6	35.7 ± 164.5	0	-0.9 ± 0.4	1.2 ± 4.1	-0.9 ± 0.4	0.5 ± 17.6	0 ± 0.0	669 ± 207
J-105	Wall E 07	16.4	11.8 ± 23.1	21.4 ± 163.3	0	1.2 ± 4.1	-15.0 ± 15.5	-0.9 ± 0.4	-13.8 ± 15.7	0 ± 0.0	68 ± 199
J-105	Wall E 08	19.6	35.3 ± 39.9	350.0 ± 188.9	0	-0.9 ± 0.4	0.5 ± 17.6	-0.9 ± 0.4	4.0 ± 18.1		
J-105	Wall E 09	21.3	23.5 ± 32.6	350.0 ± 188.9	0	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	7.6 ± 18.5		
J-105	Wall E 10	23.7	11.8 ± 23.1	314.3 ± 186.3	0	1.2 ± 4.1	-9.0 ± 16.4	-0.9 ± 0.4	-9.0 ± 16.4		
J-105	Wall E 11	3.15	8.5 ± 22.9	159.0 ± 199.5	2	-0.9 ± 0.4	4.0 ± 18.1	-0.9 ± 0.4	-12.6 ± 15.8		
J-105	Wall E 12	4.1,1.5	19.8 ± 32.2	-191.0 ± 173.8	1	-0.9 ± 0.4	-6.7 ± 16.7	-0.9 ± 0.4	8.8 ± 18.7		
J-105	Wall E 13	9.17	19.8 ± 32.2	-205.0 ± 172.7	1	-0.9 ± 0.4	-11.4 ± 16.0	-0.9 ± 0.4	-16.2 ± 15.3		
J-105	Wall E 14	10.5,10.5	8.5 ± 22.9	-54.0 ± 184.3	1	7.4 ± 8.2	18.3 ± 19.8	-0.9 ± 0.4	-16.2 ± 15.3		
J-105	Wall E 15	14.9.5	8.5 ± 22.9	-329.0 ± 162.5	0	1.2 ± 4.1	0.5 ± 17.6	-0.9 ± 0.4	-4.3 ± 17.0		
J-105	Wall E 16	13.5,15	8.5 ± 22.9	-102.0 ± 180.7	2	1.2 ± 4.1	-5.5 ± 16.8	-0.9 ± 0.4	0.5 ± 17.6		
J-105	Wall E 17	17.17.5	-2.8 ± 3.6	-349.0 ± 160.8	1	-0.9 ± 0.4	1.7 ± 17.8	-0.9 ± 0.4	-13.8 ± 15.7		

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint		Exposure μR/h	Smear Spot counted on Tennelec		Paint Spot counted on Tennelec		NE after removal of paint	
			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)
J-105	Wall E 18	19.5,11.5	31.1 ± 39.3	-157.0 ± 176.4	1	-0.9 ± 0.4	-9.0 ± 16.4	3.3 ± 5.8	5.2 ± 18.2	17 ± 32.4	312 ± 200
J-105	Wall E 19	23.15	8.5 ± 22.9	-67.0 ± 183.3	1	-0.9 ± 0.4	-13.8 ± 15.7	1.2 ± 4.1	-3.1 ± 17.2	-5.6 ± 5.0	252 ± 196
J-105	Wall E 20	24.10	-2.8 ± 3.6	-157.0 ± 176.4	2	1.2 ± 4.1	-12.6 ± 15.7	1.2 ± 4.1	-9.0 ± 16.4	-11.6 ± 7.2	-237 ± 178
J-105	Wall N 01	1.7	0.0 ± 34.2	-7.1 ± 172.5	0	3.3 ± 5.8	13.6 ± 19.3	-0.9 ± 0.4	-9.0 ± 16.4	-5.8 ± 5.1	-20 ± 171
J-105	Wall N 02	8.3	11.8 ± 41.2	178.6 ± 186.7	0	-0.9 ± 0.4	-10.2 ± 16.2	-0.9 ± 0.4	7.6 ± 18.5	-5.8 ± 5.1	-34 ± 170
J-105	Wall N 03	14.4	-11.8 ± 25.3	-14.3 ± 172.0	0	1.2 ± 4.1	-10.2 ± 16.2	-0.9 ± 0.4	-7.9 ± 16.5	-5.8 ± 5.1	-150 ± 161
J-105	Wall N 04	18.7	-11.8 ± 25.3	128.6 ± 183.0	0	-0.9 ± 0.4	-1.9 ± 17.3	-0.9 ± 0.4	4.0 ± 18.1	17.3 ± 32.7	-172 ± 159
J-105	Wall N 05	20.2	-11.8 ± 25.3	100.0 ± 180.9	0	-0.9 ± 0.4	-5.5 ± 16.8	-0.9 ± 0.4	-1.9 ± 17.3	0 ± 23.7	-5 ± 169
J-105	Wall N 06	21.5	0.0 ± 34.2	-92.9 ± 185.6	1	-0.9 ± 0.4	-15.0 ± 15.5	-0.9 ± 0.4	1.7 ± 17.8	0 ± 23.7	-12 ± 168
J-105	Wall N 07	25.6	0.0 ± 34.2	-7.1 ± 172.5	0	-0.9 ± 0.4	8.8 ± 18.7	-0.9 ± 0.4	7.6 ± 18.5	-11.3 ± 7.1	-40 ± 166
J-105	Wall N 08	39.7	-11.8 ± 25.3	57.1 ± 177.6	0	-0.9 ± 0.4	-7.9 ± 16.5	-0.9 ± 0.4	-0.7 ± 17.5	-11.3 ± 7.1	215 ± 186
J-105	Wall N 09	42.6	11.8 ± 41.2	528.6 ± 210.9	2	-0.9 ± 0.4	0.5 ± 17.6	-0.9 ± 0.4	5.2 ± 18.2	0 ± 23.7	551 ± 209
J-105	Wall N 10	45.7	-23.5 ± 10.3	478.6 ± 207.6	2	-0.9 ± 0.4	1.7 ± 17.8	3.3 ± 5.8	-0.7 ± 17.5	-11.3 ± 7.1	-74 ± 163
J-105	Wall N 11	44.16	11.8 ± 39.4	-21.4 ± 203.1	2	3.3 ± 5.8	-12.6 ± 15.8	1.2 ± 4.1	5.2 ± 18.2	2.9 ± 23.7	379 ± 187
J-105	Wall N 12	37.12	6.0 ± 28.9	140.0 ± 180.1	2	1.2 ± 4.1	-4.3 ± 17.0	-0.9 ± 0.4	6.4 ± 18.4	11.8 ± 33.1	115 ± 178
J-105	Wall N 13	21.11	23.5 ± 32.6	-242.9 ± 185.8	10	-0.9 ± 0.4	-12.6 ± 15.8	-0.9 ± 0.4	-9.0 ± 18.4	16.3 ± 29.4	-336 ± 183
J-105	Wall N 14	27.5,8.5	0.3 ± 24.0	-67.0 ± 163.5	0	-0.9 ± 0.4	4.0 ± 18.1	-0.9 ± 0.4	4.0 ± 18.1	-11.3 ± 7.1	17 ± 170
J-105	Wall N 15	34.14	0.3 ± 24.0	53.0 ± 173.3	0	-0.9 ± 0.4	-7.9 ± 16.5	1.2 ± 4.1	-13.8 ± 15.7	-5.5 ± 17.7	60 ± 174
J-105	Wall N 16	33.10	-5.5 ± 17.7	194.0 ± 184.1	0	1.2 ± 4.1	-5.5 ± 16.8	1.2 ± 4.1	-5.5 ± 16.8	-11.3 ± 7.1	138 ± 180
J-105	Wall N 17	23.5,15	23.5 ± 32.6	-317.9 ± 180.2	0	-0.9 ± 0.4	-9.0 ± 16.4	-0.9 ± 0.4	4.0 ± 18.1	0.3 ± 24.0	111 ± 178
J-105	Wall N 18	16.5,16	35.3 ± 39.9	-128.6 ± 194.0	2	-0.9 ± 0.4	8.8 ± 18.7	-0.9 ± 0.4	16.0 ± 19.5	-5.5 ± 17.7	125 ± 179
J-105	Wall N 19	10.9,5	23.5 ± 32.6	-364.3 ± 176.6	12	1.2 ± 4.1	1.7 ± 17.8	-0.9 ± 0.4	2.9 ± 17.9	16.3 ± 29.4	-397 ± 178
J-105	Wall N 20	4.15	29.4 ± 36.5	-442.9 ± 170.4	1	1.2 ± 4.1	7.6 ± 18.5	-0.9 ± 0.4	5.2 ± 18.2	2.9 ± 23.7	379 ± 187
J-105	Wall S 01	1.8	0.0 ± 0.0	350.0 ± 188.9	-4	-0.9 ± 0.4	-19.8 ± 14.8	1.2 ± 4.1	-1.9 ± 17.3	45.2 ± 51.0	160 ± 182
J-105	Wall S 02	5.2	58.8 ± 51.6	178.6 ± 176.0	-4	9.5 ± 9.1	-18.6 ± 15.0	-0.9 ± 0.4	5.2 ± 18.2	0 ± 23.7	421 ± 200
J-105	Wall S 03	11.2	35.3 ± 39.9	400.0 ± 192.5	-5	1.2 ± 4.1	-9.0 ± 16.4	-0.9 ± 0.4	-6.7 ± 16.7	0 ± 23.7	91 ± 176
J-105	Wall S 04	16.7	11.8 ± 23.1	650.0 ± 209.6	-3	1.2 ± 4.1	-18.6 ± 15.0	-0.9 ± 0.4	-3.1 ± 17.2	11.3 ± 32.7	160 ± 182
J-105	Wall S 05	23.5	35.3 ± 39.9	607.1 ± 206.8	-1	-0.9 ± 0.4	8.8 ± 18.7	-0.9 ± 0.4	-7.9 ± 16.5	-11.3 ± 7.1	641 ± 215
J-105	Wall S 06	26.2	47.1 ± 46.1	-85.7 ± 154.1	-5	1.2 ± 4.1	-13.8 ± 15.7	-0.9 ± 0.4	6.4 ± 18.4	11.3 ± 32.7	599 ± 212
J-105	Wall S 07	30.7	23.5 ± 32.6	264.3 ± 182.6	-3	-0.9 ± 0.4	-16.2 ± 15.3	-0.9 ± 0.4	2.9 ± 17.9	33.9 ± 45.8	675 ± 217
J-105	Wall S 08	34.5	47.1 ± 46.1	150.0 ± 173.8	-4	-0.9 ± 0.4	-13.8 ± 15.7	-0.9 ± 0.4	2.9 ± 17.9	11.3 ± 32.7	63 ± 174
J-105	Wall S 09	40.5	35.3 ± 32.6	271.4 ± 183.1	-5	3.3 ± 5.8	-12.6 ± 15.8	-0.9 ± 0.4	-7.9 ± 16.5	22.6 ± 39.8	63 ± 174
J-105	Wall S 10	44.2	23.5 ± 32.6	314.3 ± 186.3	-5	-0.9 ± 0.4	-6.7 ± 16.7	-0.9 ± 0.4	1.7 ± 17.8	7.3 ± 30.1	300 ± 216
J-105	Wall S 11	3.17	7.3 ± 30.1	158.0 ± 206.3	0	-0.9 ± 0.4	-1.9 ± 17.3	-0.9 ± 0.4	-7.9 ± 16.5	-11.6 ± 7.2	-157 ± 184
J-105	Wall S 12	8.11	11.5 ± 33.1	-179.0 ± 182.5	0	-0.9 ± 0.4	-3.1 ± 17.2	-0.9 ± 0.4	-6.7 ± 16.7	-5.6 ± 5.0	69 ± 182
J-105	Wall S 13	16.15	5.7 ± 23.2	7.0 ± 177.5	9	-0.9 ± 0.4	8.8 ± 18.7	-0.9 ± 0.4	-18.6 ± 15.0	-11.6 ± 7.2	104 ± 203
J-105	Wall S 14	12.5,8	0.0 ± 24.0	-27.0 ± 193.6	-1	-0.9 ± 0.4	-15.0 ± 15.5	1.2 ± 4.1	2.9 ± 17.9	17 ± 32.4	103 ± 185
J-105	Wall S 15	25.5,15.5	5.7 ± 23.2	-14.0 ± 175.9	5	1.2 ± 4.1	-7.9 ± 16.5	-0.9 ± 0.4	0.5 ± 17.6	-11.6 ± 7.2	-49 ± 192
J-105	Wall S 16	22.5,9.5	-11.6 ± 7.2	-215.0 ± 179.8	-2	-0.9 ± 0.4	6.4 ± 18.4	-0.9 ± 0.4	-0.7 ± 17.5	5.7 ± 23.2	20 ± 179
J-105	Wall S 17	25.15	5.7 ± 23.2	55.0 ± 181.2	-3	-0.9 ± 0.4	-3.1 ± 17.2	-0.9 ± 0.4	-13.8 ± 15.7	-5.6 ± 5.0	-48 ± 173
J-105	Wall S 18	39.12	-5.6 ± 5.0	-55.0 ± 172.7	-3	-0.9 ± 0.4	-13.8 ± 15.7	-0.9 ± 0.4	-0.7 ± 17.5	2.9 ± 23.7	402 ± 189
J-105	Wall S 19	40.15	-8.7 ± 6.3	219.0 ± 175.1	-1	-0.9 ± 0.4	-9.0 ± 16.4	-0.9 ± 0.4	4.0 ± 18.1	-8.7 ± 6.3	321 ± 183
J-105	Wall S 20	45.13	-8.7 ± 6.3	212.0 ± 174.6	-1	1.2 ± 4.1	7.6 ± 18.5	1.2 ± 4.1	-0.7 ± 17.5	17.2 ± 32.6	-259 ± 151
J-105	Wall W 01	1.3	11.8 ± 23.1	300.0 ± 185.3	8	-0.9 ± 0.4	10.0 ± 18.8	-0.9 ± 0.4	20.7 ± 20.1	5.2 ± 22.9	-85 ± 166
J-105	Wall W 02	1.6	23.5 ± 32.6	200.0 ± 177.7	6	-0.9 ± 0.4	2.9 ± 17.9	1.2 ± 4.1	-12.6 ± 15.8	5.2 ± 22.9	-5 ± 173
J-105	Wall W 03	4.4	23.5 ± 32.6	242.9 ± 181.0	6	-0.9 ± 0.4	-6.7 ± 16.7	-0.9 ± 0.4	1.7 ± 17.8	5.2 ± 22.9	-184 ± 157
J-105	Wall W 04	7.7	11.8 ± 23.1	242.9 ± 181.0	6	-0.9 ± 0.4	-6.7 ± 16.7	1.2 ± 4.1	13.6 ± 19.3	5.2 ± 22.9	-82 ± 165
J-105	Wall W 05	8.5	0.0 ± 0.0	128.6 ± 172.1	6	5.3 ± 7.1	-5.5 ± 16.8	-0.9 ± 0.4	-6.7 ± 16.7	-5.8 ± 5.1	-85 ± 166
J-105	Wall W 06	12.2	0.0 ± 0.0	164.3 ± 172.9	6	5.3 ± 7.1	-10.2 ± 16.2	-0.9 ± 0.4	0.5 ± 17.6	5.2 ± 22.9	-121 ± 163
J-105	Wall W 07	14.1	23.5 ± 32.6	135.7 ± 174.7	6	1.2 ± 4.1	18.3 ± 19.8	1.2 ± 4.1	-10.2 ± 16.2	5.2 ± 22.9	22.9
J-105	Wall W 08	15.6	47.1 ± 46.1	164.3 ± 174.9	6	-0.9 ± 0.4	-5.5 ± 16.8	-0.9 ± 0.4	-4.3 ± 17.0	5.2 ± 22.9	22.9

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			alpha (dis/min)	beta (dis/min)		alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)	alpha (dis/min)	beta (dis/min)							
J-105	Wall W 09	18,5	11.8 ± 23.1	35.7 ± 164.5	6	-0.9 ± 0.4	-15.0 ± 15.5	-0.9 ± 0.4	-16.2 ± 15.3	5.2 ± 22.9	-114 ± 164							
J-105	Wall W 10	19,7	23.5 ± 32.6	-121.4 ± 150.8	6	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	-3.1 ± 17.2	5.2 ± 22.9	-281 ± 149							
J-105	Wall W 11	3,5,17	0.0 ± 0.0	-214.3 ± 187.9	2	1.2 ± 4.1	4.0 ± 18.1	-0.9 ± 0.4	5.2 ± 18.2	2.9 ± 23.7	777 ± 214							
J-105	Wall W 12	2,12	23.5 ± 32.6	-121.4 ± 194.5	3	-0.9 ± 0.4	-12.6 ± 15.8	-0.9 ± 0.4	-9.0 ± 16.4	2.9 ± 23.7	596 ± 203							
J-105	Wall W 13	6,5,13	11.8 ± 23.1	-178.6 ± 190.5	1	-0.9 ± 0.4	-6.7 ± 16.7	1.2 ± 4.1	16.0 ± 19.5	-8.7 ± 6.3	458 ± 193							
J-105	Wall W 14	11,10	11.8 ± 23.1	-307.1 ± 181.0	2	-0.9 ± 0.4	4.0 ± 18.1	1.2 ± 4.1	-11.4 ± 16.0	16.3 ± 29.4	-214 ± 192							
J-105	Wall W 15	10,16	0.0 ± 0.0	-192.9 ± 189.4	1	1.2 ± 4.1	8.8 ± 18.7	11.6 ± 10.0	6.4 ± 18.4	2.9 ± 23.7	690 ± 209							
J-105	Wall W 16	14,15	11.8 ± 23.1	-250.0 ± 185.3	2	7.4 ± 8.2	-11.4 ± 16.0	-0.9 ± 0.4	-4.3 ± 17.0	14.4 ± 32.9	596 ± 203							
J-105	Wall W 17	17,16	35.3 ± 39.9	-271.4 ± 183.7	1	7.4 ± 8.2	10.0 ± 18.8	-0.9 ± 0.4	-13.8 ± 15.7	-8.7 ± 6.3	437 ± 191							
J-105	Wall W 18	17,5,11	11.8 ± 23.1	-35.7 ± 200.5	2	1.2 ± 4.1	4.0 ± 18.1	3.3 ± 5.8	-3.1 ± 17.2	16.3 ± 29.4	-153 ± 196							
J-105	Wall W 19	21,15	11.8 ± 23.1	-85.7 ± 197.0	2	1.2 ± 4.1	0.5 ± 17.6	-0.9 ± 0.4	8.8 ± 18.7	0 ± 0.0	39 ± 196							
J-105	Wall W 20	14,9	11.8 ± 23.1	-321.4 ± 179.9	0	1.2 ± 4.1	-12.6 ± 15.8	-0.9 ± 0.4	7.6 ± 18.5	16.3 ± 29.4	-241 ± 190							
Average			7.6	21.2	17.7	2.1	0.1	1.8	-2.2	17.2	-0.3	1.3	-1.6	17.3	3.6	19.3	53.2	185.8
Stand Dev			13.5	13.0	290.8	4.2	1.8	2.2	9.7	1.3	1.5	1.8	8.8	1.2	10.7	13.0	241.7	16.4
Maximum			58.8	51.6	1658.0	20.0	9.5	9.1	32.6	21.4	11.6	10.0	25.5	20.6	45.2	51.0	777.0	234.8
Minimum			-23.5	0.0	-442.9	-5.0	-0.9	0.4	-19.8	14.8	-0.9	0.4	-24.5	14.0	-11.6	0.0	-411.0	149.0
Count			171	160	171	160	171	171	171	171	140	140	140	140	171	140	171	140
J-105'	source tb 1	16,5,21,-1	9.4 ± 20.6	103.0 ± 153.8		1.2 ± 4.1	0.5 ± 17.6				*			*				
J-105'	source tb 1	16,5,21,-3	9.4 ± 20.6	31.0 ± 147.2		-0.9 ± 0.4	16.0 ± 19.5				*			*				
J-105'	source tb 1	16,5,21,-4	9.4 ± 20.6	76.0 ± 151.4		-0.9 ± 0.4	25.5 ± 20.6				*			*				
J-105'	source tb 1	16,5,21,-6	9.4 ± 20.6	63.0 ± 150.2		-0.9 ± 0.4	74.3 ± 25.5				*			*				
J-105'	source tb 2	16,5,22,-1	9.4 ± 20.6	63.0 ± 150.2		-0.9 ± 0.4	6.4 ± 18.4				*			*				
J-105'	source tb 2	16,5,22,-3	0.0 ± 0.0	-46.0 ± 139.9		-0.9 ± 0.4	42.1 ± 22.4				*			*				
J-105'	source tb 2	16,5,22,-4	9.4 ± 20.6	63.0 ± 150.2		-0.9 ± 0.4	74.3 ± 25.5				*			*				
J-105'	source tb 2	16,5,22,-6	0.0 ± 0.0	8.0 ± 145.1		-0.9 ± 0.4	13.6 ± 19.3				*			*				
Average			7.1	15.5	45.1		-0.7	0.8	31.6	21.1								
Stand Dev			4.1	8.9	43.5		0.7	1.2	27.3	2.9								
Maximum			9.4	20.6	103.0		1.2	4.1	74.3	25.5								
Minimum			0.0	0.0	-46.0		-0.9	0.4	0.5	17.6								
Count			8	8	8		8	8	8	8								
J-108	ceiling 01	10,3,5,9,5	5.7 ± 23.2	-163.0 ± 178.9	4	-0.9 ± 0.4	-1.9 ± 17.3	-0.9 ± 0.4	-7.9 ± 16.5	-5.6 ± 5.0	-253 ± 172							
J-108	ceiling 02	9,3,5,10	17.0 ± 32.4	-253.0 ± 171.8	0	-0.9 ± 0.4	-4.3 ± 17.0	-0.9 ± 0.4	-5.5 ± 16.8	39.6 ± 45.5	-294 ± 169							
J-108	ceiling 03	5,3,5,8,5	-5.6 ± 5.0	-363.0 ± 162.8	2	1.2 ± 4.1	4.0 ± 18.1											
J-108	ceiling 04	2,1,5,10	5.7 ± 23.2	-211.0 ± 175.1	4	-0.9 ± 0.4	-26.9 ± 13.6	-0.9 ± 0.4	-4.3 ± 17.0	-5.6 ± 5.0	-177 ± 178							
J-108	floor 01	3,1	-5.6 ± 5.0	-122.0 ± 182.0	6													
J-108	floor 02	1,5	-5.6 ± 5.0	-184.0 ± 177.2	3													
J-108	floor 03	2,5,8,5	-5.6 ± 5.0	-115.0 ± 182.5	2													
J-108	floor 04	12,1	5.7 ± 23.2	-101.0 ± 183.6	0													
J-108	Wall E 01	2,2,5	17.0 ± 32.4	-143.0 ± 180.4	0	-0.9 ± 0.4	-1.9 ± 17.3	-0.9 ± 0.4	-3.1 ± 17.2	5.7 ± 23.2	-156 ± 179							
J-108	Wall E 02	4,5,7	-5.6 ± 5.0	-46.0 ± 187.6	2	-0.9 ± 0.4	10.0 ± 18.8	-0.9 ± 0.4	2.9 ± 17.9	5.7 ± 23.2	-136 ± 181							
J-108	Wall E 03	10,5,8,5	-5.6 ± 5.0	-101.0 ± 183.6	2	1.2 ± 4.1	0.5 ± 17.6	-0.9 ± 0.4	-4.3 ± 17.0	5.7 ± 23.2	-19 ± 190							
J-108	Wall N 01	4,5,5	-5.6 ± 5.0	-363.0 ± 162.8	0	-0.9 ± 0.4	1.7 ± 17.8	-0.9 ± 0.4	-9.0 ± 16.4	17 ± 32.4	-253 ± 172							
J-108	Wall N 02	0,5,8	5.7 ± 23.2	-198.0 ± 176.2	8	-0.9 ± 0.4	-17.4 ± 15.1	1.2 ± 4.1	-10.2 ± 16.2	5.7 ± 23.2	-184 ± 177							
J-108	Wall S 01	0,5,7	5.7 ± 23.2	-225.0 ± 174.0	0	-0.9 ± 0.4	-9.0 ± 16.4	-0.9 ± 0.4	2.9 ± 17.9	5.7 ± 23.2	-438 ± 156							
J-108	Wall S 02	2,5,8,5	17.0 ± 32.4	-115.0 ± 182.5	0	-0.9 ± 0.4	-18.6 ± 15.0	-0.9 ± 0.4	-17.4 ± 15.1	5.7 ± 23.2	-280 ± 170							
J-108	Wall W 01	1,5,7,5	5.7 ± 23.2	-170.0 ± 178.3	2	-0.9 ± 0.4	12.4 ± 19.1	-0.9 ± 0.4	13.6 ± 19.3	28.3 ± 39.5	-40 ± 188							
J-108	Wall W 02	7,5,3	17.0 ± 32.4	-218.0 ± 174.6	1	-0.9 ± 0.4	4.0 ± 18.1	1.2 ± 4.1	-19.8 ± 14.8	5.7 ± 23.2	-191 ± 177							
J-108	Wall W 03	11,5,5,5	5.7 ± 23.2	-129.0 ± 181.4	2	1.2 ± 4.1	-19.8 ± 14.8	-0.9 ± 0.4	-1.9 ± 17.3	5.7 ± 23.2	-136 ± 181							
Average			3.8	18.1	-178.9	2.1	-0.5	1.2	-4.8	16.9	-0.6	1.0	-4.9	16.9	6.6	24.0	-142.1	176.1

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
	Stand Dev		8.6	11.0	82.9	6.5	2.2	0.9	1.5	11.5	1.6	0.8	1.3	8.3	1.1	11.0	10.7	126.1	8.4
	Maximum		17.0	32.4	-46.0	187.6	8	1.2	4.1	12.4	19.1	1.2	4.1	13.6	19.3	39.6	45.5	0.0	189.6
	Minimum		-5.6	5.0	-363.0	162.8	0	-0.9	0.4	-26.9	13.6	-0.9	0.4	-19.8	14.8	-5.6	5.0	-438.0	156.3
	Count		18	18	18	18	18	14	14	14	14	13	13	13	13	18	13	18	13
J-112	air vents 01	w. outside	11.8 ±	58.8	-250.0 ±	222.8	0	9.5 ±	9.1	-4.3 ±	17.0					*	±	*	±
J-112	air vents 02	w. inside	-35.3 ±	36.5	-142.9 ±	229.3	0	5.3 ±	7.1	-4.3 ±	17.0					*	±	*	±
J-112	air vents 03	e. outside	23.5 ±	63.1	-78.6 ±	233.1	1	7.4 ±	8.2	10.0 ±	18.8					*	±	*	±
J-112	air vents 04	e. inside	11.8 ±	58.8	28.6 ±	239.3	0	3.3 ±	5.8	12.4 ±	19.1					*	±	*	±
J-112	ceiling 01	10,2,5	11.8 ±	58.8	-57.1 ±	234.3	0	-0.9 ±	0.4	-1.9 ±	17.3	-0.9 ±	0.4	-4.3 ±	17.0	-5.8 ±	5.1	-58 ±	170
J-112	ceiling 02	1,5,6	11.8 ±	58.8	14.3 ±	238.5	0	-0.9 ±	0.4	-10.2 ±	16.2	-0.9 ±	0.4	1.7 ±	17.8	-5.8 ±	5.1	0 ±	175
J-112	ceiling 03	10,7,5	-23.5 ±	43.1	7.1 ±	238.1	0	-0.9 ±	0.4	-9.0 ±	16.4	-0.9 ±	0.4	-7.9 ±	16.5	5.8 ±	23.5	-87 ±	168
J-112	ceiling 04	1,5,10	-11.8 ±	48.9	21.4 ±	238.9	0	-0.9 ±	0.4	-5.5 ±	16.8	-0.9 ±	0.4	-9.0 ±	16.4	-5.8 ±	5.1	-87 ±	168
J-112	ceiling 05	10,11,5	0.0 ±	54.1	-28.6 ±	236.0	1	-0.9 ±	0.4	-5.5 ±	16.8	-0.9 ±	0.4	12.4 ±	19.1	-5.8 ±	5.1	130 ±	185
J-112	control pnl 01	3,8,6	-17.6 ±	42.8	-157.1 ±	227.5	0	1.2 ±	4.1	2.9 ±	17.9					*	±	*	±
J-112	control pnl 02	10,8,4	5.9 ±	53.8	-121.4 ±	229.6	-2	-0.9 ±	0.4	1.7 ±	17.8					*	±	*	±
J-112	control pnl 03	11,2,5	17.6 ±	58.6	-528.6 ±	203.8	-2	-0.9 ±	0.4	-1.9 ±	17.3					*	±	*	±
J-112	control pnl 04	13,6,6	17.6 ±	58.6	-192.9 ±	225.3	-2	-0.9 ±	0.4	-18.6 ±	15.0					*	±	*	±
J-112	control pnl 05	8,10,6	29.4 ±	62.9	-242.9 ±	222.2	0	-0.9 ±	0.4	2.9 ±	17.9					*	±	*	±
J-112	control pnl 06	4,9,4	-17.6 ±	42.8	-421.4 ±	210.9	-2	3.3 ±	5.8	10.0 ±	18.8					*	±	*	±
J-112	control pnl 07	13,5,3,5	29.4 ±	62.9	-121.4 ±	229.6	-4	1.2 ±	4.1	-0.7 ±	17.5					*	±	*	±
J-112	control pnl 08	10,9,7	17.6 ±	58.6	164.3 ±	246.1	-2	7.4 ±	8.2	-3.1 ±	17.2					*	±	*	±
J-112	floor 01	12,1	11.8 ±	53.6	-28.6 ±	231.9	0	1.2 ±	4.1	-16.2 ±	15.3					*	±	*	±
J-112	floor 02	11,7,5	-11.8 ±	42.5	121.4 ±	240.6	0	-0.9 ±	0.4	5.2 ±	18.2					*	±	*	±
J-112	floor 03	12,5,14,5	-35.3 ±	27.3	171.4 ±	243.4	5	-0.9 ±	0.4	5.2 ±	18.2					*	±	*	±
J-112	floor 04	5,13,5	23.5 ±	58.3	14.3 ±	234.4	0	1.2 ±	4.1	-7.9 ±	16.5					*	±	*	±
J-112	floor 05	0,5,14,5	-23.5 ±	35.7	85.7 ±	238.5	5	-0.9 ±	0.4	-12.6 ±	15.8					*	±	*	±
J-112	floor 06	5,5,1	-23.5 ±	35.7	164.3 ±	243.0	0	-0.9 ±	0.4	2.9 ±	17.9					*	±	*	±
J-112	floor 07	5,5,6,5	11.8 ±	53.6	142.9 ±	241.8	0	1.2 ±	4.1	-19.8 ±	14.8					*	±	*	±
J-112	floor 08	5,5,10,5	-23.5 ±	35.7	-42.9 ±	231.0	0	-0.9 ±	0.4	-18.6 ±	15.0					*	±	*	±
J-112	floor 09	1,5,3	0.0 ±	48.4	-28.6 ±	231.9	0	3.3 ±	5.8	-18.6 ±	15.0					*	±	*	±
J-112	floor 10	1,5,8	-23.5 ±	35.7	-28.6 ±	231.9	0	1.2 ±	4.1	-0.7 ±	17.5					*	±	*	±
J-112	Wall E 01	1,7,5	-23.5 ±	43.1	235.7 ±	250.9	1	-0.9 ±	0.4	11.2 ±	19.0	-0.9 ±	0.4	-5.5 ±	16.8	37.7 ±	41.3	7 ±	208
J-112	Wall E 02	4,1,5	-23.5 ±	43.1	21.4 ±	238.9	1	-0.9 ±	0.4	-3.1 ±	17.2	1.2 ±	4.1	-1.9 ±	17.3	18.9 ±	29.2	-34 ±	205
J-112	Wall E 03	7,7,5	0.0 ±	54.1	14.3 ±	238.5	5	1.2 ±	4.1	-6.7 ±	16.7	-0.9 ±	0.4	11.2 ±	19.0	28.3 ±	35.8	13 ±	208
J-112	Wall E 04	9,5,1,5	23.5 ±	63.1	314.3 ±	255.2	9	-0.9 ±	0.4	-4.3 ±	17.0	-0.9 ±	0.4	-17.4 ±	15.1	18.9 ±	29.2	122 ±	215
J-112	Wall E 05	12,7,5	-11.8 ±	48.9	107.1 ±	243.8	3	1.2 ±	4.1	-13.8 ±	15.7	-0.9 ±	0.4	2.9 ±	17.9	9.4 ±	20.6	298 ±	226
J-112	Wall N 01	1,7,5	-47.1 ±	28.2	150.0 ±	246.2	0	1.2 ±	4.1	-7.9 ±	16.5	3.3 ±	5.8	2.9 ±	17.9	28 ±	35.6	-170 ±	196
J-112	Wall N 02	4,5,2,5	0.0 ±	54.1	-28.6 ±	236.0	0	-0.9 ±	0.4	-0.7 ±	17.5	-0.9 ±	0.4	-1.9 ±	17.3	-5.8 ±	5.1	217 ±	191
J-112	Wall N 03	10,7,5	-47.1 ±	28.2	314.3 ±	255.2	2	1.2 ±	4.1	11.2 ±	19.0	-0.9 ±	0.4	12.4 ±	19.1	18.9 ±	29.2	332 ±	228
J-112	Wall N 04	13,5,2,5	23.5 ±	63.1	114.3 ±	244.2	2	-0.9 ±	0.4	1.7 ±	17.8	-0.9 ±	0.4	-5.5 ±	16.8	-5.8 ±	5.1	-44 ±	172
J-112	Wall N 05	14,5,7,5	11.8 ±	58.8	242.9 ±	251.3	3	-0.9 ±	0.4	1.7 ±	17.8	1.2 ±	4.1	-4.3 ±	17.0	28.3 ±	35.8	20 ±	209
J-112	Wall S 01	1,7,5	11.8 ±	58.8	-57.1 ±	234.3	2	1.2 ±	4.1	11.2 ±	19.0	-0.9 ±	0.4	-10.2 ±	16.2	18.9 ±	29.2	474 ±	237
J-112	Wall S 02	5,2,5	11.8 ±	58.8	-21.4 ±	236.4	0	5.3 ±	7.1	2.9 ±	17.9	-0.9 ±	0.4	-12.6 ±	15.8	-5.8 ±	5.1	-29 ±	173
J-112	Wall S 03	8,10	-23.5 ±	43.1	-278.6 ±	221.0	0	5.3 ±	7.1	0.5 ±	17.6	1.2 ±	4.1	-7.9 ±	16.5	-5.8 ±	5.1	14 ±	176
J-112	Wall S 04	10,5,12,5	-23.5 ±	43.1	-7.1 ±	237.3	0	7.4 ±	8.2	-10.2 ±	16.2	1.2 ±	4.1	-3.1 ±	17.2	-5.8 ±	5.1	-58 ±	170
J-112	Wall S 05	12,5,10	0.0 ±	54.1	-135.7 ±	229.7	0	1.2 ±	4.1	-11.4 ±	16.0	-0.9 ±	0.4	4.0 ±	18.1	5.8 ±	23.5	-70 ±	169
J-112	Wall W 01	0,5,9	-47.1 ±	28.2	-257.1 ±	222.3	0	3.3 ±	5.8	-3.1 ±	17.2	1.2 ±	4.1	-13.8 ±	15.7	-5.8 ±	5.1	82 ±	181
J-112	Wall W 02	6,1,5	-35.3 ±	36.5	-35.7 ±	235.6	0	-0.9 ±	0.4	-0.7 ±	17.5	-0.9 ±	0.4	-0.7 ±	17.5	18.9 ±	29.2	-183 ±	195
J-112	Wall W 03	8,9	-35.3 ±	36.5	-35.7 ±	235.6	0	3.3 ±	5.8	-16.2 ±	15.3	-0.9 ±	0.4	-15.0 ±	15.5	-5.8 ±	5.1	72 ±	181
J-112	Wall W 04	11,1,5	0.0 ±	54.1	28.6 ±	239.3	0	-0.9 ±	0.4	-4.3 ±	17.0	-0.9 ±	0.4	-3.1 ±	17.2	0 ±	0.0	-109 ±	200

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure $\mu R/h$	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
J-112	Wall W 05	12,5,9	0.0 ± 54.1	114.3 ± 244.2			0	1.2 ± 4.1	7.6 ± 18.5			3.3 ± 5.8	-7.9 ± 16.5			5.8 ± 23.5	101 ± 183		
	Average		-5.3	49.0	-15.7	235.5	0.6	1.3	3.1	-3.0	17.1	-0.2	1.6	-3.4	17.1	3.8	17.7	20.3	191.6
	Stand Dev		21.9	10.8	170.3	10.0	2.1	2.8	2.8	8.7	1.2	1.3	1.9	7.9	1.0	10.8	13.2	114.0	20.3
	Maximum		29.4	63.1	314.3	255.2	9	9.5	9.1	12.4	19.1	3.3	5.8	12.4	19.1	37.7	41.3	474.0	236.6
	Minimum		-47.1	27.3	-528.6	203.8	-4	-0.9	0.4	-19.8	14.8	-0.9	0.4	-17.4	15.1	-5.8	0.0	-183.0	168.1
	Count		47	47	47	47	47	47	47	47	47	25	25	25	25	47	25	47	25
J-118	ceiling 01	1,5	11.8 ± 29.8	-429.0 ± 172.1			2	1.2 ± 4.1	4.0 ± 18.1							±	*	±	
J-118	ceiling 02	1,2	11.8 ± 29.8	-8.0 ± 202.9			4	1.2 ± 4.1	2.9 ± 17.9							±	*	±	
J-118	ceiling 03	6,4	2.3 ± 21.4	-252.0 ± 185.7			4	-0.9 ± 0.4	0.5 ± 17.6							±	*	±	
J-118	ceiling 04	10,1	2.3 ± 21.4	270.0 ± 220.9			4	-0.9 ± 0.4	-9.0 ± 16.4							±	*	±	
J-118	ceiling 05	15,4	2.3 ± 21.4	-101.0 ± 196.5			4	1.2 ± 4.1	-11.4 ± 16.0							±	*	±	
J-118	floor 01	2,2	-11.3 ± 7.1	280.0 ± 204.9			6	-0.9 ± 0.4	-6.7 ± 16.7			-0.9 ± 0.4	4.0 ± 18.1			-11.3 ± 7.1	339 ± 209		
J-118	floor 02	9,5,3,5	-11.3 ± 7.1	163.0 ± 196.9			-4	1.2 ± 4.1	10.0 ± 18.8			-0.9 ± 0.4	13.6 ± 19.3			-11.3 ± 7.1	507 ± 220		
J-118	floor 03	16,2	0.0 ± 23.7	493.0 ± 218.7			2	-0.9 ± 0.4	-6.7 ± 16.7			1.2 ± 4.1	-7.9 ± 16.5			0 ± 23.7	759 ± 235		
J-118	floor 04	16,6,5	0.0 ± 23.7	328.0 ± 208.1			2	-0.9 ± 0.4	4.0 ± 18.1			-0.9 ± 0.4	-6.7 ± 16.7			0 ± 23.7	259 ± 203		
J-118	floor 05	12,6,5	-11.3 ± 7.1	19.0 ± 186.6			-4	-0.9 ± 0.4	0.5 ± 17.6			-0.9 ± 0.4	2.9 ± 17.9			-11.3 ± 7.1	129 ± 194		
J-118	floor 06	4,6	-11.3 ± 7.1	190.0 ± 198.8			-2	3.3 ± 5.8	0.5 ± 17.6			1.2 ± 4.1	-4.3 ± 17.0			0 ± 23.7	53 ± 189		
J-118	Wall E 01	5,2,5	30.6 ± 41.7	-171.0 ± 191.5			0	-0.9 ± 0.4	-21.0 ± 14.6							±	*	±	
J-118	Wall E 02	3,4	-7.1 ± 5.7	-313.0 ± 181.1			0	-0.9 ± 0.4	-4.3 ± 17.0							±	*	±	
J-118	Wall E 03	5,7,5	-7.1 ± 5.7	127.0 ± 211.8			2	1.2 ± 4.1	-6.7 ± 16.7							±	*	±	
J-118	Wall E 04	7,5,1	11.8 ± 29.8	-45.0 ± 200.4			2	1.2 ± 4.1	-3.1 ± 17.2							±	*	±	
J-118	Wall E 05	9,5,5	21.2 ± 36.2	19.0 ± 204.7			3	-0.9 ± 0.4	10.0 ± 18.8							±	*	±	
J-118	Wall N 01	0,5,1	2.3 ± 21.4	-63.0 ± 199.1			0	-0.9 ± 0.4	14.8 ± 19.4							±	*	±	
J-118	Wall N 02	4,5,7	11.8 ± 29.8	-104.0 ± 196.3			3	-0.9 ± 0.4	10.0 ± 18.8							±	*	±	
J-118	Wall N 03	7,5,2,5	2.3 ± 21.4	-137.0 ± 194.0			0	-0.9 ± 0.4	-3.1 ± 17.2							±	*	±	
J-118	Wall N 04	12,5,5	11.8 ± 29.8	-218.0 ± 188.1			2	-0.9 ± 0.4	-3.1 ± 17.2							±	*	±	
J-118	Wall N 05	17,6	21.2 ± 36.2	-293.0 ± 182.6			0	-0.9 ± 0.4	-3.1 ± 17.2							±	*	±	
J-118	Wall S 01	1,5,6	2.3 ± 21.4	900.0 ± 257.1			3	-0.9 ± 0.4	-22.1 ± 14.4							±	*	±	
J-118	Wall S 02	7,5,1,5	2.3 ± 21.4	622.0 ± 241.8			3	-0.9 ± 0.4	-3.1 ± 17.2							±	*	±	
J-118	Wall S 03	11,5,6,5	11.8 ± 29.8	588.0 ± 239.8			2	-0.9 ± 0.4	-0.7 ± 17.5							±	*	±	
J-118	Wall S 04	15,3	11.8 ± 29.8	1029.0 ± 263.9			2	-0.9 ± 0.4	-6.7 ± 16.7							±	*	±	
J-118	Wall S 05	17,5,3	11.8 ± 29.8	887.0 ± 256.4			3	1.2 ± 4.1	-12.6 ± 15.8							±	*	±	
J-118	Wall W 01	1,5,2	30.6 ± 41.7	826.0 ± 253.1			6	-0.9 ± 0.4	8.8 ± 18.7							±	*	±	
J-118	Wall W 02	2,5,6,5	2.3 ± 21.4	636.0 ± 242.6			4	-0.9 ± 0.4	23.1 ± 20.4							±	*	±	
J-118	Wall W 03	4,5,5	11.4 ± 29.5	792.0 ± 251.2			6	-0.9 ± 0.4	-0.7 ± 17.5							±	*	±	
J-118	Wall W 04	5,5,5	21.2 ± 36.2	636.0 ± 242.6			2	5.3 ± 7.1	-3.1 ± 17.2							±	*	±	
J-118	Wall W 05	8,6,5	2.3 ± 21.4	460.0 ± 232.4			3	1.2 ± 4.1	-17.4 ± 15.1							±	*	±	
	Average		6.2	23.8	230.0	213.6	2.0645	-0.0	1.7	-1.8	17.3	-0.2	1.6	0.3	17.6	-1.1	15.4	66.0	208.4
	Stand Dev		11.3	10.2	410.1	26.2	2.4	1.5	2.0	9.7	1.3	1.0	1.8	7.4	1.0	3.3	8.3	170.3	15.3
	Maximum		30.6	41.7	1029.0	263.9	6	5.3	7.1	23.1	20.4	1.2	4.1	13.6	19.3	0.0	23.7	759.0	234.8
	Minimum		-11.3	5.7	-429.0	172.1	-4	-0.9	0.4	-22.1	14.4	-0.9	0.4	-7.9	16.5	-11.3	7.1	0.0	189.1
	Count		31	31	31	31	31	31	31	31	31	6	6	6	6	31	6	31	6
J-120	ceiling 01	2,2	0.0 ± 34.2	-121.4 ± 190.1			-1	-0.9 ± 0.4	-1.9 ± 17.3			1.2 ± 4.1	-10.2 ± 16.2			8.1 ± 23.2	-323 ± 165		
J-120	ceiling 02	4,4	-11.8 ± 25.3	128.6 ± 207.3			-1	3.3 ± 5.8	10.0 ± 18.8			-0.9 ± 0.4	-18.6 ± 15.0			19.6 ± 32.6	-445 ± 155		
J-120	ceiling 03	3,6	-11.8 ± 25.3	-121.4 ± 190.1			0	-0.9 ± 0.4	-6.7 ± 16.7			-0.9 ± 0.4	-12.6 ± 15.8			19.6 ± 32.6	-461 ± 154		
J-120	ceiling 04	2,9	0.0 ± 34.2	21.4 ± 200.1			-1	1.2 ± 4.1	0.5 ± 17.6			1.2 ± 4.1	8.8 ± 18.7			8.1 ± 23.2	-301 ± 167		
J-120	ceiling 05	5,10	11.8 ± 41.2	50.0 ± 202.1			-1	-0.9 ± 0.4	-9.0 ± 16.4			1.2 ± 4.1	-12.6 ± 15.8			31.2 ± 39.8	-251 ± 171		
J-120	floor 01	1,1	-11.8 ± 25.3	85.7 ± 204.5			-1	1.2 ± 4.1	-6.7 ± 16.7							±	*	±	
J-120	floor 02	5,2	23.5 ± 47.3	-85.7 ± 192.6			-1	-0.9 ± 0.4	-3.1 ± 17.2							±	*	±	

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
J-120	floor 03	3,3	23.5 ± 47.3	50.0 ± 202.1	0		0	-0.9 ± 0.4	14.8 ± 19.4			*	±	•	±				
J-120	floor 04	5,6	0.0 ± 34.2	-128.6 ± 189.5	0		0	-0.9 ± 0.4	-17.4 ± 15.1			*	±	*	±				
J-120	floor 05	2,6	-11.8 ± 25.3	28.6 ± 200.6	0		0	1.2 ± 4.1	-12.6 ± 15.8			*	±	*	±				
J-120	floor 06	4,8	0.0 ± 34.2	-128.6 ± 189.5	0		0	3.3 ± 5.8	-0.7 ± 17.5			*	±	*	±				
J-120	floor 07	1,8	-23.5 ± 10.3	78.6 ± 204.0	0		0	3.3 ± 5.8	-10.2 ± 16.2			*	±	*	±				
J-120	floor 08	2,10	-11.8 ± 25.3	-71.4 ± 193.6	0		0	1.2 ± 4.1	-12.6 ± 15.8			*	±	•	±				
J-120	floor 09	9,4	-11.8 ± 25.3	-171.4 ± 186.4	0		0	1.2 ± 4.1	-18.6 ± 15.0			*	±	*	±				
J-120	floor 10	5,11	0.0 ± 34.2	-135.7 ± 189.0	0		0	1.2 ± 4.1	6.4 ± 18.4			*	±	•	±				
J-120	glovebox 01	2,4,5,5	-11.8 ± 25.3	-100.0 ± 191.6	-1		-1	3.3 ± 5.8	-4.3 ± 17.0			*	±	*	±				
J-120	glovebox 02	2,6,6	11.8 ± 41.2	178.6 ± 210.6	-1		-1	1.2 ± 4.1	8.8 ± 18.7			*	±	•	±				
J-120	glovebox 03	3,10,5	11.8 ± 41.2	-100.0 ± 191.6	-1		-1	7.4 ± 8.2	-10.2 ± 16.2			*	±	*	±				
J-120	glovebox 04	3,6,5,5,5	-11.8 ± 25.3	-271.4 ± 178.9	-1		-1	-0.9 ± 0.4	20.7 ± 20.1			*	±	*	±				
J-120	glovebox 05	3,6,5,4	0.0 ± 34.2	-392.9 ± 169.3	0		0	1.2 ± 4.1	16.0 ± 19.5			*	±	*	±				
J-120	glovebox 06	2,6,5,3	-11.8 ± 25.3	-271.4 ± 178.9	-1		-1	-0.9 ± 0.4	-9.0 ± 16.4			*	±	*	±				
J-120	glovebox 07	1,5,6	0.0 ± 34.2	21.4 ± 200.1	1		1	1.2 ± 4.1	16.0 ± 19.5			*	±	*	±				
J-120	glovebox 08	0,5,4,3	-11.8 ± 25.3	-142.9 ± 188.5	0		0	1.2 ± 4.1	-17.4 ± 15.1			*	±	*	±				
J-120	glovebox 09	2,6,5,3	0.0 ± 34.2	-35.7 ± 196.1	-1		-1	5.3 ± 7.1	-13.8 ± 15.7			*	±	*	±				
J-120	glovebox 10	3,6,5,5	23.5 ± 47.3	-35.7 ± 196.1	-1		-1	3.3 ± 5.8	-5.5 ± 16.8			*	±	*	±				
J-120	glvbox ex 01	2,5,1,8	35.3 ± 52.6	-35.7 ± 196.1				1.2 ± 4.1	-9.0 ± 16.4			*	±	*	±				
J-120	glvbox ex 02	2,5,6,8	-23.5 ± 10.3	-200.0 ± 184.3				-0.9 ± 0.4	8.8 ± 18.7			*	±	*	±				
J-120	glvbox ex 03	2,5,9,8	35.3 ± 52.6	164.3 ± 209.7				3.3 ± 5.8	-1.9 ± 17.3			*	±	*	±				
J-120	glvbox ex 04	2,5,4	-11.8 ± 25.3	150.0 ± 208.7				1.2 ± 4.1	4.0 ± 18.1			*	±	*	±				
J-120	glvbox ex 05	2,5,5,4,5	23.5 ± 47.3	14.3 ± 199.6				-0.9 ± 0.4	7.6 ± 18.5			*	±	*	±				
J-120	glvbox ex 06	3,5,4,5	-11.8 ± 25.3	64.3 ± 203.0				5.3 ± 7.1	-12.6 ± 15.8			*	±	*	±				
J-120	Wall E 01	2,9	0.0 ± 34.2	-214.3 ± 183.2	0		0	1.2 ± 4.1	-7.9 ± 16.5			1.2 ± 4.1	-6.7 ± 16.7	31.2 ± 39.8	-84 ± 184				
J-120	Wall E 02	6,7	0.0 ± 34.2	-50.0 ± 195.1	0		0	-0.9 ± 0.4	-4.3 ± 17.0			-0.9 ± 0.4	-0.7 ± 17.5	8.1 ± 23.2	-19 ± 189				
J-120	Wall E 03	7,2	11.8 ± 41.2	-107.1 ± 191.1	0		0	-0.9 ± 0.4	11.2 ± 19.0			-0.9 ± 0.4	-17.4 ± 15.1	8.1 ± 23.2	-120 ± 181				
J-120	Wall E 04	9,6	35.3 ± 52.6	42.9 ± 201.6	0		0	-0.9 ± 0.4	-9.0 ± 16.4			-0.9 ± 0.4	2.9 ± 17.9	31.2 ± 39.8	-128 ± 181				
J-120	Wall E 05	11,7	23.5 ± 47.3	-185.7 ± 185.4	0		0	-0.9 ± 0.4	-6.7 ± 16.7			-0.9 ± 0.4	-19.8 ± 14.8	-3.5 ± 4.0	-12 ± 189				
J-120	Wall N 01	4,9	35.3 ± 52.6	178.6 ± 210.6	1		1	-0.9 ± 0.4	-10.2 ± 16.2			1.2 ± 4.1	-3.1 ± 17.2	-3.5 ± 4.0	-4 ± 190				
J-120	Wall N 02	2,8	11.8 ± 41.2	392.9 ± 224.1	1		1	-0.9 ± 0.4	0.5 ± 17.6			-0.9 ± 0.4	-0.7 ± 17.5	31.2 ± 39.8	119 ± 199				
J-120	Wall N 03	1,6	-11.8 ± 25.3	121.4 ± 206.8	1		1	1.2 ± 4.1	8.8 ± 18.7			3.3 ± 5.8	4.0 ± 18.1	19.6 ± 32.6	271 ± 209				
J-120	Wall N 04	2,3	47.1 ± 57.4	78.6 ± 204.0	2		2	3.3 ± 5.8	11.2 ± 19.0			1.2 ± 4.1	13.6 ± 19.3	19.6 ± 32.6	271 ± 209				
J-120	Wall N 05	6,7	0.0 ± 34.2	107.1 ± 205.9	1		1	-0.9 ± 0.4	-0.7 ± 17.5			-0.9 ± 0.4	11.2 ± 19.0	19.6 ± 32.6	68 ± 195				
J-120	Wall S 01	5,10	23.5 ± 47.3	-107.1 ± 191.1	-1		-1	-0.9 ± 0.4	-7.9 ± 16.5			1.2 ± 4.1	-7.9 ± 16.5	-3.5 ± 4.0	-243 ± 172				
J-120	Wall S 02	3,7	-11.8 ± 25.3	-242.9 ± 181.1	-1		-1	-0.9 ± 0.4	6.4 ± 18.4			-0.9 ± 0.4	-0.7 ± 17.5	8.1 ± 23.2	-193 ± 176				
J-120	Wall S 03	1,9	23.5 ± 47.3	-28.6 ± 196.6	-1		-1	1.2 ± 4.1	-7.9 ± 16.5			7.4 ± 8.2	8.8 ± 18.7	8.1 ± 23.2	-193 ± 176				
J-120	Wall S 04	1,3	-11.8 ± 25.3	-150.0 ± 188.0	0		0	-0.9 ± 0.4	-6.7 ± 16.7			1.2 ± 4.1	-4.3 ± 17.0	-3.5 ± 4.0	-323 ± 165				
J-120	Wall S 05	5,4	-11.8 ± 25.3	150.0 ± 208.7	0		0	-0.9 ± 0.4	-3.1 ± 17.2			3.3 ± 5.8	-0.7 ± 17.5	-3.5 ± 4.0	-200 ± 175				
J-120	Wall W 01	2,9	11.8 ± 41.2	321.4 ± 219.7	0		0	-0.9 ± 0.4	-1.9 ± 17.3			-0.9 ± 0.4	-7.9 ± 16.5	-3.5 ± 4.0	286 ± 210				
J-120	Wall W 02	5,7	0.0 ± 34.2	314.3 ± 219.3	1		1	-0.9 ± 0.4	-9.0 ± 16.4			-0.9 ± 0.4	-7.9 ± 16.5	19.6 ± 32.6	257 ± 208				
J-120	Wall W 03	7,2	-11.8 ± 25.3	235.7 ± 214.3	0		0	-0.9 ± 0.4	-10.2 ± 16.2			-0.9 ± 0.4	21.9 ± 20.2	8.1 ± 23.2	213 ± 205				
J-120	Wall W 04	10,6	23.5 ± 47.3	657.1 ± 239.8	2		2	-0.9 ± 0.4	-21.0 ± 14.6			-0.9 ± 0.4	5.2 ± 18.2	-3.5 ± 4.0	315 ± 212				
J-120	Wall W 05	11,4	0.0 ± 34.2	485.7 ± 229.7	1		1	1.2 ± 4.1	-7.9 ± 16.5			1.2 ± 4.1	5.2 ± 18.2	-3.5 ± 4.0	452 ± 221				
Average			3.9	35.1	9.5	198.8	-0.1	0.7	2.7	-2.9	17.1	0.5	2.5	-2.0	17.3	5.3	22.0	-20.5	186.3
Stand Dev			17.2	10.9	197.2	13.3	0.8	2.0	2.4	9.8	1.3	1.9	2.3	10.3	1.4	10.2	13.5	178.5	18.6
Maximum			47.1	57.4	657.1	239.8	2	7.4	8.2	20.7	20.1	7.4	8.2	21.9	20.2	31.2	39.8	452.0	220.5
Minimum			-23.5	10.3	-392.9	169.3	-1	-0.9	0.4	-21.0	14.6	-0.9	0.4	-19.8	14.8	-3.5	4.0	-461.0	153.5
Count			51	51	51	51	45	51	51	51	51	25	25	25	25	51	25	51	25
J-200	block E	1,2,5	-11.4 ± 7.2	32.0 ± 186.1	1		1	-0.9 ± 0.4	-1.9 ± 17.3			*	±	•	±				

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
J-200	block N	3,5,2	11.4 ± 32.9	-27.0 ± 181.7			0	-0.9 ± 0.4	4.0 ± 18.1							††	*	††	
J-200	block S	3,3	0.0 ± 23.8	-59.0 ± 179.2			0	-0.9 ± 0.4	-6.7 ± 16.7							††	*	††	
J-200	block W	2,3,5	22.8 ± 40.0	-201.0 ± 168.0			0	3.3 ± 5.8	-18.6 ± 15.0							††	*	††	
J-200	ins tank		1 *					-0.9 ± 0.4	171.9 ± 33.1							††	*	††	
J-200	ins tank		2 *					-0.9 ± 0.4	151.7 ± 31.7							††	*	††	
J-200	ins tank		3 *					1.2 ± 4.1	10.0 ± 18.8							††	*	††	
J-200	ins tank		4 *					1.2 ± 4.1	24.3 ± 20.5							††	*	††	
J-200	ins tank		5 *					1.2 ± 4.1	-0.7 ± 17.5							††	*	††	
J-200	Rx top		1	47.1 ± 52.1	4278.6 ± 423.7	25		-0.9 ± 0.4	2.9 ± 17.9							††	*	††	
J-200	Rx top		2	23.5 ± 40.6	114014.3 ± 1786.2	390		1.2 ± 4.1	-5.5 ± 16.8							††	*	††	
J-200	Rx top		3	23.5 ± 40.6	907.1 ± 294.9	-3		1.2 ± 4.1	-4.3 ± 17.0							††	*	††	
J-200	Rx top		4	23.5 ± 40.6	-21.4 ± 248.0	-6		-0.9 ± 0.4	-9.0 ± 16.4							††	*	††	
J-200	Rx top		5	35.3 ± 46.7	-150.0 ± 240.8	-6		-0.9 ± 0.4	-0.7 ± 17.5							††	*	††	
J-200	Rx top		6	23.5 ± 40.6	14.3 ± 250.0	-5		3.3 ± 5.8	-6.7 ± 16.7							††	*	††	
J-200	Rx top		7	35.3 ± 46.7	-28.6 ± 247.6	-5		-0.9 ± 0.4	-10.2 ± 16.2							††	*	††	
J-200	Rx top		8	82.4 ± 65.6	2942.9 ± 377.9	4		-0.9 ± 0.4	-5.5 ± 16.8							††	*	††	
J-200	Rx top		9	58.8 ± 57.0	4185.7 ± 420.7	20		1.2 ± 4.1	-10.2 ± 16.2							††	*	††	
J-200	Rx top		10	35.3 ± 46.7	1078.6 ± 302.8	5		-0.9 ± 0.4	8.8 ± 18.7							††	*	††	
J-200	shields n	bottom	*					-0.9 ± 0.4	5.2 ± 18.2							††	*	††	
J-200	shields n	east		117.6 ± 76.8	-671.4 ± 209.0	2		5.3 ± 7.1	-15.0 ± 15.5							††	*	††	
J-200	shields n	north		58.8 ± 57.0	-571.4 ± 215.4	0		1.2 ± 4.1	-10.2 ± 16.2							††	*	††	
J-200	shields n	south		23.5 ± 40.6	-528.6 ± 218.1	0		1.2 ± 4.1	25.5 ± 20.6							††	*	††	
J-200	shields n	top		0.0 ± 24.2	-85.7 ± 244.4	2		1.2 ± 4.1	-10.2 ± 16.2							††	*	††	
J-200	shields n	west		47.1 ± 52.1	-700.0 ± 207.1	0		-0.9 ± 0.4	-11.4 ± 16.0							††	*	††	
J-200	shields s	bottom	*					3.3 ± 5.8	-4.3 ± 17.0							††	*	††	
J-200	shields s	east		47.1 ± 52.1	-642.9 ± 210.8	1		5.3 ± 7.1	-4.3 ± 17.0							††	*	††	
J-200	shields s	north		23.5 ± 40.6	-728.6 ± 205.2	0		1.2 ± 4.1	-6.7 ± 16.7							††	*	††	
J-200	shields s	south		11.8 ± 33.4	-628.6 ± 211.8	1		1.2 ± 4.1	1.7 ± 17.8							††	*	††	
J-200	shields s	top		70.6 ± 61.4	-271.4 ± 233.8	2		5.3 ± 7.1	-13.8 ± 15.7							††	*	††	
J-200	shields s	west		0.0 ± 24.2	-607.1 ± 213.1	-1		1.2 ± 4.1	4.0 ± 18.1							††	*	††	
Average			26.2	43.5	3920	312	17.8	0.9	3.0	8.2	18.2								
Stand Dev			28.9	14.8	20139	315	77.9	2.0	2.4	41.6	3.9								
Maximum			117.6	76.8	114,014	1,786	390	5.3	7.1	171.9	33.1								
Minimum			-11.4	7.2	-729	168	-6	-0.9	0.4	-18.6	15.0								
Count			31	24	31	24	24	31	31	31	31								
J-300	hi dose pit 1	below pipe		31.1 ± 39.3	48.0 ± 188.0	0		3.3 ± 5.8	-3.1 ± 17.2							††	*	††	
J-300	hi dose pit 2	pipe elbow		8.5 ± 22.9	35.0 ± 187.0	-1		-0.9 ± 0.4	-4.3 ± 17.0							††	*	††	
J-300	hi dose pit 3	south wall		-2.8 ± 3.6	-165.0 ± 171.7	-2		-0.9 ± 0.4	6.4 ± 18.4							††	*	††	
J-300	hi dose pit 4	n. wall gutt		19.8 ± 32.2	-413.0 ± 150.6	-2		-0.9 ± 0.4	-4.3 ± 17.0							††	*	††	
J-300	hi dose pit 5	north wall		19.8 ± 32.2	-323.0 ± 158.6	-3		-0.9 ± 0.4	2.9 ± 17.9							††	*	††	
J-300	hi dose pit 6	borax		19.8 ± 32.2	-371.0 ± 154.4	-2		-0.9 ± 0.4	-4.3 ± 17.0							††	*	††	
J-300	lo dose pit 1	north wall		-2.8 ± 24.0	-234.0 ± 158.5	-1		-0.9 ± 0.4	-6.7 ± 16.7							††	*	††	
J-300	lo dose pit 2	south face		-2.8 ± 24.0	-14.0 ± 176.5	-1		-0.9 ± 0.4	19.5 ± 20.0							††	*	††	
J-300	lo dose pit 3	behind pipe 6'		8.5 ± 32.9	-248.0 ± 157.3	-2		-0.9 ± 0.4	-6.7 ± 16.7							††	*	††	
J-300	lo dose pit 4	flange 8'		-14.1 ± 8.0	-131.0 ± 167.2	-2		-0.9 ± 0.4	0.5 ± 17.6							††	*	††	
J-300	lo dose pit 5	west wall		-2.8 ± 24.0	-268.0 ± 155.5	-2		1.2 ± 4.1	-13.8 ± 15.7							††	*	††	
J-300	lo dose pit 6	behind pipe 13'		8.5 ± 32.9	55.0 ± 181.8	0		1.2 ± 4.1	0.5 ± 17.6							††	*	††	
J-300	roof 01	74,44,5		37.7 ± 45.5	49.0 ± 196.1	2		-0.9 ± 0.4	0.5 ± 17.6							††	*	††	
J-300	roof 02	62,32		49.7 ± 51.1	187.0 ± 205.5	5		-0.9 ± 0.4	-10.2 ± 16.2							††	*	††	
J-300	roof 03	47,40		37.6 ± 42.9	73.0 ± 196.3	1		-0.9 ± 0.4	6.4 ± 18.4							††	*	††	

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure μR/h	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
J-300	roof 04	33,33	28.7 ± 39.6	159.0 ± 203.6			1	-0.9 ± 0.4	0.5 ± 17.6							*	††	*	††
J-300	roof 05	15,47	15.7 ± 32.7	15.0 ± 193.7			3	1.2 ± 4.1	1.7 ± 17.8							*	††	*	††
J-300	roof 06	27.5,20.5	43.3 ± 45.8	116.0 ± 199.3			-3	1.2 ± 4.1	-22.1 ± 14.4							*	††	*	††
J-300	roof 07	27.8,8.5	20.2 ± 32.5	214.0 ± 205.9			-3	3.3 ± 5.8	-12.6 ± 15.8							*	††	*	††
J-300	roof 08	23,5	26.7 ± 39.6	124.0 ± 201.2			-3	1.2 ± 4.1	-6.7 ± 16.7							*	††	*	††
J-300	roof 09	22,11	15.7 ± 32.7	118.0 ± 200.8			1	-0.9 ± 0.4	-10.2 ± 16.2							*	††	*	††
J-300	roof 10	41,17	60.7 ± 55.7	180.0 ± 205.0			-3	-0.9 ± 0.4	-4.3 ± 17.0							*	††	*	††
J-300	stack	inside N 8 ft	11.6 ± 22.9	-138.0 ± 172.3			-2	1.2 ± 4.1	-4.3 ± 17.0							*	††	*	††
J-300	stack	south 4 ft	11.6 ± 22.9	-529.0 ± 137.7			-2	-0.9 ± 0.4	-6.7 ± 16.7							*	††	*	††
J-300	stack	south 8 ft	46.2 ± 45.7	-406.0 ± 149.4			0	-0.9 ± 0.4	-0.7 ± 17.5							*	††	*	††
J-300	Wall E 01	1,1	46.2 ± 45.7	1165.0 ± 229.8			10	-0.9 ± 0.4	-7.9 ± 16.5							*	††	*	††
J-300	Wall E 02	13,5,4	34.7 ± 39.6	-9.0 ± 143.5			10	-0.9 ± 0.4	2.9 ± 17.9							*	††	*	††
J-300	Wall E 03	26,5,7,5	0.0 ± 0.0	1122.0 ± 227.2			12	-0.9 ± 0.4	-1.9 ± 17.3							*	††	*	††
J-300	Wall E 04	39,5,5	11.6 ± 22.9	1339.0 ± 239.9			12	-0.9 ± 0.4	-1.9 ± 17.3							*	††	*	††
J-300	Wall E 05	46,1	69.4 ± 56.0	1506.0 ± 249.3			12	-0.9 ± 0.4	19.5 ± 20.0							*	††	*	††
J-300	Wall N 01	0,5,4,5	4.0 ± 23.3	737.0 ± 239.4			-2	3.3 ± 5.8	-7.9 ± 16.5							*	††	*	††
J-300	Wall N 02	12,5,7	37.9 ± 45.6	647.0 ± 234.2			-1	3.3 ± 5.8	17.1 ± 19.7							*	††	*	††
J-300	Wall N 03	28,5,4,5	49.3 ± 50.9	812.0 ± 243.7			-1	-0.9 ± 0.4	-7.9 ± 16.5							*	††	*	††
J-300	Wall N 04	39,7,5	4.0 ± 23.3	730.0 ± 239.0			0	-0.9 ± 0.4	5.2 ± 18.2							*	††	*	††
J-300	Wall N 05	48,5,4,5	37.9 ± 45.6	620.0 ± 232.6			-1	1.2 ± 4.1	-0.7 ± 17.5							*	††	*	††
J-300	Wall S 01	1,6,5	17.3 ± 32.7	1400.0 ± 243.3			14	-0.9 ± 0.4	-16.2 ± 15.3							*	††	*	††
J-300	Wall S 02	20,3,5	40.4 ± 46.0	1500.0 ± 248.9			14	-0.9 ± 0.4	-10.2 ± 16.2							*	††	*	††
J-300	Wall S 03	28,5,1	28.9 ± 39.9	1667.0 ± 257.9			14	-0.9 ± 0.4	-0.7 ± 17.5							*	††	*	††
J-300	Wall S 04	41,5,3,5	52.0 ± 51.4	1203.0 ± 231.9			14	-0.9 ± 0.4	-3.1 ± 17.2							*	††	*	††
J-300	Wall S 05	56,6,5	63.6 ± 56.2	447.0 ± 181.7			6	-0.9 ± 0.4	-15.0 ± 15.5							*	††	*	††
J-300	Wall W 01	0,5,7	66.6 ± 56.2	573.0 ± 228.6			-1	1.2 ± 4.1	17.1 ± 19.7							*	††	*	††
J-300	Wall W 02	5,4	31.8 ± 39.8	623.0 ± 231.6			1	3.3 ± 5.8	6.4 ± 18.4							*	††	*	††
J-300	Wall W 03	10,5	37.6 ± 42.9	631.0 ± 232.0			-2	1.2 ± 4.1	-5.5 ± 16.8							*	††	*	††
J-300	Wall W 04	15,6,5	14.4 ± 28.2	547.0 ± 227.0			1	1.2 ± 4.1	-1.9 ± 17.3							*	††	*	††
J-300	Wall W 05	22,5,3,5	43.3 ± 45.8	707.0 ± 236.5			0	-0.9 ± 0.4	18.3 ± 19.8							*	††	*	††
Average			26.3	35.8	357.8	201.6	2.0	0.0	1.8	-1.7	17.3								
Stand Dev			20.6	13.3	583.3	34.0	5.6	1.4	2.1	9.3	1.2								
Maximum			69.4	56.2	1667.0	257.9	14	3.3	5.8	19.5	20.0								
Minimum			-14.1	0.0	-529.0	137.7	-3	-0.9	0.4	-22.1	14.4								
Count			45	45	45	45	45	45	45	45	45								
J-400	cooling tw 1	4,5	45.2 ± 45.2	75.0 ± 152.5			0	-0.9 ± 0.4	-10.2 ± 16.2							*	††	*	††
J-400	cooling tw 2	6,5,5	45.2 ± 45.2	-104.0 ± 135.4			0	-0.9 ± 0.4	-1.9 ± 17.3							*	††	*	††
J-400	cooling tw 3	4,6	45.2 ± 45.2	6.0 ± 146.1			0	-0.9 ± 0.4	8.8 ± 18.7							*	††	*	††
J-400	cooling tw 4	2,1	22.6 ± 32.0	130.0 ± 157.3			0	-0.9 ± 0.4	10.0 ± 18.8							*	††	*	††
J-400	cooling tw 5	3,3	0.0 ± 0.0	398.0 ± 179.2			1	-0.9 ± 0.4	10.0 ± 18.8							*	††	*	††
J-400	cooling tw 6	3,5,1	14.7 ± 25.8	336.0 ± 174.4			2	-0.9 ± 0.4	2.9 ± 17.9							*	††	*	††
J-400	vent pipe	1 *	±	±	±	±		1.2 ± 4.1	11.2 ± 19.0							*	††	*	††
Average			24.7	32.2	120.1	157.5	0.5	-0.6	0.9	4.4	18.1								
Stand Dev			19.2	16.3	170.6	15.3	0.8	0.7	1.3	7.4	1.0								
Maximum			45.2	45.2	398.0	179.2	2	1.2	4.1	11.2	19.0								
Minimum			0.0	0.0	-104.0	135.4	0	-0.9	0.4	-10.2	16.2								
Count			7	6	7	6	6	7	7	7	7								
R-105	ceiling 01	3,2,5	-4.0 ± 4.3	-295.0 ± 169.1			-2	1.2 ± 4.1	2.9 ± 17.9			1.2 ± 4.1	-9.0 ± 16.4			-4 ± 4.3	1 ± 192		
R-105	ceiling 02	2,12	-4.0 ± 4.3	-364.0 ± 163.4			-6	1.2 ± 4.1	-9.0 ± 16.4			-0.9 ± 0.4	8.8 ± 18.7			-4 ± 4.3	<180 ± 178		

JANUS CHARACTERIZATION FIELD MEASUREMENTS & SAMPLE DATA

room #	direction	coordinate x,y,z	NE before removal of paint				Exposure $\mu\text{R/h}$	Smear Spot counted on Tennelec				Paint Spot counted on Tennelec				NE after removal of paint			
			alpha (dis/min)	beta (dis/min)				alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)			alpha (dis/min)	beta (dis/min)		
R-105	ceiling 03	8,6,5	-4.0 ± 4.3	-178.0 ± 178.4		178.4	-2	-0.9 ± 0.4	2.9 ± 17.9		17.9	-0.9 ± 0.4	-10.2 ± 16.2		16.2	7.6 ± 23.3	-144 ± 181		181
R-105	ceiling 04	10,5,3,5	7.3 ± 23.0	-371.0 ± 162.9		162.9	-3	-0.9 ± 0.4	1.7 ± 17.8		17.8	-0.9 ± 0.4	-3.1 ± 17.2		17.2	7.6 ± 23.3	-194 ± 177		177
R-105	floor 01	1,5,1	7.3 ± 23.0	83.0 ± 197.4		197.4	0	1.2 ± 4.1	-7.9 ± 16.5		16.5								
R-105	floor 02	3,12,5	7.3 ± 23.0	-89.0 ± 185.1		185.1	0	-0.9 ± 0.4	5.2 ± 18.2		18.2								
R-105	floor 03	5,6,5	7.3 ± 23.0	-151.0 ± 180.4		180.4	-2	-0.9 ± 0.4	11.2 ± 19.0		19.0								
R-105	floor 04	10,11,5	7.3 ± 23.0	83.0 ± 197.4		197.4	-4	1.2 ± 4.1	-1.9 ± 17.3		17.3								
R-105	floor 05	11,5,6,5	-4.0 ± 4.3	7.0 ± 192.1		192.1	0	-0.9 ± 0.4	-13.8 ± 15.7		15.7								
R-105	Wall E 01	0,5,5	7.3 ± 23.0	111.0 ± 199.4		199.4	0	1.2 ± 4.1	-6.7 ± 16.7		16.7	-0.9 ± 0.4	6.4 ± 18.4		18.4	19.1 ± 32.6	59 ± 198		198
R-105	Wall E 02	5,5,9,5	7.3 ± 23.0	-116.0 ± 183.1		183.1	-3	1.2 ± 4.1	38.6 ± 22.0		22.0	-0.9 ± 0.4	-5.5 ± 16.8		16.8	-4 ± 4.3	23 ± 193		193
R-105	Wall E 03	11,8	-4.0 ± 4.3	-178.0 ± 178.4		178.4	-2	-0.9 ± 0.4	20.7 ± 20.1		20.1	-0.9 ± 0.4	0.5 ± 17.6		17.6	7.6 ± 23.3	-194 ± 177		177
R-105	Wall N 01	0,5,4,5	7.3 ± 23.0	234.0 ± 207.7		207.7	-2	-0.9 ± 0.4	-3.1 ± 17.2		17.2	-0.9 ± 0.4	-9.0 ± 16.4		16.4	-4 ± 4.3	183 ± 204		204
R-105	Wall N 02	6,5,1	7.3 ± 23.0	76.0 ± 196.9		196.9	-2	1.2 ± 4.1	-6.7 ± 16.7		16.7	-0.9 ± 0.4	-6.7 ± 16.7		16.7	7.6 ± 23.3	74 ± 197		197
R-105	Wall N 03	12,5,5	7.3 ± 23.0	138.0 ± 201.2		201.2	-2	-0.9 ± 0.4	-6.7 ± 16.7		16.7	1.2 ± 4.1	4.0 ± 18.1		18.1	7.6 ± 23.3	103 ± 199		199
R-105	Wall S 01	0,5,1,5	7.3 ± 23.0	117.0 ± 199.8		199.8	-1	-0.9 ± 0.4	6.4 ± 18.4		18.4	-0.9 ± 0.4	-5.5 ± 16.8		16.8	-4 ± 4.3	-49 ± 188		188
R-105	Wall S 02	7,8	18.6 ± 32.2	-6.0 ± 191.2		191.2	-3	-0.9 ± 0.4	1.7 ± 17.8		17.8	1.2 ± 4.1	6.4 ± 18.4		18.4	-4 ± 4.3	-35 ± 189		189
R-105	Wall S 03	13,5,5,5	-4.0 ± 4.3	145.0 ± 201.7		201.7	0	-0.9 ± 0.4	2.9 ± 17.9		17.9	-0.9 ± 0.4	-13.8 ± 15.7		15.7	-4 ± 4.3	313 ± 213		213
R-105	Wall W 01	2,6	29.9 ± 39.4	193.0 ± 204.9		204.9	-3	-0.9 ± 0.4	8.8 ± 18.7		18.7	-0.9 ± 0.4	-10.2 ± 16.2		16.2	7.6 ± 23.3	183 ± 204		204
R-105	Wall W 02	7,1	7.3 ± 23.0	76.0 ± 196.9		196.9	-3	-0.9 ± 0.4	1.7 ± 17.8		17.8	-0.9 ± 0.4	-9.0 ± 16.4		16.4	7.6 ± 23.3	-49 ± 188		188
R-105	Wall W 03	10,5,4	7.3 ± 23.0	90.0 ± 197.9		197.9	-6	-0.9 ± 0.4	-15.0 ± 15.5		15.5	-0.9 ± 0.4	-12.6 ± 15.8		15.8	7.6 ± 23.3	-57 ± 187		187
Average			5.7	18.9	-18.8	189.8	-2.2	-0.2	1.6	1.6	17.7	-0.5	1.1	-4.3	17.0	2.5	15.5	1.8	191.5
Stand Dev			8.0	10.0	175.8	13.0	1.7	1.0	1.8	11.7	1.4	0.8	1.5	7.1	0.9	6.2	10.2	124.0	10.1
Maximum			29.9	39.4	234.0	207.7	0	1.2	4.1	38.6	22.0	1.2	4.1	8.8	18.7	19.1	32.6	313.0	212.8
Minimum			-4.0	4.3	-371.0	162.9	-6	-0.9	0.4	-15.0	15.5	-0.9	0.4	-13.8	15.7	-4.0	4.3	-194.0	177.1
Count			21	21	21	21	21	21	21	21	21	16	16	16	16	21	16	21	16
retention	tank #5 01	37,22,5,7	28.3 ± 39.5	-510.0 ± 160.2		160.2	0	-0.9 ± 0.4	5.2 ± 18.2		18.2								
retention	tank #5 02	36,5,28,5,6	6.8 ± 24.2	-640.0 ± 148.7		148.7	0	3.3 ± 5.8	-4.3 ± 17.0		17.0								
retention	tank #5 03	34,5,23,5,4	28.3 ± 39.5	-702.0 ± 142.8		142.8	0	1.2 ± 4.1	-13.8 ± 15.7		15.7								
retention	tank #5 04	36,17,5	17.0 ± 32.4	-585.0 ± 153.7		153.7	0	3.3 ± 5.8	5.2 ± 18.2		18.2								
retention	tank #5 05	41,22,4,5	73.5 ± 60.0	-599.0 ± 152.4		152.4	0	1.2 ± 4.1	-7.9 ± 16.5		16.5								
retention	tank #6 01	36,10,7,5	6.8 ± 24.2	-331.0 ± 174.9		174.9	4	-0.9 ± 0.4	-0.7 ± 17.5		17.5								
retention	tank #6 02	39,13,5,6	28.3 ± 39.5	-695.0 ± 143.5		143.5	0	-0.9 ± 0.4	-17.4 ± 15.1		15.1								
retention	tank #6 03	41,6,5,2,5	5.7 ± 23.2	-427.0 ± 167.2		167.2	2	-0.9 ± 0.4	-4.3 ± 17.0		17.0								
retention	tank #6 04	39,1,5,4	73.5 ± 60.0	-599.0 ± 152.4		152.4	0	-0.9 ± 0.4	-4.3 ± 17.0		17.0								
retention	tank #6 05	34,5,4,5	39.6 ± 45.5	-640.0 ± 148.7		148.7	0	-0.9 ± 0.4	-13.8 ± 15.7		15.7								
retention	tank #7 01	20,5,6,7,5	17.0 ± 32.4	-434.0 ± 166.6		166.6	0	-0.9 ± 0.4	-13.8 ± 15.7		15.7								
retention	tank #7 02	22,5,8,6	50.9 ± 50.8	-558.0 ± 156.0		156.0	0	3.3 ± 5.8	-12.6 ± 15.8		15.8								
retention	tank #7 03	28,5,5,2	50.9 ± 50.8	-757.0 ± 137.4		137.4	2	-0.9 ± 0.4	-6.7 ± 16.7		16.7								
retention	tank #7 04	17,3,5,4	39.6 ± 45.5	-634.0 ± 149.2		149.2	0	1.2 ± 4.1	-5.5 ± 16.8		16.8								
retention	tank #7 05	19,5,1,5,4,5	8.5 ± 47.0	-531.0 ± 139.7		139.7	0	-0.9 ± 0.4	-4.3 ± 17.0		17.0								
retention	tank #8 01	6,5,6,7,5	-2.8 ± 41.2	-256.0 ± 164.5		164.5	0	1.2 ± 4.1	1.7 ± 17.8		17.8								
retention	tank #8 02	11,1,5,5	8.5 ± 47.0	-593.0 ± 133.4		133.4	2	-0.9 ± 0.4	-9.0 ± 16.4		16.4								
retention	tank #8 03	13,4,5,5,5	31.1 ± 56.8	-462.0 ± 146.3		146.3	0	-0.9 ± 0.4	2.9 ± 17.9		17.9								
retention	tank #8 04	10,7,5,2,5	-25.4 ± 26.0	-337.0 ± 157.6		157.6	0	1.2 ± 4.1	0.5 ± 17.6		17.6								
retention	tank #8 05	1,5,6,5,4	8.5 ± 47.0	-545.0 ± 138.3		138.3	0	-0.9 ± 0.4	4.0 ± 18.1		18.1								
Average			24.7	41.6	-541.8	151.7	0.5	0.2	2.1	-4.9	16.9								
Stand Dev			24.3	11.3	129.4	10.8	1.1	1.5	2.2	6.8	0.9								
Maximum			73.5	60.0	-256.0	174.9	4	3.3	5.8	5.2	18.2								
Minimum			-25.4	23.2	-757.0	133.4	0	-0.9	0.4	-17.4	15.1								
Count			20	20	20	20	20	20	20	20	20								

CONCRETE

CORING

THIMBLE

TUBES

SMEARS

3,4,5,6,7,10

ARE UNDER SHEILDING, 2ft FROM EDGE

APPENDIX D

Special Procedures

Title: Janus Characterization D&D Procedure

PROCEDURE FOR THE REMOVAL OF JANUS REACTOR INSTRUMENT THIMBLE INSTRUMENT FRAME AND ION CHAMBER CABLES.

1.0 INTRODUCTION

The removal of the instrument thimble is essential in the characterization of the janus reactor. The removal of the instrument thimble will permit the exposure of the graphite section of the reactor. This will allow a direct reading to be taken adjacent to the reactor and possibly eliminate the necessity for drilling a hole through the steel containment shell thereby saving time and money.

2.0 PREREQUISITES

The following requirements must be satisfied before this procedure is performed.

- a. An approved work permit must be in effect covering this procedure.
- b. An ESH-HP technician must be present, to determine the exposure rate of the holding fixture, chambers and cables and radioactive the contamination levels.
- c. All personnel assigned to work on the reactor top must wear ANL-supplied work clothes, shoe covers, and TLD badges and SAIC dosimeters.
- d. Record the most recent survey information of the instrument thimble.

_____ mR/h

3.0 EQUIPMENT NEEDED

- a. Polyethylene sheeting.
- b. Half inch drive ratchet wrench.
- c. appropriate size socket for the 8 bolts on flange at reactor top.
- d. RO 7 eberline ion chamber detector with extended cable.
- e. E-530 GM detector with extended cable.
- f. Photographer with camera.
- g. Smear paper and vinyl gloves.

- h. Proportional radiation detection instrument ASP-1, NE etc.
- i. air sampler.
- j. full face respirators.
- k. four eye bolts size to screw into thimble flange.
- l. large zip lock bags.
- m. crowbar.
- n. steel cable.
- o. 55 gallon drum.

4.0 PROCEDURE

STEP

INITIALS

1. Fill out a JANUS Work Permit from the JANUS shift Supervisor. Record the assigned work permit no. below.

Work Permit No. _____

2. Remove the reactor shielding from the instrument hole _____
3. Perform a radiation survey of the reactor top. _____

mR/h _____

4. Cover the reactor top around the instrument hole with plastic film and smear paper. _____
5. Remove any shielding from over instrument hole 1 and measure the radiation field over the hole and perform any radiation protection actions necessary. _____

HOLD POINT

The removal of the instrument frame by pulling the instrument cables could result in the spread of loose contamination from the deterioration of the plastic covering the cable.

Verify that:

- a. polyethylene sheeting is covering reactor top complete. _____
- b. air sampler is in operation. _____

STEPINITIALS

- c. personnel responsible for pulling instrument cable have proper PPE (suits, gloves, shoe covers, & respirators) _____
- d. Carefully raise the chamber holding fixture from the instrument hole and support it in an upright position on the covered reactor top. Wear plastic gloves when touching the fixture, chamber, or cables. During the removal Health Physics will monitor the fixture for radioactivity as it is raised. _____
- e. Have Health Physics survey and label the wrapped instrument cables and frame prior to storing in a 55 gallon drum located in J 118. _____
- f. Remove the 8 bolts on the flange at reactor top and placed in a plastic zip lock bag. _____
- g. Use a crowbar to determine if the instrument thimble is free from the reactor. _____
- h. Screw four eye bolts into the flange at the top of the reactor and attach a steel cable to the eye bolts. _____
- i. Measure the radioactivity with a extended reach detector near the thimble hole as it is lifted by the over head crane after all personnel have vacated the reactor top. _____
- j. Health Physics will take smears of the fixture, cables, and ion chambers to determine extent of radioactive contamination. _____
- k. Once the thimble is lifted, place it on a plastic sheet of polyethylene, wrap and tag it to reflect current conditions. _____

SAMPLE CONTAINERS FOR SOIL SAMPLES

JANUS Characterization Project

Analytical Chemistry Laboratory
Argonne National Laboratory

The table below describes containers provided for the collection of soil samples called for in the Characterization Plan for the Biological Irradiation Facility (JANUS Reactor) . It is presumed that a total of six sample sets will be collected, including samples from three depths at each of two sampling locations. However, we are providing seven sets of sample containers to allow for contingency sampling or other situations in which a spare set might be needed.

The sample jars for Volatile Organics (VOC) are to be filled with sample material prior to mixing or homogenization of the sampled soil; all other sample jars are to be filled with soil that was "placed in a stainless steel mixing bowl and homogenized by hand while removing large items such as rocks and organic matter." Please fill each jar completely so there will be sufficient sample for designated analyses and Quality Control subsamples.

Seven sets of sample containers are provided, each containing the four containers shown in the table. The label to be affixed to each container must indicate the parameters for which the sample is to be analyzed as well as other pertinent information (sample identification, etc) called for in the characterization plan.

Sample Type (Parameters)	Container Provided	Preservative	No. Provided	Preparer/Reference
Soil (pH, Metals, Cyanide, TOC, Phenols,Sulfide)	500 mL (16 oz.) Clear WM Glass Jar	None Added; Cool to 4 degrees C	Seven Total	L.B.TenKate Book: 1256 Page: 136
Soil (Volatile Organics [VOC])	125 mL (4 oz.) Amber WM Glass Jar	None Added; Cool to 4 degrees C	Seven Total	L.B.TenKate Book: 1256 Page: 136
Soil (Semivol. Organics, PCBs)	250 mL (8 oz.) Clear WM Glass Jar	None Added; Cool to 4 degrees C	Seven Total	L.B.TenKate Book: 1256 Page: 136
Soil (Gamma Spectrometry)	250 mL (8 oz.) HDPE WM Jar	None Added; Cool to 4 degrees C	Seven Total	L.B.TenKate Book: 1256 Page: 136

D. Graczyk
1/9/96

JANUS Project
(Requirements per Characterization Plan)

The following sections are extracted from the JANUS Characterization Plan (Nov. 1995).

8.2 Sample Containers

RADS Samples

1. Containers supplied by contractor.

Hazardous Material Samples

1. Containers supplied by ACL.
2. Must be COC sealed.
3. Accompanied by COC form.

8.3 Measures of QA/QC

1. Five (5) percent of all rads samples to be analyzed by an independent lab.

8.3.1 Trip Blanks

1. Needed for VOCs only.
2. Prepared by ACL.
3. Shipped with each shipping container.
4. Maintained at $4 \pm 2^{\circ}\text{C}$.
5. Must arrive to contractor within one (1) day of prep.
6. Must not be held by the contractor for more than two (2) days.
7. Blanks required at rate of one (1) per shipment, or two (2) day sampling event.

8.3.2 Field Blanks

- 1.-6. Same as above.
7. Generated at the rate of one (1) per day per sample matrix.
8. To be analyzed for all matrix parameters except pH.

8.3.3 Duplicate Samples

1. Generated at the rate of five (5) percent of the samples collected per matrix, with a minimum of one (1) per matrix.
2. To be analyzed for all parameters.

8.3.4 Lab QA/QC Samples

1. Method blanks, surrogates spikes, etc., will be analyzed according to reference methods.

Documentation:

RADs:

The following are required to be maintained during the radiological data collection process.

9.1.6 Lab Analysis Form

1. Sample number
2. Location of sample collection
3. Description of material
4. Date sample analyzed
5. MDA of analysis equipment
6. Equipment used to analyze sample (model, serial number)
7. Calibration date of equipment
8. Analysis data
9. Error bands (if applicable)
10. Analyst's name
11. Reviewer's name and date of review
12. All data reported in pCi/g or $\mu\text{Ci/mL}$

9.2 Hazardous Material

9.2.2 Chain-of-Custody

1. Initiate COC form with transfer of sampling materials to the site.
2. Must (per SOW) include:
 - name of lab persons preparing bottles for shipment (by ACL)
 - date and time the containers were placed in shipping container (by ACL)
 - number of the COC seal affixed to the shipping container (by ACL)
 - name of persons breaking COC seal and collecting the samples (by samplers)
 - date and time seal was broken (by samplers)
 - date and time the sample was collected (by samplers)
 - parameters for analysis (by samplers)
 - sample number, number & volume of containers, preservative used (by samplers)

9.2.3 Lab Data Pkg

May (?) consist of but not limited to:

1. Narrative
2. Methodology
3. Lab chronicles
4. Non-conformance reports
5. Org extraction logs
6. Analytical results (including methods of blanks and sample detection limits)
7. MS and MSD recoveries
8. Surrogate recoveries
9. Spike and surrogate recovery QC limits
10. Labeled chromatograms
11. Quant reports
12. Mass spec
13. Library searches

9.2.4 QA/QC Check

The contractor shall review for the following to determine usefulness of the data. Therefore, the ACL shall review for the same, at a minimum.

Organics:

1. Holding times met
2. Initial and continuing calibration
3. Spectral performance and interpretation
4. Detection limits
5. Blank contaminants
6. Surrogate spikes
7. Matrix spikes
8. Lab duplicates
9. Narrative
10. Field duplicates

Inorganics:

1. Detection limits
2. Initial and continuing calibration
3. Prep blanks
4. ICP interference check
5. Spike sample analysis
6. Duplication sample analysis
7. Lab control analysis
8. Furnace atomic absorption analysis
9. Narrative

SAMPLE CONTAINERS FOR "SLUDGE" SAMPLES

JANUS Characterization Project

Analytical Chemistry Laboratory
Argonne National Laboratory

The table below describes containers provided for the collection of sludge samples called for in the Characterization Plan for the Biological Irradiation Facility (JANUS Reactor). It is presumed that a total of **six sample sets will be collected**. Because the nature of the sludges to be encountered is uncertain, we are providing containers to be used for either "solid" samples (e.g., dry solids or thick sludges consisting of wet solids) or "waters" (e.g., water matrices, possibly containing suspended or suspendable solids).

Please fill each container completely (if enough sample is available) so there will be sufficient sample for designated analyses and Quality Control subsamples. Note particularly that if "water" samples are taken, the vials for Volatile Organics (VOC) must be filled with no headspace.

Six sets of sample containers are provided, each containing the four containers shown in the table for solid samples and the five containers shown for waters. The label to be affixed to each container must indicate the parameters for which the sample is to be analyzed as well as other pertinent information (sample identification, etc.) called for in the characterization plan.

Note also that no preservatives have been added to most containers for the water samples. We omitted recommended preservatives in these cases because the samples to be collected are not clean waters but are actually aqueous waste of unknown composition; a potential exists for incompatibility between the preservative and waste, which makes the use of preservative imprudent. We recommend that the sampling team not add any chemical reagents to the samples for safety's sake.

SAMPLE CONTAINERS FOR "SLUDGE" SAMPLES

JANUS Characterization Project

Sample Type (Parameters) for Solid Samples	Container Provided	Preservative	No. Provided	Preparer/ Reference
pH, Metals, Cyanide, TOC, Phenols, Sulfide	500 mL (16 oz.) Clear WM Glass Jar	None Added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139
Volatile Organics (VOC)	125 mL (4 oz.) Amber WM Glass Jar	None Added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139
Semivol. Organics, PCBs	250 mL (8 oz.) Clear WM Glass Jar	None Added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139
Gamma Spectrometry	250 mL (8 oz.) HDPE WM Jar	None Added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139

Sample Type (Parameters) for Water Samples	Container Provided	Preservative	No. Provided	Preparer/ Reference
pH, Metals, Gamma Spec	1000-mL (32 oz.) Narrow Mouth HDPE Bottle	None Added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139
Volatile Organics (VOC)	Two 40-mL Glass Vials (Fill both; no Headspace!)	0.2 mL 1:1 HCl added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139
Semivol. Organics, PCBs	4000-mL (1-gallon) Amber Jug	None Added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139
Cyanide, Sulfide	1000-mL (32-oz.) Clear Glass, Narrow Mouth Bottle	None Added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139
Phenols, Total Organic Carbon (TOC).	1000-mL (32-oz.) Clear Glass, Narrow Mouth Bottle	None Added; Cool to 4 degrees C	Six Total	L.B.TenKate Book: 1256 Page: 139

APPENDIX E

Sample Labels, Request for Analysis Form,
and Chain of Custody Record Form

00153

[illegible]

***A sample is under custody if:**

1. It is in your possession, or
2. It is in your view, after being in your possession, or

3. It was in your possession and you locked it up, or
4. It is in a designated secure area.

ACL:1 (4 94)

Chain of Custody Record

REQUEST FOR ANALYSIS **Analytical Chemistry Laboratory**

SUBMITTED BY (Print Name)		DIVISION	LOCATION	DATE
COST CODE NUMBER		COST CODE AUTHORIZATION (Signature)		
NAME OF PROGRAM/PROJECT SUPPORTING THIS WORK				

REPORT RESULTS TO: (Print Name)	DIVISION	LOCATION	PHONE
	DIVISION	LOCATION	PHONE
	DIVISION	LOCATION	PHONE

It is agreed that publication of the data resulting from this analysis will provide appropriate acknowledgment for the analysts involved.

DESCRIBE ANALYTICAL SERVICE NEEDED:		Submitter's Sample No.	ACL Sample No.
ACCURACY NEEDED:			
SPECIFIC PROCEDURE REQUIRED: ☐ NO ☐ YES			
DOCUMENT NO.	REVISION NO.		
SAMPLE DESCRIPTION: (Approximate composition)			
SOLVENT (if in solution):			
RADIOACTIVITY: ☐ NO ☐ YES			
TYPE	LEVEL		
SPM INTERNAL TRANSITION NO.			
HEALTH PHYSICS AUTHORIZATION			
POTENTIAL HEALTH HAZARD OR SPECIAL WASTE DISPOSAL (Carcinogenic, Toxic, etc.) ☐ NO ☐ YES Describe:			
SAMPLE ORIGIN: (Sample history, source, manufacturer, etc.)			
SPECIAL HANDLING REQUIRED ☐ NO ☐ YES Describe:			
REMARKS: (If more space is necessary, continue on back)			

FOR ACL OFFICE USE ONLY		
ANALYSTS ASSIGNED:	ESTIMATED HOURS:	DATE REPORTED:

ANL-80 (2-58)

100-100-100

Reduced Copy of Form Used to Request Analyses from the ANL
 Analytical Chemistry Laboratory in Argonne, Illinois

APPENDIX F

Air Sampling Data

AIR SAMPLE DATA FROM 202 JANUS

date counted	room #	date Collected	flow rate m ³ /min	volume m ³	tennelec			
					dpm alpha		dpm beta	
02/01/96	J-105	01/08/96	0.1	37.9	0.3	± 1.5	5.2	± 8.4
02/01/96	J-015	01/08/96	0.1	37.7	1.2	± 1.9	7.6	± 8.6
02/01/96	J-101	01/10/96	0.1	51.8	1.2	± 1.9	7.1	± 8.6
02/28/96	J-102	01/10/96	0.1	51.8	1.6	± 2.0	2.4	± 8.3
02/01/96	J-118	01/10/96	0.1	51.8	0.0	± 1.2	8.1	± 8.6
02/28/96	J-014	01/11/96	0.1	83	0.8	± 1.7	9.8	± 8.7
02/01/96	J-010	01/01/96	0.1	83	2.4	± 2.3	5.2	± 8.4
02/01/96	J-007	01/12/96	0.1	52	-0.5	± 0.9	4.3	± 8.4
02/01/96	J-010	01/12/96	0.1	52	0.0	± 0.4	2.1	± 8.3
02/01/96	J-112	01/16/96	0.1	58.6	0.0	± 1.2	6.4	± 8.5
02/01/96	J-002	01/15/96	0.1	58.6	0.3	± 1.5	2.6	± 8.3
02/01/96	Rx top	01/24/96	0.1	16.7	0.0	± 1.2	5.0	± 8.4
02/01/96	J-108	01/24/96	0.1	38	0.8	± 1.7	0.0	± 8.0
02/01/96	J-120	01/24/96	0.1	38	-0.5	± 0.9	3.6	± 8.4
Average			0.1	50.8	0.5	1.4	4.8	8.4
Stand Dev			0.0	17.6	0.9	0.5	3.1	0.2
Maximum			0.1	83	2.4	2.3	9.8	8.7
Minimum			0.1	16.7	0.0	0.4	0.0	8.0
Count			14	14	14	14	14	14

INDUSTRIAL HYGIENE ANALYTICAL REPORT

REQUESTOR NUMBER	ANALYTICAL NUMBER	ANALYTE	RESULT (UNITS)
27865	96-C-0168	Lead	0.46 ug
27866	96-C-0169	Lead	0.32 ug

ANALYST: RA Buepker DATE: 1-23-96
PROCEDURE USED: DACH 0060
NOTEBOOK REFERENCE: DACH 3018

QUALITY CONTROL RESULTS

PERCENT RECOVERY: PRECISION:

INTERNAL STANDARD USED: YES NO ✓

DATA STORAGE LOCATION: 200 F101

APPROVAL

MS Farnandis LABORATORY DIRECTOR

DATE: 1/24/96

INDUSTRIAL HYGIENE ANALYSIS REPORT

Requestor: M. Bonkowski

Analysis Requested:

☒ INORGANIC

☐ Specific Analyte _____

☒ Standard AA Analysis LEAD

☐ Standard ICP Analysis _____

☐ OSHA Number _____

☐ NIOSH Number _____

☐ Other (Specify) _____

☐ ORGANIC

☐ Standard GC/MS Analysis _____

☐ OSHA Number _____

☐ NIOSH Number _____

☐ Other (Specify) _____

Requestor Sample Number	Analytical Sample Number

CHAIN OF CUSTODY CHRONICLE

Collected By: <u>M. Bonkowski</u>	Date	Time	Relinquished By: <u>M. Bonkowski</u>	Date	Time
Signature <u>M. Bonkowski</u>	<u>1/8/76</u>	<u>1950</u>	Signature <u>M. Bonkowski</u>	<u>1/7/76</u>	<u>1355</u>
Received By: <u>P. KASTER</u>	Date	Time	Disposal	Date	Time
Signature <u>P. Kaster</u>	<u>1/7/76</u>	<u>1355</u>			

APPENDIX G

Analytical Results for Soil Samples
ANL Analytical Chemistry Laboratory Data Package Summaries

Location of Soil Samples		
JANUS Sample Number	ACL Sample Number	Sample Location
pH, Metals, Cyanide, TOC, Phenols and Sulfide Samples		
S1-A	96-8064-01	South of Building 1 foot deep
S6-A	96-8064-02	South of Building 6 feet deep
S9-A	96-8064-03	South of Building 9 feet deep
W1-A	96-8064-04	West of Building 1 foot deep
W6-A	96-8064-05	West of Building 6 feet deep
W9-A	96-8064-06	West of Building 9 feet deep
Volatile Organic Samples		
S1-B	96-8060-01	South of Building 1 foot deep
S6-B	96-8060-02	South of Building 6 feet deep
S9-B	96-8060-03	South of Building 9 feet deep
W1-B	96-8060-04	West of Building 1 foot deep
W6-B	96-8060-05	West of Building 6 feet deep
W9-B	96-8060-06	West of Building 9 feet deep
Semivolatile Organic and PCB Samples		
SN-T1	96-8061-01	Trip Blank - Water for Volatile Organics
S1-C	96-8062-01	South of Building 1 foot deep
S6-C	96-8062-02	South of Building 6 feet deep
S9-C	96-8062-03	South of Building 9 feet deep
W1-C	96-8062-04	West of Building 1 foot deep
W6-C	96-8062-05	West of Building 6 feet deep
W9-C	96-8062-06	West of Building 9 feet deep

Location of Soil Samples		
JANUS Sample Number	ACL Sample Number	Sample Location
Gamma Spectroscopy Samples		
S1-D	96-8063-01	South of Building 1 foot deep
S6-D	96-8063-02	South of Building 6 feet deep
S9-D	96-8063-03	South of Building 9 feet deep
W1-D	96-8063-04	West of Building 1 foot deep
W6-D	96-8063-05	West of Building 6 feet deep
W9-D	96-8063-06	West of Building 9 feet deep

ARGONNE NATIONAL LABORATORY

9700 SOUTH CASS AVENUE, ARGONNE, ILLINOIS 60439-4831

TELEPHONE: (708)252-3490

FAX: (708)252-3146

E-MAIL: LINDAHL@CMT.ANL.GOV

March 26, 1996

TO: McLouis Robinet Environment, Safety and Health-HP
FROM: Peter Lindahl Chemical Technology/ACL
SUBJECT: JANUS Reactor Characterization Project Report - Analytical Methods
and Quality Control Samples

Please find enclosed the information you requested on the analytical methods and the associated quality control samples employed in the analysis of the JANUS Reactor Characterization Project samples submitted to the ACL. If you need additional information related to the analysis protocols, please call me at the telephone number listed above.

PCL:amb

Attachments

cc: w/attach.
J. Laidler (2)
D. Green
D. Graczyk
A. Boparai
D. Bowers
F. Martino
C. Sholeen (ESH-HP/202)

ANALYTICAL METHODOLOGY AND ASSOCIATED QUALITY CONTROL SAMPLES

Laboratory analyses for the JANUS Reactor Characterization Project were conducted by the Analytical Chemistry Laboratory at Argonne National Laboratory. Samples were collected for hazardous materials characterization (HMC) and radiological characterization. The HMC is to determine the presence of inorganic and organic hazardous substances, their concentrations, and the potential regulatory status of materials to be disposed. The radiological characterization is to determine the radiological status of the facility and the surrounding area. The inorganic, organic, and radiological parameters and analytical reference methods used to determine these parameters for the Project are listed in Table 1. For the inorganic and organic parameters, when practicable, the quality control (QC) samples were those specified in the EPA SW-846 method. For the radiological parameters, again when practicable, the QC samples used were those specified in the ACL Standard Operating Procedure. In some cases due to either the limited amount of sample collected or the limited amount of sample available for collection, the preparation and subsequent analysis of QC samples such as duplicate samples and/or spike duplicate samples were not possible. The quality control samples employed with the each analytical method are described in this section.

INORGANIC PARAMETERS

Metals

ICP Metals - In the ICP analysis protocols for the determination of ICP metals in waters and soils the QC samples included were the spike and spike duplicate samples (containing all analytes except Na and K) and the Laboratory Control Sample (LCS).

GFAA Metals - In the GFAA analysis protocols for the determinations of antimony, arsenic, lead, selenium, and thallium in waters and soils the QC samples included were the spike sample, the spike duplicate sample, and the LCS.

Mercury - In the CVAA analysis protocols for the determination of mercury in waters and soils the QC samples included were the spike sample, the spike duplicate sample, and the LCS.

Miscellaneous

pH - In the protocols for determination of pH in waters and soils the QC samples included were the duplicate sample and the LCS.

Cyanide - In the analysis protocols for the determination of total cyanide in waters and soils the QC samples included were the spike sample, the spike duplicate sample, and the LCS.

Sulfide - In the analysis protocols for the determination of total sulfide in waters and soils the QC samples included were the spike sample, the spike duplicate sample, and the LCS.

ORGANIC PARAMETERS

Organic Compounds

Volatile Organic Compounds - In the GC/MS analysis protocols for the determination of volatile organic compounds the waters and soils the QC samples included were the matrix spike sample and the matrix spike duplicate sample.

Semi-volatile Organic Compounds - In the GC/MS analysis protocols for the determination of semi-volatile organic compounds in waters and soils the QC samples included were the matrix spike sample and the matrix spike duplicate sample.

Polychlorinated Biphenyls (PCBs) - In the GC analysis protocols for the determination of polychlorinated biphenyls in waters, soils, and oils the QC samples included were the matrix spike sample and matrix spike duplicate sample.

Miscellaneous

Phenols - In the analysis protocols for the determination of phenols in waters the QC samples included were two spiked samples and the LCS; for soils the QC samples included were the spike sample, the spike duplicate sample, and the LCS.

Total Organic Carbon - In the analysis protocols for the determination of total organic carbon in waters the QC samples included were the spike sample and the spike duplicate sample; for soils the QC samples included were the duplicate sample and the LCS.

RADIOLOGICAL PARAMETERS

Alpha Spectrometry

Thorium, Uranium, and Plutonium - In the isotope-dilution alpha spectrometry analysis protocols for the determination of thorium, uranium, and plutonium on filter papers, and in metal and graphite samples the QC sample included was the LCS. Duplicate samples were not included since in all cases the entire sample was consumed during analysis.

Gamma Spectrometry

Gamma Radionuclides - In the gamma spectrometry analysis protocols for the determination of gamma radionuclides in soil; water; graphite; lead shavings; filter papers; filters; smears; and in the concrete, hard board, metal, lead, and steel cores the QC sample included was the laboratory control standard. Duplicate samples were not included, except in the case of the water samples.

Table 1. Analytical Parameters

Parameter	Matrix	Methods ¹	
		Sample Preparation	Analysis
Metals-ICP	Soil	3051 (all except Ag) 3050A (Ag)	6010A
	Water	3015	
Metals-CVAA	Soil	3051 (all except Sb) 3050A (Sb)	7041 (Sb), 7060A (As) 7421 (Pb), 7740 (Se), 7841 (Tl)
	Water	3015	
Mercury	Soil	3051	7470A
	Water	7470A	
pH	Soil	9045C	9045C
	Water	NR	9040B
Cyanide (Total)	Soil	9010A	9010A
	Water		
Volatile Organic Compounds	Soil	NR ²	8260A
	Water		
Semivolatile Organic Compounds	Soil	3550A	8270B
	Water	3510B	
Polychlorinated Biphenyls	Soil	3550A	8081
	Water	3510B	
	Oil	3580A	
Total Organic Carbon	Soil	9060 Modified	9060 Modified
	Water	9060	9060
Phenols (Total)	Soil	9065 Modified	9065 Modified
	Water	9065	9065
Thorium, Uranium, Plutonium	Filters	ACL-165 ^{1,3}	ACL-181
	Metal		
	Graphite		
Gamma Radionuclides	Soil Graphite Concrete Lead Shavings Water	ACL-072	ACL-080 or ACL-127
Gamma Radionuclides	Concrete Core Lead Core Steel Core Metal Core Hard Board Core Filter Paper Filters Smears	NR	ACL-080 or ACL-127

Table 1. Analytical Parameters (cont'd.)

- ¹ Except when the method number has an "ACL" designation, this Sample Preparation and Analysis Methods reference USEPA, "Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods, SW-846, [3rd Edition, Nov. 1986, and Final Updates I (7/92) or II (9/94)].
- ² NR = Not Required.
- ³ Indicates an Analytical Chemistry Laboratory (ACL) Standard Operating Procedure.

The EPA-defined qualifiers used are as follows:

- U - Indicated compound was analyzed for but not detected. The sample quantitation limit must be corrected for dilution and for percent moisture.
- J - Indicates an estimated value. This flag is used under the following circumstances: 1) when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, 2) when the mass spectral and retention time data indicate the presence of a compound that meets the volatile and semivolatile GC/MS identification criteria, and the result is less than the CRQL but greater than zero, 3) when the retention time data indicate the presence of a compound that meets the pesticide/Aroclor identification criteria and the result is less than the CRQL but greater than zero. Note: the "J" code is not used and the compound is not reported as being identified for pesticide/Aroclor results less than the CRQL, if the technical judgement of the pesticide residue analysis expert determines that the peaks used for compound identification resulted from instrument noise or other interferences (column bleed, solvent contamination, etc.).
- N - Indicates presumptive evidence of a compound. This flag is only used for tentatively identified compounds, where the identification is based on a mass spectral library search. It is applied to all TIC results. For generic characterization of a TIC, such as chlorinated hydrocarbon, the N code is not used.
- B - This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action. This flag must be used for a TIC as well as for a positively identified target compound.

January 17, 1996

CASE NARRATIVE - SOIL pH

1. INORGANIC ANALYSIS DATA PACKAGE °

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: S1-A (ACL 96-8064)

Number of Pages: 2

2. INTRODUCTION

Six soil samples from the grounds surrounding the JANUS Reactor facility were analyzed to determine soil pH as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory).

Each soil sample was analyzed to determine pH by Method 9045C ("Soil and Waste pH") in the U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, Update IIB, January 1995. This method represents the current promulgated method for determination of soil pH and was applied in place of Method 9040 ("pH Electrometric Measurement"), which was specified in the characterization plan, but which is not intended for characterization of solid samples. This report contains results and raw data from the pH determinations on these soils.

3. METHODS

The method applied to the analysis described in this package is as listed in the following table:

Method for Soil pH in JANUS Facility Characterization Samples		
Samples	Parameter Determined	Method (SW-846)
Soils, Surrounding Grounds	Soil pH Measured in Water at Temperature (C)	9045C (Soil and Waste pH)

4. CLARIFICATIONS AND COMMENTS

Equipment: Measurements of the soil pH were made with a Brinkman/Metrohm Model 605 pH meter.

Method Deviations: No deviations from the specified method were noted during execution of the measurements or review of the data.

Holding Time: Samples in this SDG were collected on January 11, 1996, and analyzed on January 12. Hence, samples were analyzed within 24 hours of collection.

5. QUALITY CONTROL

Quality control measurements appropriate to Method 9045C were performed when samples were analyzed. These included calibration of the pH meter with standard buffer solutions (pH 4.00 and 10.00), verification of calibration with an additional buffer having a value between the calibration buffers (pH 7.00), and measurements on duplicate portions of one sample. Results of the QC measurements are presented on the Report of Analytical Results form together with results for each sample. Data generated during the analyses (copy of logbook page) are included in this package. Chain of Custody forms for the samples are collected at the back of this report.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to evaluate soil pH showed no values outside the range defining nonhazardous classification. Values of the soil pH ranged from 8.09 to 8.45. Results for the duplicate determinations agreed within the combined uncertainties for the two measurements.

Date 1-17-96
Donald G. Graczyk,
Laboratory Supervisor

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Soil from JANUS Characterization

Date Received: 1/11/96

Submitted by: M. Robinet

Date Reported: 1/17/96

Submitter's Sample No.	ACL Sample No.	Date Collected	Date Analyzed	Soil pH Measured in Water at 19°C ^a
S1-A	96-8064-01	1/11/96	1/12/96	8.23 ± 0.10
S6-A	-02	1/11/96	1/12/96	8.09 ± 0.10
S9-A	-03	1/11/96	1/12/96	8.18 ± 0.10
	-03 Duplicate ^b	1/11/96	1/12/96	8.32 ± 0.10
W1-A	-04	1/11/96	1/12/96	8.18 ± 0.10
W6-A	-05	1/11/96	1/12/96	8.26 ± 0.10
W9-A	-06	1/11/96	1/12/96	8.45 ± 0.10
<p>Laboratory Quality Standard, Fisher Chemical Buffer Solution:</p> <p style="text-align: center;">Expected pH: 7.00 Found pH: 7.00</p>				
<p>^a pH determinations were performed according to U.S. EPA SW-846 Method 9045C.</p> <p>^b Laboratory duplicate sample.</p>				

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call J. Kiely at 2- 7399 .

Reference(s): J. Kiely Logbook No. 1254, pg. 80.

Copies To: M. Robinet
M. O'Connor
C. Sholeen
D. Green
D. Graczyk

P. Lindahl
F. Martino
ACL Results File
ACL 200 File
Janus Project File

Analyst(s): J. Kiely JK

CASE NARRATIVE -Metals in Soil

1. INORGANIC ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: S1-A (ACL 96-8064)

Number of Pages: 5

2. INTRODUCTION

Six soil samples from the grounds surrounding the JANUS Reactor facility were analyzed to determine 23 metallic analytes as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Results of these metals determinations and for associated Quality Control (QC) parameters are presented in the format described in the U.S. EPA Contract Laboratory Program (CLP) Statement of Work for Inorganic Analysis (SOW) ILM03.0. Qualifiers and flags associated with data on the CLP forms are assigned in accordance with the CLP SOW and QC data were evaluated against criteria established in this SOW, as well.

Forms for this data package were generated with software purchased from Ward Scientific, Ltd. ("Environmental Data Reporting Software," Version 2.73 or Version 2.91).

Analytes determined for samples in this SDG included those metals listed in the U.S. EPA CLP Target Analyte List (23 metals normally reported on the CLP forms).

3. METHODS

Methods applied to the analysis of these samples were selected to conform to the JANUS Facility Characterization Plan and the detection limit requirements communicated to our laboratory by the Project Manager. The methods used are summarized in Table 1 and are as described in the U.S. EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846 [3rd Edition, November 1986, and Final Updates I (7/92) or II (9/94)].

Methods for Metal Determinations in JANUS Facility Characterization Soil Samples		
Analyte	Sample Preparation	Sample Analysis*
Antimony	Method 3050A	Method 7041 (GFAA)
Arsenic	Method 3051	Method 7060A (GFAA)
Lead	Method 3051	Method 7421 (GFAA)
Mercury	Method 3051	Method 7470A (CVAA)
Selenium	Method 3051	Method 7740 (GEAA)
Silver	Method 3050A	Method 6010A (ICP)
Thallium	Method 3051	Method 7841 (GFAA)
Other Metals	Method 3051	Method 6010A (ICP)

* GFAA = Graphite Furnace Atomic Absorption; CVAA = Cold Vapor Atomic Absorption; ICP = Inductively Coupled Plasma-Atomic Emission.

Samples prepared by Method 3051 ("Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils") may be analyzed for all the specified metals. However, poor recovery of antimony and silver in digestates from this method prompted us to determine these elements from a second digestion using the hotplate digestion Method 3050A.

4. CLARIFICATIONS AND COMMENTS

A. ICP Analyses

Equipment: ICP analysis of sample digestates was performed with an Instruments S.A. Model JY86 ICP Spectrometer System consisting of a JY-48 polychromator system and a JY-38 scanning monochromator system. For this SDG, the elements Na, K, Ag, and V were determined with the JY-38 monochromator; the remaining ICP elements were determined with the JY-48 polychromator.

ICP Raw Data: Sample concentrations in the ICP raw data printouts are in units of µg/L except for Na and K data from the JY-38 system, which are in units of mg/L. Data reported for Al, Ca, Fe, and Mg are taken from channels Al1, Ca1, Fe2, and Mg1, respectively.

ICP Method Deviations:

- (1) No duplicate results are available from the ICP data for Na and K. Because

these elements were determined in a separate ICP run and were not among the elements added to the spike and spike duplicate samples, the spike and spike duplicate were left out of the run sequence. This omission resulted in the replicate data not being available. Because these elements are typically very well behaved during digestion and measurement, this omission should not compromise the usability of the Na and K results for these samples.

- (2) Beryllium recovery in the solid Laboratory Control Sample (LCS) was slightly above the upper control limit for Be (found value of 23.0 mg/kg vs. upper acceptance limit of 22.3 mg/kg) but samples were not redigested and reanalyzed for this element. It has been our observation that the SW-846 digestion Method 3051 (Microwave Assisted Acid Digestion) is somewhat more aggressive than the hotplate methods on which the control limits for this LCS are based. Hence, slightly higher recoveries of some metals in this reference material are the norm when microwave-assisted digestion is used. With digestion by Method 3051, we would anticipate that redigestion and reanalysis of the sample batch would give a comparable Be result to that observed in this run. The Be result observed with this LCS preparation does not indicate a problem with the sample preparation or measurement and was therefore accepted.

B. Graphite Furnace Atomic Absorption (GFAA) Analyses

Equipment: GFAA analysis of sample digestates employed a Perkin-Elmer 5100 AA Spectrophotometer equipped with Zeeman background correction and an autosampler.

No deviations from the specified methods were noted during execution of the GFAA measurements or review of the GFAA data.

C. Cold Vapor Atomic Absorption (CVAA) Analyses

Equipment: The CVAA determination of mercury was performed with a Leeman Labs, Inc. Model PS200 Automated Mercury Analyzer System. The IDL for Hg with this system is 0.02 µg/L. This value shows on the forms as 0.0 µg/L owing to rounding by the report-generation software.

CVAA Method Deviations: No deviations from the specified methods were noted during execution of the CVAA measurements or review of the CVAA data.

Mercury Holding Time: Samples in this SDG were collected on January 11, 1996; were digested on January 16; and were analyzed on January 18. Hence, the holding time requirement for mercury (28 days) was met.

5. QUALITY CONTROL

Quality assurance data generated in the course of analyses associated with this SDG are summarized on the appropriate forms included in the CLP-type data package. All QC parameters are within acceptance criteria established in the CLP SOW except the following:

- (1) Those deviations called out in the Method Deviations sections of the foregoing discussion and comments.
- (2) Matrix spike recoveries for antimony, arsenic, and silver:

For antimony, both the spike and spike duplicate samples showed low recoveries (26.4 and 19.8%). Results for Sb are therefore flagged with the "N" qualifier on the CLP - Type reporting forms. These low spike recoveries very likely reflect losses of Sb during the soil digestion by Method 3050A; poor performance of Method 3050A for Sb is well - recognized, but this method remains the best SW-846 method for digestion of soil samples for antimony measurement. Results for Sb in the field samples might be biased low.

For arsenic the predigestion spike recovery was acceptable in the spiked sample (78.9%) but below 75% in the spike duplicate (72.6%). Results for As are also flagged with the "N" qualifier, indicating a possible matrix effect on the arsenic determinations.

For silver, both the predigestion spike recoveries (70.2 and 74.3%) and the post-digestion spike recovery (65.4%) were low. The results for Ag in this SDG are also flagged with the "N" qualifier to indicate a possible matrix effect on the digestions or measurements related to this element. Results reported for silver might be biased low.

- (3) Duplicates result for Al: The Relative Percent Difference (RPD) for Al (Form 6) is 21.1% and exceeds the 20% control limit for agreement between duplicate results. Values reported for Al are therefore flagged with the "*" qualifier. This variation between Al results for duplicate sample portions suggests that some non uniformity of Al distribution in the soil matrix exists. It is neither uncommon nor unexpected with such materials.
- (4) Serial dilution flags for copper, and zinc: Results for copper and zinc are flagged with the "E" qualifier as a result of an RPD greater than 10% for the ICP serial dilution. This flag is assigned in the CLP SOW to provide an alert to a possible chemical or physical interference on the ICP measurement. The RPD observed for

the serial dilution of Cu (64.1%), and Zn (30.9%) in this SDG might suggest such an interference; this suspected interference should be considered when the data for these elements are interpreted.

Chain of Custody forms for the samples in this SDG are collected in this data package just after this Case Narrative.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to determine metals in the samples in this SDG are summarized on the Inorganic Analyses Data Sheets (Forms 1) in the accompanying data package. Major and trace constituents in these soils are quite typical of soils from the Argonne site and do not show any obvious signs of metals contamination in the areas sampled.

Date 3-1-96
Donald G. Graczyk,
Laboratory Supervisor

S1-A

Date Received: 01/11/96

[illegible]

omments:

1
INORGANIC ANALYSES DATA SHEET

S9-A

Concentration Units (ug/L or mg/kg dry weight): MG/KG

[illegible]

omments:

b Name: ARGONNE_NATL_LAB_EAST_____ Contract: _____
b Code: ANLE_____ Case No.: _____ SAS No.: _____ SDG No.: S1-A
trix (soil/water): SOIL_____ Lab Sample ID: 96806405
vel (low/med): MED_____ Date Received: 01/11/96
Solids: 84.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

[illegible]

Color Before: DARK_BROW Clarity Before: _____ Texture: COARSE
Color After: BROWN Clarity After: _____ Artifacts:

omments:

1

INORGANIC ANALYSES DATA SHEET

W6-A

Concentration Units (ug/L or mg/kg dry weight): MG/KG

[illegible]

Comments:

```

Job Name: ARGONNE_NATL_LAB_EAST_____ Contract: _____
Job Code: ANLE_____ Case No.: _____ SAS No.: _____ SDG No.: S1-A_____
Matrix (soil/water): SOIL_____ Lab Sample ID: 96806406
Level (low/med): MED_____ Date Received: 01/11/96
Solids: _____ 88.2

```

[illegible]

omments:

March 1, 1996

CASE NARRATIVE - Total Organic Carbon

1. INORGANIC ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: S1-A (ACL 96-8064)

Number of Pages: 5

2. INTRODUCTION

Six soil samples from the grounds surrounding the JANUS Reactor facility were analyzed to determine Total Organic Carbon (TOC) as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Each soil sample was analyzed to determine TOC by Method 9060 modified. A method modification was necessary for the analysis of the soil samples because Method 9060 (Total Organic Carbon) as described in the U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, September 1986 is designed for the analysis of water samples. This method represents the current promulgated method for determination of TOC and was specified in the characterization plan. Currently, there is no SW-846 method specific to the determination of TOC in soil. This report contains results and raw data from the determination of both Total Carbon, i.e. carbon measured without acid pretreatment of the soil, and TOC, i.e. carbon measured after acid pretreatment of the soils to remove carbonate carbon (Inorganic Carbon) in these soils.

3. METHODS

The methods applied to the analyses described in this package are as listed in the following table:

Method for Determination of TOC in JANUS Facility Characterization Soil Samples		
Samples	Parameter Determined	Method (SW-846)
Soils, Surrounding Grounds	Total Organic Carbon	9060 (Total Organic Carbon) - Modified

4. CLARIFICATIONS AND COMMENTS

A. TOC Determination

Procedure: Method 9060 was modified for the analysis of the soil samples. In the modified procedure a weighed sample is treated with dilute acid to remove carbonate carbon, the treated sample is analyzed by combustion at $\sim 1500^{\circ}\text{C}$ in pure oxygen to determine the non-carbonate carbon. The non-carbonate carbon results (acid treated) are reported as "Total Organic Carbon" (TOC).

A copy of the LECO Corporation Application Bulletin entitled "Total and Organic Carbon in Soil, Limestone and Similar Materials" describing the method in more detail is enclosed as part of the Case Narrative.

Equipment: Total Carbon and Total Organic Carbon were determined using a LECO WR-12 Analyzer.

Holding Time: Samples in this SDG were collected on January 11, 1996, and analyzed on February 6 or 7, 1996, within the recommended holding time (28 days).

Sample Preservation: For the Janus Reactor Characterization Project, soil samples were preserved at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ at collection and maintained in refrigerated storage at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ until analysis.

5. QUALITY CONTROL

Quality control measurements appropriate to Method 9060 - Modified were performed when samples were analyzed. These included sample duplicates and laboratory control samples. Results of the QC measurements are presented on the Report of Analytical Results form together with results for each sample. Data generated during the analyses (copies of logbook pages) are included in this package. Chain of Custody forms for the samples are collected at the back of this report.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to evaluate the concentration of TOC in the soil samples showed values ranging from 0.573 wt.% to 1.37 wt. %. The agreement between the duplicate samples was outside the typically acceptable range ($\pm 20\%$). After reviewing the data for that specific sample, it appears that lack of agreement between the duplicate analyses is most likely a manifestation of the within sample variability.

Date 3-1-96
Donald G. Graczyk,
Laboratory Supervisor

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: JANUS Characterization (Soils)

Date Received: 1/11/96

Submitted by: M. Robinet

Date Reported: 2/7/96

Submitter's Sample No.	ACL Sample No.	Total Carbon (Wt. %)	Total Organic Carbon (Wt. %)
S1-A	96-8064-01	3.44 3.55 <u>3.90</u> Avg: 3.63	1.37 <u>1.33</u> Avg: 1.35
S6-A	-02	3.04 <u>2.89</u> Avg: 2.97	0.500 <u>0.562</u> Avg: 0.531
S9-A	-03	3.19 <u>4.08</u> Avg: 3.64	1.11 <u>0.794</u> Avg: 0.952
Duplicate	-03 Dup.	3.77 <u>3.40</u> Avg: 3.58	0.607 <u>0.539</u> Avg: 0.573
W1-A	-04	2.65 <u>2.52</u> Avg: 2.58	1.33 <u>1.25</u> Avg: 1.29
W6-A	-05	3.61 <u>3.70</u> Avg: 3.66	1.26 <u>1.47</u> Avg: 1.37
W9-A	-06	4.89 <u>4.42</u> Avg: 4.66	1.19 <u>1.22</u> Avg: 1.20

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call S. Kent at 2- 1203 .

Reference(s): S. Kent Notebook No. 990, pp. 113-120.

Copies To: M. Robinet
M. O'Connor
C. Sholeen
D. Geraghty
D. Green

P. Lindahl
D. Graczyk
F. Martino
ACL Results File
ACL 200 File

Analyst(s): S. Kent

ASG for S. Kent

REPORT OF ANALYTICAL RESULTS

Sample Material: JANUS Characterization (Soils)
Submitted by: M. Robinet

Date Received: 1/11/96
Date Reported: 2/7/96

Submitter's Sample No.	ACL Sample No.	Total Carbon (Wt. %)	Total Organic Carbon (Wt. %)
	96-8064-01		
	Laboratory Control Sample (NIST SRM 2704*)	3.36	3.27** 3.35** Avg: 3.31
<p>Carbon determined using the LECO WR-12 Analyzer; combustion at ~1500°C in pure oxygen. Total carbon determined by direct measurement on sample after drying at 105°C. Total organic carbon determined by measurement on sample after treatment with acid (1:1 HCl) to remove carbonate.</p> <p>Instrument detection limit (IDL) is 25 µg C.</p> <p>* "Buffalo River Sediment," certified value for total carbon is 3.348 ± 0.016 wt. %.</p> <p>** NIST SRM analyzed for total carbon during analysis run for Total Organic Carbon on samples. The SRM was not analyzed for TOC because no reference value for TOC is available.</p>			

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call S. Kent at 2- 1203 .

Reference(s): S. Kent Notebook No. 990, pp. 113-120.

Copies To: M. Robinet P. Lindahl Analyst(s): S. Kent
M. O'Connor D. Graczyk
C. Sholeen F. Martino
D. Geraghty ACL Results File
D. Green ACL 200 File

REPORT OF ANALYTICAL RESULTS

Sample Material: JANUS Characterization (Soils)
Submitted by: M. Robinet

Date Received: 1/11/96
Date Reported: 2/7/96

Submitter's Sample No.	ACL Sample No.			
	96-8064-01 thru 96-8064-06	<u>Total Carbon</u>		
		<u>Calibration Verification Standards</u>		
		<u>Standard, Wt. % C</u>	<u>% Recovery Before Samples Run</u>	<u>% Recovery After Samples Run</u>
		0.0072	94.4	93.1
		0.021	97.1	96.7
		0.035	84.9	92.6
		0.059	102.2	102.9
		0.172	105.0	105.2
		0.370	103.0	102.4
		<u>Total Organic Carbon</u>		
		<u>Calibration Verification Standards</u>		
		<u>Standard, Wt. % C</u>	<u>% Recovery Before Samples Run</u>	<u>% Recovery After Samples Run</u>
		0.0072	81.9	97.2
		0.021	95.7	104.3
		0.035	92.3	96.9
		0.059	99.5	102.0
		0.172	105.8	106.7
		0.370	102.2	102.2
		Carbon determined using the LECO WR-12 Analyzer. Combustion is at ~1500°C in pure oxygen. Instrument detection limit (IDL) is 25 µg C.		

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call S. Kent at 2- 1203 .

Reference(s): S. Kent Notebook No. 990, pp. 113-120.

Copies To: M. Robinet
M. O'Connor
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D. Geraghty
D. Green
P. Lindahl
D. Graczyk
F. Martino
ACL Results File
200 Results File

Analyst(s): S. Kent

Page 3 of 3

CASE NARRATIVE - Phenols in Soil**1. INORGANIC ANALYSIS DATA PACKAGE**

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: S1-A (ACL 96-8064)

Number of Pages: 2

2. INTRODUCTION

Six soil samples from the grounds surrounding the JANUS Reactor facility were analyzed to determine soil phenols as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Each soil sample was analyzed to determine phenols by Method 9065 modified. A method modification was necessary for the analysis of the soil samples because Method 9065 (Phenolics) as described in the U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, September 1986 is designed for the analysis of water samples. This method represents the current promulgated method for determination of phenols and was specified in the characterization plan. Currently, there is no SW-846 method specific to the determination of phenols in soil. This report contains results and raw data from the determination of phenols in these soils.

3. METHODS

The methods applied to the analyses described in this package are as listed in the following table:

Method for Determination of Phenols in JANUS Facility Characterization Soil Samples		
Samples	Parameter Determined	Method (SW-846)
Soils, Surrounding Grounds	Phenols	9065 (Phenolics) - Modified

4. CLARIFICATIONS AND COMMENTS

A. Phenols Determination

Procedure: Method 9065 was modified for the analysis of the soil samples. The modification was to add the soil sample, 25 g, to 500 mL of water and then proceed as if analyzing a water.

Equipment: Spectrophotometric analysis of sample distillates was performed with a Cary 16 Spectrophotometer.

Holding Time: Samples in this SDG were collected on January 11, 1996, distilled on January 23 or 24, 1996 and analyzed on February 9, 1996. Hence, the holding time requirement for phenol (28 days) was exceeded by one day. The exceedance is noted, but it is not expected that this deviation will adversely impact the quality of the phenols data since both the original soil samples and the associated distillates were maintained in refrigerated storage at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. This aspect is important since refrigeration at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ is designed to maintain sample and distillate integrity by minimizing biological degradation.

5. QUALITY CONTROL

Quality control measurements appropriate to Method 9065 were performed when samples were analyzed. These included a blank, spike and spike duplicates, and laboratory control samples. Results of the QC measurements are presented on the Report of Analytical Results form together with results for each sample. Data generated during the analyses (copies of logbook pages) are included in this package. Chain of Custody forms for the samples are collected at the back of this report.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to evaluate the concentration of phenols in the soil samples showed several values at the method detection limit (MDL) ($800 \mu\text{g/kg}$) and several values just above the MDL. The values ranged from $<800 \mu\text{g/kg}$ to $1330 \mu\text{g/kg}$. Recovery results for the spiked samples were well within the typically acceptable percent recovery range (80-120%) for spiked samples. The agreement between the spiked and spiked duplicate samples was also within the typically acceptable range ($\pm 20\%$).

Date 2-22-96
Donald G. Graczyk,
Laboratory Supervisor

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Soils from JANUS Characterization
Submitted by: M. Robinet

Date Received: 1/11/96
Date Reported: 2/12/96

Submitter's Sample No.	ACL Sample No.	Date Collected	Date Distilled	Date Analyzed	Phenols ^{a,b}	
					µg/kg	µg/L
S1-A	96-8064-01	1/11/96	1/23/96	2/9/96	850	--
S6-A	-02	1/11/96	1/23/96	2/9/96	<800	--
S9-A	-03	1/11/96	1/24/96	2/9/96	812	--
W1-A	-04	1/11/96	1/24/96	2/9/96	1330	--
W6-A	-05	1/11/96	1/24/96	2/9/96	<800	--
W9-A	-06	1/11/96	1/24/96	2/9/96	1080	--
	Blank	--	--	--	--	<20.0
	Laboratory Control Sample	1000 µg/L phenol added 1000 µg/L phenol found: 100.0% Recovery				
	96-8064-05S Spike	47,100 µg/kg phenol added 47,600 µg/kg phenol found: 101.1% Recovery				
	96-8064- 05SD Spike Duplicate	47,100 µg/kg phenol added 45,200 µg/kg phenol found: 96.0% Recovery				
<div><div>^a Samples were analyzed to determine total steam distillable phenols by U.S. EPA Method 9065, Phenolics (Spectrophotometric, Manual 4-AAP with Distillation), as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, September 1986. Method detection limit is 20 µg/L (800 µg/kg for a 25 g sample).</div><div>^b Values reported for soils on a dry weight basis.</div></div>						

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. TenKate at 2- 7398.

Reference(s): CMT Notebook No. 653, pp. 22-27; CMT Notebook No. 1254, pg. 81 (percent solids).

Copies To: M. Robinet
M. O'Connor
C. Sholeen
D. Green
P. Lindahl
D. Graczyk
F. Martino
L. TenKate
ACL Results File
ACL 200 File

Analyst(s): L. TenKate

L. TenKate

February 13, 1996

CASE NARRATIVE - Cyanide and Sulfide in Soil

1. INORGANIC ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: S1-A (ACL 96-8064)

Number of Pages: 3

2. INTRODUCTION

Six soil samples from the grounds surrounding the JANUS Reactor facility were analyzed to determine soil cyanide and sulfide as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Each soil sample was analyzed to determine cyanide by Method 9010A (Total and Amenable Cyanide), and acid-insoluble sulfide by Method 9030A (Acid-Soluble and Acid-Insoluble Sulfides) in the U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, Update I, July 1992. These methods represent the current promulgated methods for determinations of cyanide and sulfide and were applied in place of Methods 9010 and 9030, which are specified in the characterization plan. This report contains results and raw data from the cyanide and sulfide determinations on these soils.

3. METHODS

The methods applied to the analyses described in this package are as listed in the following table:

Methods for Determinations of Cyanide and Sulfide in JANUS Facility Characterization Soil Samples		
Samples	Parameter Determined	Method (SW-846)
Soils, Surrounding Grounds	Cyanide (Total)	9010A (Total and Amenable Cyanide)
	Sulfide (Total)	9030A (Acid-Soluble and Acid-Insoluble Sulfide)

4. CLARIFICATIONS AND COMMENTS

A. Cyanide Determinations

Procedure: No deviations from the specified procedure were noted during the analysis of the samples or the review of the data.

Equipment: Spectrophotometric analysis of sample distillates was performed with a Cary 16 Spectrophotometer.

Holding Time: Samples in this SDG were collected on January 11, 1996 and were analyzed on January 16, 1996. Hence, the holding time requirement for cyanide (14 days) was met.

B. Sulfide Determinations

Procedure: For the determination of total sulfide in these samples the procedure described in the method for acid-insoluble sulfide was used instead of the procedure for acid-soluble sulfide. As required in the method, the acid-insoluble sulfide procedure is to be used when a low recovery is calculated for the matrix spiked sample analyzed by the acid-soluble sulfide procedure.

Equipment: Titrimetric analysis of the sample distillates was conducted using a Metrohm 665 Dosimat.

Holding Time: Samples in this SDG were collected on January 11, 1996 and were analyzed on January 18, 1996. Hence, the holding time requirement for sulfide (7 days) was met.

5. QUALITY CONTROL

Quality control measurements appropriate to both Methods 9010A and 9030A were performed when samples were analyzed. These included blanks, spike and spike duplicates, and laboratory control samples. Results of the QC measurements are presented on the Report of Analytical Results form together with results for each sample. Data generated during the analyses (copies of logbook pages) are included in this package. Chain of Custody forms for the samples are collected at the back of this report.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to evaluate soil cyanide showed no values above the interim EPA guidance level for reactive cyanide. The current EPA guidance level for total releasable cyanide is 250 mg HCN/kg. Values of the soil cyanide ranged from <0.02 mg/kg to 0.15 mg/kg. Results of the measurements to evaluate soil sulfide showed two samples, W6-A and W9-A, elevated in sulfide content, 43.9 mg/kg and 359 mg/kg, respectively. Neither value is above the interim EPA guidance level for reactive sulfide. The current EPA guidance level for total releasable sulfide is 500 mg H_2S /kg. It should be noted that sample W9-A was much darker black in color than the other samples but it had no distinguishing odor. The acid-insoluble sulfide values ranged from <20.0 mg/kg to 359 mg/kg. Results for the duplicate determinations agreed within the combined uncertainties for the two measurements.

Date 2-16-96
Donald G. Graczyk,
Laboratory Supervisor

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Soils from JANUS Characterization

Date Received: 1/11/96

Submitted by: M. Robinet

Date Reported: 1/29/96

Submitter's Sample No.	ACL Sample No.	Cyanide ^a
S1-A	96-8064-01	0.11 mg/kg
S6-A	-02	0.15 mg/kg
Spike	-02S	25.5 mg/kg (Spike Added: 25.6 mg/kg - 99.0% Recovery)
Spike Duplicate	-02SD	25.6 mg/kg (Spike Added: 25.6 mg/kg - 99.4% Recovery)
S9-A	-03	<0.02 mg/kg
W1-A	-04	0.13 mg/kg
W6-A	-05	0.09 mg/kg
W9-A	-06	<0.02 mg/kg
	Preparation	
	Blank	<0.2 µg/L
	LCS ^b	6.05 mg/kg (Control Limits: 4.3 mg/kg to 6.9 mg/kg,
	ICV	77.7 µg/L (Expected Value: 80.6 µg/L - 96.4% Recovery)
	CCV	76.4 µg/L (Expected Value: 80.6 µg/L - 94.8% Recovery)
^a Samples were analyzed by spectrophotometry according to the U.S. EPA Method 9010 A as described in "Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, Final Update I, July 1992. Quality control measurements were made consistent with protocol described in U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis (SOW ILMO3.0). QC measurements included spike sample (96-8064-02S), spike duplicate sample (96-8064-02SD), Laboratory Control Sample (LCS), Initial Calibration Verification sample (ICV), and Continuing Calibration Verification sample (CCV). The method detection limit for cyanide is 0.2 µg/L (equivalent to 0.02 mg/kg). ^b EPA Reference Material, Solid Laboratory Control Sample - Cyanide, LCS (Cyanide) 0689.		

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call J. Marr at 2- 9638 .

Reference(s): Notebook No. 814, pp. 68-71.

Copies To:	M. Robinet	F. Martino	Analyst(s):	J. Marr
	M. O'Connor	D. Graczyk		
	C. Sholeen	J. Marr		
jll/amb	D. Green	ACL Results File		
2/7/96	P. Lindahl	ACL 200 File		

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Soils from JANUS Characterization
Submitted by: M. Robinet

Date Received: 1/11/96
Date Reported: 2/7/96

Submitter's Sample No.	ACL Sample No.	Date Collected	Date Analyzed	Acid-Insoluble Sulfides ^a	
				mg/kg	mg/L
S1-A	96-8064-01	1/11/96	1/16/96	<20.0	--
S6-A	-02	1/11/96	1/16/96	<20.0	--
S9-A	-03	1/11/96	1/17/96	<20.0	--
W1-A	-04	1/11/96	1/16/96	<20.0	--
W6-A	-05	1/11/96	1/17/96	43.9	--
W9-A	-06	1/11/96	1/17/96	359	--
	Blank	--	--	--	<5.0
	Laboratory Control Sample		87 mg/L sulfide added (as sodium sulfide) 71.8 mg/L sulfide found (82.5% Recovery)		
	96-8064-04S Spike		421 mg/kg sulfide added (as sodium sulfide) 397 mg/kg sulfide found (94.3% Recovery)		
	96-8064-04SD Spike Duplicate		416 mg/kg sulfide added (as sodium sulfide) 346 mg/kg sulfide found (83.2% Recovery)		

^a Samples were analyzed to determine acid-insoluble sulfides by U.S. EPA Method 9030A, Acid-Soluble and Acid-Insoluble Sulfides, as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, Update I, July 1992. Method detection limit is 5.0 mg/L (20 mg/kg for 12 g sample).

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. TenKate at 2- 7398.

Reference(s): CMT Notebook No. 651, pp. 132-141.

Copies To:	M. Robinet	D. Graczyk	Analyst(s):	L. TenKate
	M. O'Connor	F. Martino		
	C. Sholeen	L. TenKate		
/amb	D. Green	ACL Results File		
2/7/96	P. Lindahl	ACL 200 File		

February 13, 1996

CASE NARRATIVE

1. VOLATILE ORGANICS DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: S1-B

Instrument: HP5970 GC/MSD-1; HP UNIX System Software; Tekmar Purge and Trap Model 4000 Dynamic Headspace Concentrator with Automatic Laboratory Sampler

2. INTRODUCTION

Analyses of samples for volatile organic compounds, which are reported in this data package, were performed using Method 8260A in the EPA Document SW-846 (Final Update II, Revision 1, September 1994).

The enclosed data package contains data for seven soil samples, one matrix spike (MS) sample, one matrix spike duplicate (MSD) sample, and two method blanks. The samples were collected from the Janus Reactor site and were received on January 11 and 29, 1996.

The samples were stored at 4°C until the analyses were performed on the dates given on the attached bench sheets.

3. SUMMARY COMMENTS

Holding Time: Holding time was met for all samples included in this data package.

GC/MS Tuning: All samples were analyzed within 12 hours of a BFB tune which met tuning criteria.

Instrument Calibrations: All instrumental calibrations met SW-846 criteria.

Laboratory Blanks: The laboratory blanks were found to be within SW-846 criteria.

Surrogate Recoveries: All of the surrogate recoveries reported in this data package were within SW-846 QC limits.

Matrix Spike Recoveries: SW-846 provides no QC limits for recoveries of matrix spike compounds for volatile organic analysis. Matrix spike and MSD recoveries were within the CLP (Contract Laboratory Program) QC limits for ten out of ten values reported; relative percent difference between MS and MSD were within the CLP QC limits for five out of five values reported.

4. **DATA PACKAGE CLARIFICATIONS**

Copies of pages from the VOA Sample Preparation Book V are included at the end of the data package.

Date 2/13/96
Laura L. Chromizky, Analyst
Volatile Organic Analysis

Date 2/13/96
Amrit S. Boparai, Group Leader
Organic Analysis Group

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S1-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-01

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
74-87-3	CHLOROMETHANE	10.00	U
75-01-4	VINYL CHLORIDE	10.00	U
74-83-9	BROMOMETHANE	10.00	U
75-00-3	CHLOROETHANE	10.00	U
75-35-4	1 1-DICHLOROETHENE	10.00	U
75-09-2	METHYLENE CHLORIDE	10.00	U
156-60-5	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3	1 1-DICHLOROETHANE	10.00	U
74-97-5	BROMOCHLOROMETHANE	10.00	U
67-66-3	CHLOROFORM	10.00	U
71-55-6	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5	CARBON TETRACHLORIDE	10.00	U
71-43-2	BENZENE	10.00	U
107-06-2	1 2-DICHLOROETHANE	10.00	U
79-01-6	TRICHLOROETHENE	10.00	U
78-87-5	1 2-DICHLOROPROPANE	10.00	U
75-27-4	BROMODICHLOROMETHANE	10.00	U
10061-02-0	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3	TOLUENE	10.00	U
10061-01-0	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4	TETRACHLOROETHENE	10.00	U
124-48-1	DIBROMOCHLOROMETHANE	10.00	U
108-90-7	CHLOROBENZENE	10.00	U
100-41-4	ETHYL BENZENE	10.00	U
	m&p-XYLENE	10.00	U
95-47-6	o-XYLENE	10.00	U
100-42-5	STYRENE	10.00	U
75-25-2	BROMOFORM	10.00	U
79-34-5	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7	2 2-DICHLOROPROPANE	10.00	U
156-59-2	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S1-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-01

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
106-43-4-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S1-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-01

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S6-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-02

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
74-87-3-----	CHLOROMETHANE	10.00	U
75-01-4-----	VINYL CHLORIDE	10.00	U
74-83-9-----	BROMOMETHANE	10.00	U
75-00-3-----	CHLOROETHANE	10.00	U
75-35-4-----	1 1-DICHLOROETHENE	10.00	U
75-09-2-----	METHYLENE CHLORIDE	10.00	U
156-60-5-----	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3-----	1 1-DICHLOROETHANE	10.00	U
74-97-5-----	BROMOCHLOROMETHANE	10.00	U
67-66-3-----	CHLOROFORM	10.00	U
71-55-6-----	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5-----	CARBON TETRACHLORIDE	10.00	U
71-43-2-----	BENZENE	10.00	U
107-06-2-----	1 2-DICHLOROETHANE	10.00	U
79-01-6-----	TRICHLOROETHENE	10.00	U
78-87-5-----	1 2-DICHLOROPROPANE	10.00	U
75-27-4-----	BROMODICHLOROMETHANE	10.00	U
10061-02-0-----	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3-----	TOLUENE	10.00	U
10061-01-0-----	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5-----	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4-----	TETRACHLOROETHENE	10.00	U
124-48-1-----	DIBROMOCHLOROMETHANE	10.00	U
108-90-7-----	CHLOROBENZENE	10.00	U
100-41-4-----	ETHYL BENZENE	10.00	U
-----	m&p-XYLENE	10.00	U
95-47-6-----	o-XYLENE	10.00	U
100-42-5-----	STYRENE	10.00	U
75-25-2-----	BROMOFORM	10.00	U
79-34-5-----	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8-----	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4-----	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7-----	2 2-DICHLOROPROPANE	10.00	U
156-59-2-----	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6-----	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S6-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-02

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
106-43-4-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S6-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-02

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 109-99-9	Furan, tetrahydro-	11.960	9.26	NJ

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S9-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-03

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
74-87-3	CHLOROMETHANE	10.00	U
75-01-4	VINYL CHLORIDE	10.00	U
74-83-9	BROMOMETHANE	10.00	U
75-00-3	CHLOROETHANE	10.00	U
75-35-4	1 1-DICHLOROETHENE	10.00	U
75-09-2	METHYLENE CHLORIDE	10.00	U
156-60-5	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3	1 1-DICHLOROETHANE	10.00	U
74-97-5	BROMOCHLOROMETHANE	10.00	U
67-66-3	CHLOROFORM	10.00	U
71-55-6	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5	CARBON TETRACHLORIDE	10.00	U
71-43-2	BENZENE	10.00	U
107-06-2	1 2-DICHLOROETHANE	10.00	U
79-01-6	TRICHLOROETHENE	10.00	U
78-87-5	1 2-DICHLOROPROPANE	10.00	U
75-27-4	BROMODICHLOROMETHANE	10.00	U
10061-02-0	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3	TOLUENE	10.00	U
10061-01-0	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4	TETRACHLOROETHENE	10.00	U
124-48-1	DIBROMOCHLOROMETHANE	10.00	U
108-90-7	CHLOROBENZENE	10.00	U
100-41-4	ETHYL BENZENE	10.00	U
	m&p-XYLENE	10.00	U
95-47-6	o-XYLENE	10.00	U
100-42-5	STYRENE	10.00	U
75-25-2	BROMOFORM	10.00	U
79-34-5	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7	2 2-DICHLOROPROPANE	10.00	U
156-59-2	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S9-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-03

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
106-43-4-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: S9-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-03

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 109-99-9	Furan, tetrahydro-	11.960	6.87	NJ

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W1-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-04

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
74-87-3	CHLOROMETHANE	10.00	U
75-01-4	VINYL CHLORIDE	10.00	U
74-83-9	BROMOMETHANE	10.00	U
75-00-3	CHLOROETHANE	10.00	U
75-35-4	1 1-DICHLOROETHENE	10.00	U
75-09-2	METHYLENE CHLORIDE	10.00	U
156-60-5	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3	1 1-DICHLOROETHANE	10.00	U
74-97-5	BROMOCHLOROMETHANE	10.00	U
67-66-3	CHLOROFORM	10.00	U
71-55-6	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5	CARBON TETRACHLORIDE	10.00	U
71-43-2	BENZENE	10.00	U
107-06-2	1 2-DICHLOROETHANE	10.00	U
79-01-6	TRICHLOROETHENE	10.00	U
78-87-5	1 2-DICHLOROPROPANE	10.00	U
75-27-4	BROMODICHLOROMETHANE	10.00	U
10061-02-0	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3	TOLUENE	10.00	U
10061-01-0	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4	TETRACHLOROETHENE	10.00	U
124-48-1	DIBROMOCHLOROMETHANE	10.00	U
108-90-7	CHLOROBENZENE	10.00	U
100-41-4	ETHYL BENZENE	10.00	U
	m&p-XYLENE	10.00	U
95-47-6	o-XYLENE	10.00	U
100-42-5	STYRENE	10.00	U
75-25-2	BROMOFORM	10.00	U
79-34-5	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7	2 2-DICHLOROPROPANE	10.00	U
156-59-2	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W1-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-04

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
106-43-4-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W1-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-04

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 109-99-9	Furan, tetrahydro-	11.960	8.02	NJ

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W6-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-05

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
74-87-3-----	CHLOROMETHANE	10.00	U
75-01-4-----	VINYL CHLORIDE	10.00	U
74-83-9-----	BROMOMETHANE	10.00	U
75-00-3-----	CHLOROETHANE	10.00	U
75-35-4-----	1 1-DICHLOROETHENE	10.00	U
75-09-2-----	METHYLENE CHLORIDE	10.00	U
156-60-5-----	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3-----	1 1-DICHLOROETHANE	10.00	U
74-97-5-----	BROMOCHLOROMETHANE	10.00	U
67-66-3-----	CHLOROFORM	10.00	U
71-55-6-----	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5-----	CARBON TETRACHLORIDE	10.00	U
71-43-2-----	BENZENE	10.00	U
107-06-2-----	1 2-DICHLOROETHANE	10.00	U
79-01-6-----	TRICHLOROETHENE	10.00	U
78-87-5-----	1 2-DICHLOROPROPANE	10.00	U
75-27-4-----	BROMODICHLOROMETHANE	10.00	U
10061-02-0-----	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3-----	TOLUENE	10.00	U
10061-01-0-----	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5-----	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4-----	TETRACHLOROETHENE	10.00	U
124-48-1-----	DIBROMOCHLOROMETHANE	10.00	U
108-90-7-----	CHLOROBENZENE	10.00	U
100-41-4-----	ETHYL BENZENE	10.00	U
-----	m&p-XYLENE	10.00	U
95-47-6-----	o-XYLENE	10.00	U
100-42-5-----	STYRENE	10.00	U
75-25-2-----	BROMOFORM	10.00	U
79-34-5-----	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8-----	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4-----	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7-----	2 2-DICHLOROPROPANE	10.00	U
156-59-2-----	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6-----	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W6-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-05

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:		Q
		(ug/L or ug/Kg)	ug/Kg	
74-95-3-----	DIBROMOMETHANE	10.00		U
142-28-9-----	1 3-DICHLOROPROPANE	10.00		U
106-93-4-----	1 2-DIBROMOETHANE	10.00		U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00		U
98-82-8-----	ISOPROPYLBENZENE	10.00		U
108-86-1-----	BROMOBENZENE	10.00		U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00		U
103-65-1-----	n PROPYLBENZENE	10.00		U
95-49-8-----	2 CHLOROTOLUENE	10.00		U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00		U
106-43-4-----	4 CHLOROTOLUENE	10.00		U
98-06-6-----	TERT BUTYLBENZENE	10.00		U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00		U
135-98-8-----	SEC-BUTYLBENZENE	10.00		U
99-87-6-----	p ISOPROPYLTOLUENE	10.00		U
541-73-1-----	1 3 DICHLOROBENZENE	10.00		U
106-46-7-----	1 4 DICHLOROBENZENE	10.00		U
104-51-8-----	n BUTYLBENZENE	10.00		U
95-50-1-----	1 2-DICHLOROBENZENE	10.00		U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00		U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00		U
87-68-3-----	HEXACHLOROBUTADIENE	10.00		U
91-20-3-----	NAPHTHALENE	10.00		U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00		U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W6-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-05

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W9-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-06

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

74-87-3-----	CHLOROMETHANE	10.00	U
75-01-4-----	VINYL CHLORIDE	10.00	U
74-83-9-----	BROMOMETHANE	10.00	U
75-00-3-----	CHLOROETHANE	10.00	U
75-35-4-----	1 1-DICHLOROETHENE	10.00	U
75-09-2-----	METHYLENE CHLORIDE	10.00	U
156-60-5-----	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3-----	1 1-DICHLOROETHANE	10.00	U
74-97-5-----	BROMOCHLOROMETHANE	10.00	U
67-66-3-----	CHLOROFORM	10.00	U
71-55-6-----	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5-----	CARBON TETRACHLORIDE	10.00	U
71-43-2-----	BENZENE	10.00	U
107-06-2-----	1 2-DICHLOROETHANE	10.00	U
79-01-6-----	TRICHLOROETHENE	10.00	U
78-87-5-----	1 2-DICHLOROPROPANE	10.00	U
75-27-4-----	BROMODICHLOROMETHANE	10.00	U
10061-02-0-----	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3-----	TOLUENE	10.00	U
10061-01-0-----	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5-----	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4-----	TETRACHLOROETHENE	10.00	U
124-48-1-----	DIBROMOCHLOROMETHANE	10.00	U
108-90-7-----	CHLOROBENZENE	10.00	U
100-41-4-----	ETHYL BENZENE	10.00	U
-----	m&p-XYLENE	10.00	U
95-47-6-----	o-XYLENE	10.00	U
100-42-5-----	STYRENE	10.00	U
75-25-2-----	BROMOFORM	10.00	U
79-34-5-----	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8-----	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4-----	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7-----	2 2-DICHLOROPROPANE	10.00	U
156-59-2-----	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6-----	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W9-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-06

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----1	3-DICHLOROPROPANE	10.00	U
106-93-4-----1	2-DIBROMOETHANE	10.00	U
630-20-6-----1 1 1	2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----1 2	3-TRICHLOROPROPANE	10.00	U
103-65-1-----n	PROPYLBENZENE	10.00	U
95-49-8-----2	CHLOROTOLUENE	10.00	U
108-67-8-----1 3	5-TRIMETHYLBENZENE	10.00	U
106-43-4-----4	CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----1,2,4	TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----p	ISOPROPYLTOLUENE	10.00	U
541-73-1-----1 3	DICHLOROBENZENE	10.00	U
106-46-7-----1 4	DICHLOROBENZENE	10.00	U
104-51-8-----n	BUTYLBENZENE	10.00	U
95-50-1-----1	2-DICHLOROBENZENE	10.00	U
96-12-8-----1	2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----1 2	4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----1 2 3	TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: W9-B

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8060-06

Date Received: 01/11/96

Sample Type: SOIL

Date Reported: 01/25/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====

February 13, 1996

CASE NARRATIVE

1. SEMIVOLATILE ORGANIC DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: S1-C
Instrument: Hewlett Packard 5890 Ser II GC/5989 MS with Unix-Based Target 3.1 Software

2. INTRODUCTION

Sample preparation is based on U.S. EPA Method 3550A (SW-846, Revision 1, September 1994). The analytical method used is based on EPA Method 8270B (SW-846, Revision 1, September 1994) for semivolatile organic compounds. The methods described are appropriate for the determination of 92 semivolatile organic compounds that are partitioned into an organic solvent and are amenable to gas chromatography. The target compounds do not include PCB/Pesticides.

The enclosed data package contains data for six soil samples, one matrix spike (MS) sample, one matrix spike duplicate (MSD) sample and one laboratory blank. The samples were collected from the Janus Reactor, Argonne National Laboratory-East, and were received on January 11, 1996.

3. SUMMARY COMMENTS

Holding Time: Holding time was met for all the samples.

GC/MS Tuning: All samples were analyzed within 12 h of a DFTPP tune, which met the method tuning criteria.

Instrument Calibration: All instrument calibrations, initial and continuing, met the QC criteria with the exception of hexachlorocyclopentadiene and 2,4-dinitrophenol. Their relative response factors were out of the QC limit ($RF < 0.05$) for some of the calibration standards. However, this should not affect the data quality since these two compounds were not detected in the samples.

Internal Standard Area: Internal standard (IS) area were within the QC limits for 54 out of 54 values reported.

Laboratory Blank: Phthalates and some TICs were found in the laboratory blank as well as in the samples. Since the laboratory blank did not contain any of the target analytes (except for phthalates) it meet method criteria.

Surrogate Recoveries: All of the surrogate recoveries were within the QC limits for 54 out of 54 values reported.

Matrix Spikes: All of the MS and MSD recoveries were within the CLP QC limits for 22 out of 22 values reported; relative percent difference (RPD) between MS and MSD were within the CLP QC limits for 11 out of 11 values reported.

4. DATA PACKAGE CLARIFICATIONS

Estimated Quantitation Limits (EQLs): The EQLs for all the target compounds are based on 10 ng on column (330 µg/kg for soil sample) except for the following target compounds for which the EQLs are 20 ng on column (660 µg/kg for soil sample): methyl methanesulfonate, hexachlorocyclopentadiene, 2,4-dinitrophenol, 4-nitrophenol, α,α-dimethylphenethylamine, and benzidine. The EQL values reported in this data package meet the EQL criteria of EPA Method 8270B.

N-nitrosodiphenylamine and Diphenylamine: N-nitrosodiphenylamine (N-nitrosoDPA) can not be separated from diphenylamine as stated in EPA Method 8270B. Since these two compounds co-elute, they are reported as N-nitroso DPA and diphenylamine on the Quantitation Reports and Form I.

Aldol Condensation: An Aldol condensation product (4-hydroxyl-4-methyl-2-pentanone) was detected (RT=9-10 minutes) in all of the samples and laboratory blank. The aldol condensation product is normally formed when acetone is used for extraction. Therefore, it is not reported as an Tentatively Identified Compound (TIC).

Date 2/15/96
Yifen Tsai, Analyst
Semivolatile Organic Analysis

Date 2/15/96
Amrit S. Boparai, Group Leader
Organic Analysis Group

1B

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: S1-C
Sample Location:
Lab Sample ID: 96-8062-01
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan246
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/Kg	Q
62-75-9-----	N-Nitrosodimethylamine	330	U
109-06-8-----	2-Picoline	330	U
66-27-3-----	Methyl methansulfonate	660	U
62-50-0-----	Ethyl methansulfonate	330	U
108-95-2-----	Phenol	330	U
62-53-3-----	Aniline	330	U
111-44-4-----	bis(2-Chloroethyl) ether	330	U
95-57-8-----	2-Chlorophenol	330	U
541-73-1-----	1,3-Dichlorobenzene	330	U
106-46-7-----	1,4-Dichlorobenzene	330	U
100-51-6-----	Benzyl alcohol	330	U
95-48-7-----	2-Methylphenol	330	U
95-50-1-----	1,2-Dichlorobenzene	330	U
106-44-5-----	4-Methylphenol	330	U
108-60-1-----	bis(2-Chloroisopropyl) ether	330	U
98-86-2-----	Acetophenone	330	U
621-64-7-----	N-nitroso-di-n-propylamine	330	U
67-72-1-----	Hexachloroethane	330	U
98-95-3-----	Nitrobenzene	330	U
100-75-4-----	N-Nitrosopiperidine	330	U
78-59-1-----	Isophorone	330	U
88-75-5-----	2-Nitrophenol	330	U
105-67-9-----	2,4-Dimethyphenol	330	U
65-85-0-----	Benzoic acid	330	U
111-91-1-----	bis(2-Chloroethoxy) methane	330	U
120-83-2-----	2,4-Dichlorophenol	330	U
122-09-8-----	a,a-Dimethylphenethylamine	660	U
120-82-1-----	1,2,4-Trichlorobenzene	330	U
91-20-3-----	Naphthalene	330	U
106-47-8-----	4-Chloroaniline	330	U
87-65-0-----	2,6-Dichlorophenol	330	U
87-68-3-----	Hexachlorobutadiene	330	U
924-16-3-----	N-Nitrosodibutylamine	330	U
59-50-7-----	4-Chloro-3-methylphenol	330	U
91-57-6-----	2-Methylnaphthalene	330	U
77-47-4-----	Hexachlorocyclopentadiene	660	U
95-94-3-----	1,2,4,5-Tetrachlorobenzene	330	U

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: S1-C
 Sample Location:
 Lab Sample ID: 96-8062-01
 Sample Matrix: SOIL
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan246
 Sample Date: JAN/11/96
 Sample Point:
 Date Received: JAN/11/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/Kg	Q
88-06-2-----	2,4,6-Trichlorophenol	330	U
95-95-4-----	2,4,5-Trichlorophenol	330	U
91-58-7-----	2-Chloronaphthalene	330	U
90-13-1-----	1-Chloronaphthalene	330	U
88-74-4-----	2-Nitroaniline	330	U
131-11-3-----	Dimethyl phthalate	330	U
606-20-2-----	2,6-Dinitrotoluene	330	U
208-96-8-----	Acenaphthylene	330	U
-----	3-Nitroaniline	330	U
83-32-9-----	Acenaphthene	330	U
51-28-5-----	2,4-Dinitrophenol	660	U
100-02-7-----	4-Nitrophenol	660	U
608-93-5-----	Pentachlorobenzene	330	U
121-14-2-----	2,4-Dinitrotoluene	330	U
91-59-8-----	2-Naphthylamine	330	U
58-90-2-----	2,3,4,6-Tetrachlorophenol	330	U
134-32-7-----	1-Naphthylamine	330	U
84-66-2-----	Diethylphthalate	330	U
86-73-7-----	Fluorene	330	U
7005-72-3-----	4-Chlorophenyl phenyl ether	330	U
100-01-6-----	4-Nitroaniline	330	U
534-52-1-----	4,6-Dinitro-2-methylphenol	330	U
132-64-9-----	Dibenzofuran	330	U
-----	N-NitrosoDPA & Diphenylamine	160	U
122-66-7-----	1,2-Diphenylhydrazine	330	U
62-44-2-----	Phenacetin	330	U
101-55-3-----	4-Bromophenyl phenyl ether	330	U
118-74-1-----	Hexachlorobenzene	330	U
87-86-5-----	Pentachlorophenol	330	U
206-44-0-----	Fluoranthene	330	U
82-68-8-----	Pentachloronitrobenzene	330	U
92-67-1-----	4-Aminobiphenyl	330	U
23950-58-5-----	Pronamide	330	U
85-01-8-----	Phenanthrene	330	U
120-12-7-----	Anthracene	330	U
84-74-2-----	Di-n-butylphthalate	1090	
129-00-0-----	Pyrene	330	U

1 D

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: S1-C
 Sample Location:
 Lab Sample ID: 96-8062-01
 Sample Matrix: SOIL
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan246
 Sample Date: JAN/11/96
 Sample Point:
 Date Received: JAN/11/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
92-87-5-----	Benzidine	660	U
60-11-7-----	p-Dimethylaminoazobenzene	330	U
85-68-7-----	Butylbenzylphthalate	330	U
91-94-1-----	3,3'-Dichlorobenzidine	330	U
56-55-3-----	Benzo (a) anthracene	330	U
218-01-9-----	Chrysene	330	U
117-81-7-----	bis (2-Ethylhexyl) phthalate	268	J
117-84-0-----	Di-n-octylphthalate	330	U
205-99-2-----	Benzo (b) fluoranthene	330	U
207-08-9-----	Benzo (k) fluoranthene	330	U
50-32-8-----	Benzo (a) pyrene	330	U
56-49-5-----	3-Methylcholanthrene	330	U
224-42-0-----	Dibenz (a, j) acridine	330	U
193-39-5-----	Indeno (1,2,3-cd) pyrene	330	U
53-70-3-----	Dibenzo (a, h) anthracene	330	U
191-24-2-----	Benzo (g, h, i) perylene	330	U
=====			
367-12-4-----	2-Fluorophenol	5670	
-----	Phenol-d5	5650	
-----	Nitrobenzene-d5	3020	
321-60-8-----	2-Fluorobiphenyl	3280	
-----	2,4,6-Tribromophenol	5580	
-----	Terphenyl-d14	3680	

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: S1-C
Sample Location:
Lab Sample ID: 96-8062-01
Sample Matrix: SOIL
Analysis Type: SV

Client SDG: 4jan246
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96

Level: LOW

Number TICs found: 20

CONCENTRATION UNITS:
(ug/L or ug/KG) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1.	Oxirane, Trimethyl	3.740	179	JB
2. 75-85-4	2-Butanol, 2-methyl-	4.070	1490	NJB
3. 563-80-4	2-Butanone, 3-methyl-	4.379	691	NJB
4.	3-pentene-2-ol	4.936	478	JB
5. 141-79-7	3-Penten-2-one, 4-methyl-	7.823	872	NJB
6.	Unknown	8.462	4210	JB
7.	Unknown	8.772	4430	JB
8.	Unknown	10.463	276	JB
9.	Unknown	11.185	193	JB
10.	Unknown	11.350	2500	JB
11. 79-34-5	Ethane, 1,1,2,2-tetrachloro	11.536	438	NJB
12.	Unknown	11.804	737	J
13.	Unknown	12.092	341	J
14.	Unknown	18.878	516	J
15. 1002-43-3	Undecane, 3-methyl-	29.933	200	NJ
16. 1921-70-6	Pentadecane, 2,6,10,14-tetr	29.995	409	NJ
17. 593-45-3	Octadecane	31.418	200	NJ
18. 4337-65-9	Hexanedioic acid, mono(2-ethylhexyl)ester	36.543	2630	NJ
19. 629-99-2	Pentacosane	36.626	349	NJ

1 B

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: S6-C
Sample Location:
Lab Sample ID: 96-8062-02
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/Kg	Q
62-75-9-----	N-Nitrosodimethylamine	330	U
109-06-8-----	2-Picoline	330	U
66-27-3-----	Methyl methansulfonate	660	U
62-50-0-----	Ethyl methansulfonate	330	U
108-95-2-----	Phenol	330	U
62-53-3-----	Aniline	330	U
111-44-4-----	bis(2-Chloroethyl) ether	330	U
95-57-8-----	2-Chlorophenol	330	U
541-73-1-----	1,3-Dichlorobenzene	330	U
106-46-7-----	1,4-Dichlorobenzene	330	U
100-51-6-----	Benzyl alcohol	330	U
95-50-1-----	1,2-Dichlorobenzene	330	U
95-48-7-----	2-Methylphenol	330	U
108-60-1-----	bis(2-Chloroisopropyl) ether	330	U
98-86-2-----	Acetophenone	330	U
106-44-5-----	4-Methylphenol	330	U
621-64-7-----	N-nitroso-di-n-propylamine	330	U
67-72-1-----	Hexachloroethane	330	U
98-95-3-----	Nitrobenzene	330	U
100-75-4-----	N-Nitrosopiperidine	330	U
78-59-1-----	Isophorone	330	U
88-75-5-----	2-Nitrophenol	330	U
105-67-9-----	2,4-Dimethyphenol	330	U
111-91-1-----	bis(2-Chloroethoxy) methane	330	U
65-85-0-----	Benzoic acid	330	U
120-83-2-----	2,4-Dichlorophenol	330	U
122-09-8-----	a,a-Dimethylphenethylamine	660	U
120-82-1-----	1,2,4-Trichlorobenzene	330	U
91-20-3-----	Naphthalene	330	U
106-47-8-----	4-Chloroaniline	330	U
87-65-0-----	2,6-Dichlorophenol	330	U
87-68-3-----	Hexachlorobutadiene	330	U
924-16-3-----	N-Nitrosodibutylamine	330	U
59-50-7-----	4-Chloro-3-methylphenol	330	U
91-57-6-----	2-Methylnaphthalene	330	U
77-47-4-----	Hexachlorocyclopentadiene	660	U
95-94-3-----	1,2,4,5-Tetrachlorobenzene	330	U

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: S6-C
 Sample Location:
 Lab Sample ID: 96-8062-02
 Sample Matrix: SOIL
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan2796
 Sample Date: JAN/11/96
 Sample Point:
 Date Received: JAN/11/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/Kg	Q
88-06-2-----	2,4,6-Trichlorophenol	330	U
95-95-4-----	2,4,5-Trichlorophenol	330	U
91-58-7-----	2-Chloronaphthalene	330	U
90-13-1-----	1-Chloronaphthalene	330	U
88-74-4-----	2-Nitroaniline	330	U
131-11-3-----	Dimethyl phthalate	330	U
606-20-2-----	2,6-Dinitrotoluene	330	U
208-96-8-----	Acenaphthylene	330	U
-----	3-Nitroaniline	330	U
83-32-9-----	Acenaphthene	330	U
51-28-5-----	2,4-Dinitrophenol	660	U
100-02-7-----	4-Nitrophenol	660	U
608-93-5-----	Pentachlorobenzene	330	U
121-14-2-----	2,4-Dinitrotoluene	330	U
91-59-8-----	2-Naphthylamine	330	U
58-90-2-----	2,3,4,6-Tetrachlorophenol	330	U
134-32-7-----	1-Naphthylamine	330	U
84-66-2-----	Diethylphthalate	330	U
86-73-7-----	Fluorene	330	U
7005-72-3-----	4-Chlorophenyl phenyl ether	330	U
100-01-6-----	4-Nitroaniline	330	U
534-52-1-----	4,6-Dinitro-2-methylphenol	330	U
132-64-9-----	Dibenzofuran	330	U
-----	N-NitrosodPA & Diphenylamine	160	U
122-66-7-----	1,2-Diphenylhydrazine	330	U
62-44-2-----	Phenacetin	330	U
101-55-3-----	4-Bromophenyl phenyl ether	330	U
118-74-1-----	Hexachlorobenzene	330	U
87-86-5-----	Pentachlorophenol	330	U
82-68-8-----	Pentachloronitrobenzene	330	U
92-67-1-----	4-Aminobiphenyl	330	U
23950-58-5-----	Pronamide	330	U
85-01-8-----	Phenanthrene	330	U
120-12-7-----	Anthracene	330	U
84-74-2-----	Di-n-butylphthalate	1110	
206-44-0-----	Fluoranthene	330	U
92-87-5-----	Benzidine	660	U

1 D

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: S6-C
 Sample Location:
 Lab Sample ID: 96-8062-02
 Sample Matrix: SOIL
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan2796
 Sample Date: JAN/11/96
 Sample Point:
 Date Received: JAN/11/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
129-00-0-----	Pyrene	330	U
60-11-7-----	p-Dimethylaminoazobenzene	330	U
85-68-7-----	Butylbenzylphthalate	330	U
91-94-1-----	3,3'-Dichlorobenzidine	330	U
56-55-3-----	Benzo (a) anthracene	330	U
117-81-7-----	bis (2-Ethylhexyl) phthalate	706	
218-01-9-----	Chrysene	330	U
117-84-0-----	Di-n-octylphthalate	330	U
205-99-2-----	Benzo (b) fluoranthene	330	U
57-97-6-----	7,12Dimethylbenz (a) anthracen	330	U
207-08-9-----	Benzo (k) fluoranthene	330	U
50-32-8-----	Benzo (a) pyrene	330	U
56-49-5-----	3-Methylcholanthrene	330	U
224-42-0-----	Dibenz (a, j) acridine	330	U
193-39-5-----	Indeno (1,2,3-cd) pyrene	330	U
53-70-3-----	Dibenzo (a, h) anthracene	330	U
191-24-2-----	Benzo (g, h, i) perylene	330	U
=====			
367-12-4-----	2-Fluorophenol	5830	
-----	Phenol-d5	6060	
-----	Nitrobenzene-d5	3120	
321-60-8-----	2-Fluorobiphenyl	3220	
-----	2,4,6-Tribromophenol	5360	
-----	Terphenyl-d14	3780	

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: S6-C
Sample Location:
Lab Sample ID: 96-8062-02
Sample Matrix: SOIL
Analysis Type: SV

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96

Level: LOW

Number TICs found: 16

CONCENTRATION UNITS:
(ug/L or ug/KG) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 75-85-4	2-Butanol, 2-methyl-	4.265	3440	NJB
2. 107-87-9	2-Pentanone	4.534	1590	NJ
3. 115-18-4	3-Buten-2-ol, 2-methyl-	5.049	449	NJ
4. 141-79-7	3-Penten-2-one, 4-methyl-	7.874	562	NJB
5.	Unknown	7.977	254	J
6.	Unknown	8.493	1990	J
7.	Unknown	11.422	1920	J
8. 79-34-5	Ethane, 1,1,2,2-tetrachloro	11.587	244	NJB
9.	Unknown	11.834	440	J
10.	Unknown	12.123	282	J
11.	Unknown	12.329	243	J
12. 111-90-0	Ethanol, 2-(2-ethoxyethoxy)	13.752	200	NJ
13. 102-76-1	1,2,3-Propanetriol, triacet	22.329	318	NJ
14. 19047-85-9	Phosphonic acid, dioctadecy	34.187	141	NJ
15. 638-67-5	Tricosane	35.033	155	NJ
16. 123-79-5	Hexanedioic acid, dioctyl ester	36.540	4710	NJB

1B

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: S9-C
Sample Location:
Lab Sample ID: 96-8062-03
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG)	ug/Kg	Q
62-75-9-----	N-Nitrosodimethylamine	330	U	
109-06-8-----	2-Picoline	330	U	
66-27-3-----	Methyl methansulfonate	660	U	
62-50-0-----	Ethyl methansulfonate	330	U	
108-95-2-----	Phenol	330	U	
62-53-3-----	Aniline	330	U	
111-44-4-----	bis(2-Chloroethyl) ether	330	U	
95-57-8-----	2-Chlorophenol	330	U	
541-73-1-----	1,3-Dichlorobenzene	330	U	
106-46-7-----	1,4-Dichlorobenzene	330	U	
100-51-6-----	Benzyl alcohol	330	U	
95-50-1-----	1,2-Dichlorobenzene	330	U	
95-48-7-----	2-Methylphenol	330	U	
108-60-1-----	bis(2-Chloroisopropyl) ether	330	U	
98-86-2-----	Acetophenone	330	U	
106-44-5-----	4-Methylphenol	330	U	
621-64-7-----	N-nitroso-di-n-propylamine	330	U	
67-72-1-----	Hexachloroethane	330	U	
98-95-3-----	Nitrobenzene	330	U	
100-75-4-----	N-Nitrosopiperidine	330	U	
78-59-1-----	Isophorone	330	U	
88-75-5-----	2-Nitrophenol	330	U	
105-67-9-----	2,4-Dimethyphenol	330	U	
111-91-1-----	bis(2-Chloroethoxy) methane	330	U	
65-85-0-----	Benzoic acid	330	U	
120-83-2-----	2,4-Dichlorophenol	330	U	
122-09-8-----	a,a-Dimethylphenethylamine	660	U	
120-82-1-----	1,2,4-Trichlorobenzene	330	U	
91-20-3-----	Naphthalene	330	U	
106-47-8-----	4-Chloroaniline	330	U	
87-65-0-----	2,6-Dichlorophenol	330	U	
87-68-3-----	Hexachlorobutadiene	330	U	
924-16-3-----	N-Nitrosodibutylamine	330	U	
59-50-7-----	4-Chloro-3-methylphenol	330	U	
91-57-6-----	2-Methylnaphthalene	330	U	
77-47-4-----	Hexachlorocyclopentadiene	660	U	
95-94-3-----	1,2,4,5-Tetrachlorobenzene	330	U	

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: S9-C
Sample Location:
Lab Sample ID: 96-8062-03
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/KG)	ug/Kg
			Q
88-06-2-----	2,4,6-Trichlorophenol	330	U
95-95-4-----	2,4,5-Trichlorophenol	330	U
91-58-7-----	2-Chloronaphthalene	330	U
90-13-1-----	1-Chloronaphthalene	330	U
88-74-4-----	2-Nitroaniline	330	U
131-11-3-----	Dimethyl phthalate	330	U
606-20-2-----	2,6-Dinitrotoluene	330	U
208-96-8-----	Acenaphthylene	330	U
-----	3-Nitroaniline	330	U
83-32-9-----	Acenaphthene	330	U
51-28-5-----	2,4-Dinitrophenol	660	U
100-02-7-----	4-Nitrophenol	660	U
608-93-5-----	Pentachlorobenzene	330	U
121-14-2-----	2,4-Dinitrotoluene	330	U
91-59-8-----	2-Naphthylamine	330	U
58-90-2-----	2,3,4,6-Tetrachlorophenol	330	U
134-32-7-----	1-Naphthylamine	330	U
84-66-2-----	Diethylphthalate	330	U
86-73-7-----	Fluorene	330	U
7005-72-3-----	4-Chlorophenyl phenyl ether	330	U
100-01-6-----	4-Nitroaniline	330	U
534-52-1-----	4,6-Dinitro-2-methylphenol	330	U
132-64-9-----	Dibenzofuran	330	U
-----	N-NitrosoDPA & Diphenylamine	160	U
122-66-7-----	1,2-Diphenylhydrazine	330	U
62-44-2-----	Phenacetin	330	U
101-55-3-----	4-Bromophenyl phenyl ether	330	U
118-74-1-----	Hexachlorobenzene	330	U
87-86-5-----	Pentachlorophenol	330	U
82-68-8-----	Pentachloronitrobenzene	330	U
92-67-1-----	4-Aminobiphenyl	330	U
23950-58-5-----	Pronamide	330	U
85-01-8-----	Phenanthrene	330	U
120-12-7-----	Anthracene	330	U
84-74-2-----	Di-n-butylphthalate	614	
206-44-0-----	Fluoranthene	330	U
92-87-5-----	Benzidine	660	U

1 D
TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: S9-C
Sample Location:
Lab Sample ID: 96-8062-03
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:		Q
		(ug/L or ug/KG)	ug/Kg	
129-00-0-----	Pyrene	330		U
60-11-7-----	p-Dimethylaminoazobenzene	330		U
85-68-7-----	Butylbenzylphthalate	330		U
91-94-1-----	3,3'-Dichlorobenzidine	330		U
56-55-3-----	Benzo(a)anthracene	330		U
117-81-7-----	bis(2-Ethylhexyl)phthalate	330		U
218-01-9-----	Chrysene	330		U
117-84-0-----	Di-n-octylphthalate	330		U
205-99-2-----	Benzo(b)fluoranthene	330		U
207-08-9-----	Benzo(k)fluoranthene	330		U
50-32-8-----	Benzo(a)pyrene	330		U
56-49-5-----	3-Methylcholanthrene	330		U
224-42-0-----	Dibenz(a,j)acridine	330		U
193-39-5-----	Indeno(1,2,3-cd)pyrene	330		U
53-70-3-----	Dibenzo(a,h)anthracene	330		U
191-24-2-----	Benzo(g,h,i)perylene	330		U
=====		=====	=====	
367-12-4-----	2-Fluorophenol	5980		
-----	Phenol-d5	5850		
-----	Nitrobenzene-d5	3050		
321-60-8-----	2-Fluorobiphenyl	3300		
-----	2,4,6-Tribromophenol	5100		
-----	Terphenyl-d14	3300		

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: S9-C
 Sample Location:
 Lab Sample ID: 96-8062-03
 Sample Matrix: SOIL
 Analysis Type: SV

Client SDG: 4jan2796
 Sample Date: JAN/11/96
 Sample Point:
 Date Received: JAN/11/96
 Level: LOW

Number TICs found: 17

CONCENTRATION UNITS:
 (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 75-85-4	2-Butanol, 2-methyl-	4.245	3070	NJB
2. 563-80-4	2-Butanone, 3-methyl-	4.534	1600	NJB
3. 1569-50-2	3-Penten-2-ol	5.049	401	NJB
4. 141-79-7	3-Penten-2-one, 4-methyl-	7.874	555	NJB
5.	Unknown	7.977	228	J
6.	Unknown	8.492	1990	JB
7.	Unknown	11.400	1910	J
8. 79-34-5	Ethane, 1,1,2,2-tetrachloro	11.565	216	NJB
9.	Unknown	11.833	323	JB
10. 4291-79-6	Cyclohexane, 1-methyl-2-propyl	12.328	211	NJ
11. 111-90-0	Ethanol, 2-(2-ethoxyethoxy)	13.730	187	NJ
12. 25395-31-7	1,2,3-Propanetriol, diacetate	22.309	343	NJ
13. 1921-70-6	Pentadecane, 2,6,10,14-tetramethyl-	29.981	482	NJ
14. 629-78-7	Heptadecane	31.404	189	NJ
15. 629-92-5	Nonadecane	32.539	171	NJ
16. 123-79-5	Hexanedioic acid, dioctyl ester	36.525	6340	NJ
17. 55401-55-3	Docosane, 11-decyl-	36.608	240	NJ

1B

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W1-C
Sample Location:
Lab Sample ID: 96-8062-04
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/KG)	ug/Kg
			Q
62-75-9	N-Nitrosodimethylamine	330	U
109-06-8	2-Picoline	330	U
66-27-3	Methyl methansulfonate	660	U
62-50-0	Ethyl methansulfonate	330	U
108-95-2	Phenol	330	U
62-53-3	Aniline	330	U
111-44-4	bis(2-Chloroethyl) ether	330	U
95-57-8	2-Chlorophenol	330	U
541-73-1	1,3-Dichlorobenzene	330	U
106-46-7	1,4-Dichlorobenzene	330	U
100-51-6	Benzyl alcohol	330	U
95-50-1	1,2-Dichlorobenzene	330	U
95-48-7	2-Methylphenol	330	U
108-60-1	bis(2-Chloroisopropyl) ether	330	U
98-86-2	Acetophenone	330	U
106-44-5	4-Methylphenol	330	U
621-64-7	N-nitroso-di-n-propylamine	330	U
67-72-1	Hexachloroethane	330	U
98-95-3	Nitrobenzene	330	U
100-75-4	N-Nitrosopiperidine	330	U
78-59-1	Isophorone	330	U
88-75-5	2-Nitrophenol	330	U
105-67-9	2,4-Dimethyphenol	330	U
111-91-1	bis(2-Chloroethoxy) methane	330	U
65-85-0	Benzoic acid	330	U
120-83-2	2,4-Dichlorophenol	330	U
122-09-8	a,a-Dimethylphenethylamine	660	U
120-82-1	1,2,4-Trichlorobenzene	330	U
91-20-3	Naphthalene	330	U
106-47-8	4-Chloroaniline	330	U
87-65-0	2,6-Dichlorophenol	330	U
87-68-3	Hexachlorobutadiene	330	U
924-16-3	N-Nitrosodibutylamine	330	U
59-50-7	4-Chloro-3-methylphenol	330	U
91-57-6	2-Methylnaphthalene	330	U
77-47-4	Hexachlorocyclopentadiene	660	U
95-94-3	1,2,4,5-Tetrachlorobenzene	330	U

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: W1-C
 Sample Location:
 Lab Sample ID: 96-8062-04
 Sample Matrix: SOIL
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan2796
 Sample Date: JAN/11/96
 Sample Point:
 Date Received: JAN/11/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/Kg	Q
88-06-2-----	2,4,6-Trichlorophenol	330	U
95-95-4-----	2,4,5-Trichlorophenol	330	U
91-58-7-----	2-Chloronaphthalene	330	U
90-13-1-----	1-Chloronaphthalene	330	U
88-74-4-----	2-Nitroaniline	330	U
131-11-3-----	Dimethyl phthalate	330	U
606-20-2-----	2,6-Dinitrotoluene	330	U
208-96-8-----	Acenaphthylene	330	U
-----	3-Nitroaniline	330	U
83-32-9-----	Acenaphthene	330	U
51-28-5-----	2,4-Dinitrophenol	660	U
100-02-7-----	4-Nitrophenol	660	U
608-93-5-----	Pentachlorobenzene	330	U
121-14-2-----	2,4-Dinitrotoluene	330	U
91-59-8-----	2-Naphthylamine	330	U
58-90-2-----	2,3,4,6-Tetrachlorophenol	330	U
134-32-7-----	1-Naphthylamine	330	U
84-66-2-----	Diethylphthalate	330	U
86-73-7-----	Fluorene	330	U
7005-72-3-----	4-Chlorophenyl phenyl ether	330	U
100-01-6-----	4-Nitroaniline	330	U
534-52-1-----	4,6-Dinitro-2-methylphenol	330	U
132-64-9-----	Dibenzofuran	330	U
-----	N-NitrosoDPA & Diphenylamine	160	U
122-66-7-----	1,2-Diphenylhydrazine	330	U
62-44-2-----	Phenacetin	330	U
101-55-3-----	4-Bromophenyl phenyl ether	330	U
118-74-1-----	Hexachlorobenzene	330	U
87-86-5-----	Pentachlorophenol	330	U
82-68-8-----	Pentachloronitrobenzene	330	U
92-67-1-----	4-Aminobiphenyl	330	U
23950-58-5-----	Pronamide	330	U
85-01-8-----	Phenanthrene	330	U
120-12-7-----	Anthracene	330	U
84-74-2-----	Di-n-butylphthalate	470	U
206-44-0-----	Fluoranthene	330	U
92-87-5-----	Benzidine	660	U

1D

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: W1-C
 Sample Location:
 Lab Sample ID: 96-8062-04
 Sample Matrix: SOIL
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan2796
 Sample Date: JAN/11/96
 Sample Point:
 Date Received: JAN/11/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/Kg	Q
129-00-0-----	Pyrene	330	U
60-11-7-----	p-Dimethylaminoazobenzene	330	U
85-68-7-----	Butylbenzylphthalate	330	U
91-94-1-----	3,3'-Dichlorobenzidine	330	U
56-55-3-----	Benzo (a) anthracene	330	U
117-81-7-----	bis (2-Ethylhexyl) phthalate	330	U
218-01-9-----	Chrysene	330	U
117-84-0-----	Di-n-octylphthalate	330	U
205-99-2-----	Benzo (b) fluoranthene	330	U
207-08-9-----	Benzo (k) fluoranthene	330	U
50-32-8-----	Benzo (a) pyrene	330	U
56-49-5-----	3-Methylcholanthrene	330	U
224-42-0-----	Dibenz (a, j) acridine	330	U
193-39-5-----	Indeno (1, 2, 3-cd) pyrene	330	U
53-70-3-----	Dibenzo (a, h) anthracene	330	U
191-24-2-----	Benzo (g, h, i) perylene	330	U
=====			
367-12-4-----	2-Fluorophenol	5690	
-----	Phenol-d5	5960	
-----	Nitrobenzene-d5	3060	
321-60-8-----	2-Fluorobiphenyl	3120	
-----	2,4,6-Tribromophenol	5830	
-----	Terphenyl-d14	3770	

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W1-C
Sample Location:
Lab Sample ID: 96-8062-04
Sample Matrix: SOIL
Analysis Type: SV

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96

Level: LOW

Number TICs found: 16

CONCENTRATION UNITS:
(ug/L or ug/KG) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1.	Unknown	4.204	2600	J
2. 563-80-4	2-Butanone, 3-methyl-	4.492	1480	NJB
3. 814-78-8	3-Buten-2-one, 3-methyl-	4.739	616	NJ
4. 1569-50-2	3-Penten-2-ol	5.007	646	NJB
5. 141-79-7	3-Penten-2-one, 4-methyl-	7.848	512	NJB
6.	Unknown	7.951	248	J
7.	Unknown	8.447	1140	JB
8.	Unknown	11.374	1880	JB
9. 79-34-5	Ethane, 1,1,2,2-tetrachloro	11.539	225	NJB
10.	Unknown	11.807	188	JB
11. 4291-79-6	Cyclohexane, 1-methyl-2-propyl	12.302	199	NJ
12. 111-90-0	Ethanol, 2-(2-ethoxyethoxy)	13.725	144	NJ
13. 102-76-1	1,2,3-Propanetriol, triacetate	22.300	134	NJ
14. 1921-70-6	Pentadecane, 2,6,10,14-tetratetramethyl-	29.951	262	NJ
15. 123-79-5	Hexanedioic acid, dioctyl ester	36.520	7190	NJ
16. 40710-42-7	1-Hentetracontanol	44.182	678	NJ

1B

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W6-C
Sample Location:
Lab Sample ID: 96-8062-05
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/Kg	Q
62-75-9	N-Nitrosodimethylamine	330	U
109-06-8	2-Picoline	330	U
66-27-3	Methyl methansulfonate	660	U
62-50-0	Ethyl methansulfonate	330	U
108-95-2	Phenol	330	U
62-53-3	Aniline	330	U
111-44-4	bis(2-Chloroethyl) ether	330	U
95-57-8	2-Chlorophenol	330	U
541-73-1	1,3-Dichlorobenzene	330	U
106-46-7	1,4-Dichlorobenzene	330	U
100-51-6	Benzyl alcohol	330	U
95-50-1	1,2-Dichlorobenzene	330	U
95-48-7	2-Methylphenol	330	U
108-60-1	bis(2-Chloroisopropyl) ether	330	U
98-86-2	Acetophenone	330	U
106-44-5	4-Methylphenol	330	U
621-64-7	N-nitroso-di-n-propylamine	330	U
67-72-1	Hexachloroethane	330	U
98-95-3	Nitrobenzene	330	U
100-75-4	N-Nitrosopiperidine	330	U
78-59-1	Isophorone	330	U
88-75-5	2-Nitrophenol	330	U
105-67-9	2,4-Dimethyphenol	330	U
111-91-1	bis(2-Chloroethoxy) methane	330	U
65-85-0	Benzoic acid	330	U
120-83-2	2,4-Dichlorophenol	330	U
122-09-8	a,a-Dimethylphenethylamine	660	U
120-82-1	1,2,4-Trichlorobenzene	330	U
91-20-3	Naphthalene	330	U
106-47-8	4-Chloroaniline	330	U
87-65-0	2,6-Dichlorophenol	330	U
87-68-3	Hexachlorobutadiene	330	U
924-16-3	N-Nitrosodibutylamine	330	U
59-50-7	4-Chloro-3-methylphenol	330	U
91-57-6	2-Methylnaphthalene	330	U
77-47-4	Hexachlorocyclopentadiene	660	U
95-94-3	1,2,4,5-Tetrachlorobenzene	330	U

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W6-C
Sample Location:
Lab Sample ID: 96-8062-05
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:		Q
		(ug/L or ug/KG)	ug/Kg	
88-06-2-----	2,4,6-Trichlorophenol	330		U
95-95-4-----	2,4,5-Trichlorophenol	330		U
91-58-7-----	2-Chloronaphthalene	330		U
90-13-1-----	1-Chloronaphthalene	330		U
88-74-4-----	2-Nitroaniline	330		U
131-11-3-----	Dimethyl phthalate	330		U
606-20-2-----	2,6-Dinitrotoluene	330		U
208-96-8-----	Acenaphthylene	330		U
-----	3-Nitroaniline	330		U
83-32-9-----	Acenaphthene	330		U
51-28-5-----	2,4-Dinitrophenol	660		U
100-02-7-----	4-Nitrophenol	660		U
608-93-5-----	Pentachlorobenzene	330		U
121-14-2-----	2,4-Dinitrotoluene	330		U
91-59-8-----	2-Naphthylamine	330		U
58-90-2-----	2,3,4,6-Tetrachlorophenol	330		U
134-32-7-----	1-Naphthylamine	330		U
84-66-2-----	Diethylphthalate	330		U
86-73-7-----	Fluorene	330		U
7005-72-3-----	4-Chlorophenyl phenyl ether	330		U
100-01-6-----	4-Nitroaniline	330		U
534-52-1-----	4,6-Dinitro-2-methylphenol	330		U
132-64-9-----	Dibenzofuran	330		U
-----	N-NitrosoDPA & Diphenylamine	160		U
122-66-7-----	1,2-Diphenylhydrazine	330		U
62-44-2-----	Phenacetin	330		U
101-55-3-----	4-Bromophenyl phenyl ether	330		U
118-74-1-----	Hexachlorobenzene	330		U
87-86-5-----	Pentachlorophenol	330		U
82-68-8-----	Pentachloronitrobenzene	330		U
92-67-1-----	4-Aminobiphenyl	330		U
23950-58-5-----	Pronamide	330		U
85-01-8-----	Phenanthrene	330		U
120-12-7-----	Anthracene	330		U
84-74-2-----	Di-n-butylphthalate	366		
206-44-0-----	Fluoranthene	330		U
92-87-5-----	Benzidine	660		U

1 D

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W6-C
Sample Location:
Lab Sample ID: 96-8062-05
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/KG)	ug/Kg
			Q
129-00-0-----	Pyrene	330	U
60-11-7-----	p-Dimethylaminoazobenzene	330	U
85-68-7-----	Butylbenzylphthalate	330	U
91-94-1-----	3,3'-Dichlorobenzidine	330	U
56-55-3-----	Benzo (a) anthracene	330	U
117-81-7-----	bis (2-Ethylhexyl) phthalate	330	U
218-01-9-----	Chrysene	330	U
117-84-0-----	Di-n-octylphthalate	330	U
205-99-2-----	Benzo (b) fluoranthene	330	U
207-08-9-----	Benzo (k) fluoranthene	330	U
50-32-8-----	Benzo (a) pyrene	330	U
56-49-5-----	3-Methylcholanthrene	330	U
224-42-0-----	Dibenz (a, j) acridine	330	U
193-39-5-----	Indeno (1, 2, 3-cd) pyrene	330	U
53-70-3-----	Dibenzo (a, h) anthracene	330	U
191-24-2-----	Benzo (g, h, i) perylene	330	U
=====		=====	=====
367-12-4-----	2-Fluorophenol	5610	
-----	Phenol-d5	5880	
-----	Nitrobenzene-d5	3030	
321-60-8-----	2-Fluorobiphenyl	3230	
-----	2,4,6-Tribromophenol	5570	
-----	Terphenyl-d14	3270	

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W6-C
Sample Location:
Lab Sample ID: 96-8062-05
Sample Matrix: SOIL
Analysis Type: SV

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96

Level: LOW

Number TICs found: 19

CONCENTRATION UNITS:
(ug/L or ug/KG) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 75-85-4	2-Butanol, 2-methyl-	4.265	3360	NJB_
2. 563-80-4	2-Butanone, 3-methyl-	4.534	1660	NJB_
3. 814-78-8	3-Buten-2-one, 3-methyl-	4.781	298	NJB_
4. 1569-50-2	3-Penten-2-ol	5.049	522	NJB_
5. 141-79-7	3-Penten-2-one, 4-methyl-	7.874	536	NJB_
6.	Unknown	8.492	825	_JB_
7.	Unknown	10.225	3880	_J_
8.	Unknown	11.400	1850	_J_
9. 72535-87-6	2,2-Dimethyl-1-isopropenyl- cyclopentane	11.442	1850	NJ_
10. 79-34-5	Ethane, 1,1,2,2-tetrachloro	11.565	295	NJB_
11.	Branched alkane	11.813	364	_J_
12. 629-62-9	Pentadecane	28.003	204	NJ_
13.	Unknown alkane	28.910	236	_J_
14. 629-50-5	Tridecane	29.983	816	NJ_
15. 593-45-3	Octadecane	31.386	296	NJ_
16. 112-95-8	Eicosane	32.524	248	NJ_
17.	Unknown alkane	33.475	228	_J_
18. 123-79-5	Hexanedioic acid, dioctyl ester	36.538	7060	NJB_
19.	Unknown	36.600	327	_J_

1B

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W9-C
Sample Location:
Lab Sample ID: 96-8062-06
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/KG)	ug/Kg
			Q
62-75-9-----	N-Nitrosodimethylamine	330	U
109-06-8-----	2-Picoline	330	U
66-27-3-----	Methyl methansulfonate	660	U
62-50-0-----	Ethyl methansulfonate	330	U
108-95-2-----	Phenol	330	U
62-53-3-----	Aniline	330	U
111-44-4-----	bis(2-Chloroethyl) ether	330	U
95-57-8-----	2-Chlorophenol	330	U
541-73-1-----	1,3-Dichlorobenzene	330	U
106-46-7-----	1,4-Dichlorobenzene	330	U
100-51-6-----	Benzyl alcohol	330	U
95-50-1-----	1,2-Dichlorobenzene	330	U
95-48-7-----	2-Methylphenol	330	U
108-60-1-----	bis(2-Chloroisopropyl) ether	330	U
98-86-2-----	Acetophenone	330	U
106-44-5-----	4-Methylphenol	330	U
621-64-7-----	N-nitroso-di-n-propylamine	330	U
67-72-1-----	Hexachloroethane	330	U
98-95-3-----	Nitrobenzene	330	U
100-75-4-----	N-Nitrosopiperidine	330	U
78-59-1-----	Isophorone	330	U
88-75-5-----	2-Nitrophenol	330	U
105-67-9-----	2,4-Dimethyphenol	330	U
111-91-1-----	bis(2-Chloroethoxy) methane	330	U
65-85-0-----	Benzoic acid	330	U
120-83-2-----	2,4-Dichlorophenol	330	U
122-09-8-----	a,a-Dimethylphenethylamine	660	U
120-82-1-----	1,2,4-Trichlorobenzene	330	U
91-20-3-----	Naphthalene	330	U
106-47-8-----	4-Chloroaniline	330	U
87-65-0-----	2,6-Dichlorophenol	330	U
87-68-3-----	Hexachlorobutadiene	330	U
924-16-3-----	N-Nitrosodibutylamine	330	U
59-50-7-----	4-Chloro-3-methylphenol	330	U
91-57-6-----	2-Methylnaphthalene	330	U
77-47-4-----	Hexachlorocyclopentadiene	660	U
95-94-3-----	1,2,4,5-Tetrachlorobenzene	330	U

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W9-C
Sample Location:
Lab Sample ID: 96-8062-06
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:		Q
		(ug/L or ug/KG)	ug/Kg	
88-06-2-----	2,4,6-Trichlorophenol	330		U
95-95-4-----	2,4,5-Trichlorophenol	330		U
91-58-7-----	2-Chloronaphthalene	330		U
90-13-1-----	1-Chloronaphthalene	330		U
88-74-4-----	2-Nitroaniline	330		U
131-11-3-----	Dimethyl phthalate	330		U
606-20-2-----	2,6-Dinitrotoluene	330		U
208-96-8-----	Acenaphthylene	330		U
-----	3-Nitroaniline	330		U
83-32-9-----	Acenaphthene	330		U
51-28-5-----	2,4-Dinitrophenol	660		U
100-02-7-----	4-Nitrophenol	660		U
608-93-5-----	Pentachlorobenzene	330		U
121-14-2-----	2,4-Dinitrotoluene	330		U
91-59-8-----	2-Naphthylamine	330		U
58-90-2-----	2,3,4,6-Tetrachlorophenol	330		U
134-32-7-----	1-Naphthylamine	330		U
84-66-2-----	Diethylphthalate	330		U
86-73-7-----	Fluorene	330		U
7005-72-3-----	4-Chlorophenyl phenyl ether	330		U
100-01-6-----	4-Nitroaniline	330		U
534-52-1-----	4,6-Dinitro-2-methylphenol	330		U
132-64-9-----	Dibenzofuran	330		U
-----	N-NitrosoDPA & Diphenylamine	160		U
122-66-7-----	1,2-Diphenylhydrazine	330		U
62-44-2-----	Phenacetin	330		U
101-55-3-----	4-Bromophenyl phenyl ether	330		U
118-74-1-----	Hexachlorobenzene	330		U
87-86-5-----	Pentachlorophenol	330		U
82-68-8-----	Pentachloronitrobenzene	330		U
92-67-1-----	4-Aminobiphenyl	330		U
23950-58-5-----	Pronamide	330		U
85-01-8-----	Phenanthrene	330		U
120-12-7-----	Anthracene	330		U
84-74-2-----	Di-n-butylphthalate	330		U
206-44-0-----	Fluoranthene	330		U
92-87-5-----	Benzidine	660		U

1 D

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W9-C
Sample Location:
Lab Sample ID: 96-8062-06
Sample Matrix: SOIL
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:		Q
		(ug/L or ug/KG)	ug/Kg	
129-00-0-----	Pyrene	330	U	
60-11-7-----	p-Dimethylaminoazobenzene	330	U	
85-68-7-----	Butylbenzylphthalate	330	U	
91-94-1-----	3,3'-Dichlorobenzidine	330	U	
56-55-3-----	Benzo(a)anthracene	330	U	
117-81-7-----	bis(2-Ethylhexyl)phthalate	330	U	
218-01-9-----	Chrysene	330	U	
117-84-0-----	Di-n-octylphthalate	330	U	
205-99-2-----	Benzo(b)fluoranthene	330	U	
207-08-9-----	Benzo(k)fluoranthene	330	U	
50-32-8-----	Benzo(a)pyrene	330	U	
56-49-5-----	3-Methylcholanthrene	330	U	
224-42-0-----	Dibenz(a,j)acridine	330	U	
193-39-5-----	Indeno(1,2,3-cd)pyrene	330	U	
53-70-3-----	Dibenzo(a,h)anthracene	330	U	
191-24-2-----	Benzo(g,h,i)perylene	330	U	
=====		=====	=====	
367-12-4-----	2-Fluorophenol	4450		
-----	Phenol-d5	4450		
-----	Nitrobenzene-d5	2280		
321-60-8-----	2-Fluorobiphenyl	2390		
-----	2,4,6-Tribromophenol	3660		
-----	Terphenyl-d14	2660		

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: W9-C
Sample Location:
Lab Sample ID: 96-8062-06
Sample Matrix: SOIL
Analysis Type: SV

Client SDG: 4jan2796
Sample Date: JAN/11/96
Sample Point:
Date Received: JAN/11/96

Level: LOW

Number TICs found: 19

CONCENTRATION UNITS:
(ug/L or ug/KG) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 75-85-4	2-Butanol, 2-methyl-	4.245	2600	NJB
2. 563-80-4	2-Butanone, 3-methyl-	4.513	1230	NJB
3. 814-78-8	3-Buten-2-one, 3-methyl-	4.781	699	NJ
4. 115-18-4	3-Buten-2-ol, 2-methyl-	5.049	760	NJ
5.	Unknown	8.431	1740	JB
6.	Unknown	11.360	1390	JB
7. 1120-21-4	Undecane	16.517	588	NJ
8.	Alkane	19.095	479	J
9. 17301-23-4	Undecane, 2,6-dimethyl-	19.425	394	NJ
10. 629-50-5	Tridecane	21.529	547	NJ
11.	Alkane	23.822	1110	J
12. 638-36-8	Hexadecane, 2,6,10,14-tetramethyl-	25.124	435	NJ
13. 56666-87-6	Benzene, 1-(2,2-dimethylpropyl) -2,4,5-trimethyl-	25.248	330	NJ
14. 629-62-9	Pentadecane	25.972	692	NJ
15.	Alkane	27.999	466	J
16.	Alkane	28.909	389	J
17.	Branched alkane	29.985	1430	J
18. 112-95-8	Eicosane	33.483	355	NJ
19. 123-79-5	Hexanedioic acid, dioctyl ester	36.528	6220	NJ B

February 12, 1996

CASE NARRATIVE

1. PCB DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: S1-C

Instrument: HP5890A Series II Gas Chromatograph/ Electron Capture Detector with HP 7673A Automatic Sampler, Electronic Pressure Control, and On-Column Injection; HP ChemStation Software

2. INTRODUCTION

Soil samples from the JANUS Reactor site received January 11, 1996 were analyzed for PCBs using the EPA SW-846 Method 8081 (RCRA) protocol (Revision 0, September 1994). The enclosed data package contains data for six soil samples, one matrix spike sample (MS), one matrix spike duplicate sample (MSD), and one laboratory blank (ABLK). The samples were extracted and analyzed within the specified RCRA holding times.

Since only PCBs were requested, the EPA Contract Laboratory Program (CLP) forms were modified to meet the needs of EPA SW-846 Method 8081 and for reporting PCB data.

3. SUMMARY COMMENTS

PCB Analysis Data Form: These data forms lists the target analytes and the quantitation limits for each one. All quantitation is on a wet weight basis. PCBs were not detected in the samples presented in this data package.

PCB Surrogate Recovery: Surrogate recoveries reported within this data package are within QC limits. QC limits are based upon CLP (Contract Laboratory Program) limits.

Matrix Spike/Matrix Spike Duplicate Recovery: All matrix spike and matrix spike duplicate recoveries reported within this data package are acceptable.

PCB Initial Calibration A Form: This form lists the retention times and calibration factors of Aroclor 1016/1260 (Aroclor 1660) calibration peaks for the 5-point calibration curve. The %RSD of all the calibration peaks was within the specified Method 8081 QC limits.

PCB Initial Calibration B Form: This form lists the retention times and calibration factors of Aroclors 1221, 1232, 1242, 1248, and 1254.

PCB Initial Calibration C Form: This form lists the retention times and calibration factors of the surrogates, TCMX and DCBP, from the initial calibration. The %RSD for TCMX and DCBP was within the specified Method 8081 QC limits.

PCB Continuing Calibration Check: This form lists the retention times and calibration factors of the Aroclor 1016/1260 continuing calibration. The %Difference of the calibration peaks was within the specified Method 8081 QC limit

PCB Florisil Cartridge Check: This form indicates the recovery of analytes from a specified Florisil lot number. All compounds tested had acceptable recovery from Florisil Lot #1589FL.

4. DATA PACKAGE CLARIFICATIONS

EPA Method 8081 specifies a matrix spike solution that contains various pesticides. However, since only PCB analysis was requested, the matrix spike solution used for spiking samples contained in this data package consisted of Aroclors 1016 and 1260.

In order to accommodate changes in retention time during analysis, Method 8081 recommends obtaining data on standards over the course of 72 hours. The method states that shorter times could lead to tighter retention time windows. The retention time windows reported in this data package were established by running standards over the course of 51 hours. All samples and blanks reported were within the retention time windows

Every lot of Florisil cartridges to be used in sample cleanup is required to be tested for acceptable analyte recovery. Florisil lot number 1589FL was previously tested June 14, 1995 for recovery of Aroclor 1260 and the surrogates, TCMX and DCBP. Recovery of all three analytes was found to be acceptable. Florisil lot number 1589FL was also used for samples included in this data package. To ensure that no change in the quality and integrity of the Florisil cartridge had occurred, lot number 1589FL was again tested on February 2, 1996 for recovery of surrogates, Aroclors 1016 and 1260. Recovery of analytes was acceptable and is presented in this data package.

Pamela D. Postlethwait Date 16 Feb 96
Pam Postlethwait, Analyst
PCB/Pesticide Analysis

Amrit S. Boparai Date 2/16/96
Amrit S. Boparai, Group Leader
Organic Analysis Group

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

S1-C

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: S1-C

Matrix: (soil/water) Soil

Lab Sample ID: 96-8062-01

Sample wt/vol: 30.0 (g/mL) g

Lab File ID: 017F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/11/96

Extraction: (SepF/Cont/Sonc) _____

Date Extracted: 1/19/96

Concentrated Extract Volume: 10,000µL

Date Analyzed: 2/9/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) _____

Sulfur Cleanup: (Y/N) _____

CAS NO.

COMPOUND

Concentration Units
(µg/L or µg/Kg) µg/Kg

Q

12674-11-2	Aroclor 1016	33	U
11104-28-2	Aroclor 1221	67	U
11141-16-5	Aroclor 1232	33	U
53469-21-9	Aroclor 1242	33	U
12672-29-6	Aroclor 1248	33	U
11097-69-1	Aroclor 1254	33	U
11096-82-5	Aroclor 1260	33	U

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

S6-C

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: S1-C

Matrix: (soil/water) Soil

Lab Sample ID: 96-8062-02

Sample wt/vol: 30.2 (g/mL) g

Lab File ID: 020F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/11/96

Extraction: (SepF/Cont/Sonc) _____

Date Extracted: 1/19/96

Concentrated Extract Volume: 10,000µL

Date Analyzed: 2/9/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) _____

Sulfur Cleanup: (Y/N) _____

CAS NO.	COMPOUND	Concentration Units (µg/L or µg/Kg) <u>µg/Kg</u>	Q
12674-11-2	Aroclor 1016	33	U
11104-28-2	Aroclor 1221	67	U
11141-16-5	Aroclor 1232	33	U
53469-21-9	Aroclor 1242	33	U
12672-29-6	Aroclor 1248	33	U
11097-69-1	Aroclor 1254	33	U
11096-82-5	Aroclor 1260	33	U

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

S9-C

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: S1-C

Matrix: (soil/water) Soil

Lab Sample ID: 96-8062-03

Sample wt/vol: 30.2 (g/mL) g

Lab File ID: 021F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/11/96

Extraction: (SepF/Cont/Sonc) _____

Date Extracted: 1/19/96

Concentrated Extract Volume: 10,000µL

Date Analyzed: 2/9/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) _____

Sulfur Cleanup: (Y/N) _____

CAS NO.	COMPOUND	Concentration Units (µg/L or µg/Kg) <u>µg/Kg</u>	Q
12674-11-2	Aroclor 1016	33	U
11104-28-2	Aroclor 1221	67	U
11141-16-5	Aroclor 1232	33	U
53469-21-9	Aroclor 1242	33	U
12672-29-6	Aroclor 1248	33	U
11097-69-1	Aroclor 1254	33	U
11096-82-5	Aroclor 1260	33	U

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

W1-C

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: S1-C

Matrix: (soil/water) Soil

Lab Sample ID: 96-8062-04

Sample wt/vol: 30.1 (g/mL) g

Lab File ID: 022F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/11/96

Extraction: (SepF/Cont/Sonc) _____

Date Extracted: 1/19/96

Concentrated Extract Volume: 10,000µL

Date Analyzed: 2/9/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) _____

Sulfur Cleanup: (Y/N) _____

CAS NO.	COMPOUND	Concentration Units (µg/L or µg/Kg) <u>µg/Kg</u>	Q
12674-11-2	Aroclor 1016	33	U
11104-28-2	Aroclor 1221	67	U
11141-16-5	Aroclor 1232	33	U
53469-21-9	Aroclor 1242	33	U
12672-29-6	Aroclor 1248	33	U
11097-69-1	Aroclor 1254	33	U
11096-82-5	Aroclor 1260	33	U

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

W6-C

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: S1-C

Matrix: (soil/water) Soil

Lab Sample ID: 96-8062-05

Sample wt/vol: 30.1 (g/mL) g

Lab File ID: 023F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/11/96

Extraction: (SepF/Cont/Sonc) _____

Date Extracted: 1/19/96

Concentrated Extract Volume: 10,000µL

Date Analyzed: 2/9/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) _____

Sulfur Cleanup: (Y/N) _____

CAS NO.

COMPOUND

Concentration Units
(µg/L or µg/Kg) µg/Kg

Q

12674-11-2	Aroclor 1016	33	U
11104-28-2	Aroclor 1221	67	U
11141-16-5	Aroclor 1232	33	U
53469-21-9	Aroclor 1242	33	U
12672-29-6	Aroclor 1248	33	U
11097-69-1	Aroclor 1254	33	U
11096-82-5	Aroclor 1260	33	U

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

W9-C

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: S1-C

Matrix: (soil/water) Soil

Lab Sample ID: 96-8062-06

Sample wt/vol: 30.1 (g/mL) g

Lab File ID: 024F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/11/96

Extraction: (SepF/Cont/Sonc) _____

Date Extracted: 1/19/96

Concentrated Extract Volume: 10,000µL

Date Analyzed: 2/9/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) _____

Sulfur Cleanup: (Y/N) _____

CAS NO.	COMPOUND	Concentration Units (µg/L or µg/Kg) <u>µg/Kg</u>	Q
12674-11-2	Aroclor 1016	33	U
11104-28-2	Aroclor 1221	67	U
11141-16-5	Aroclor 1232	33	U
53469-21-9	Aroclor 1242	33	U
12672-29-6	Aroclor 1248	33	U
11097-69-1	Aroclor 1254	33	U
11096-82-5	Aroclor 1260	33	U

February 19, 1996

CASE NARRATIVE

1. GAMMA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: S1-D

2. INTRODUCTION

Gamma spectroscopy analyses were performed on six soil samples: S1-D, S6-D, S9-D, W1-D, W6-D, and W9-D. Standard operating procedure (SOP): ACL-072 was followed for the preparation of each sample for gamma spec analysis. For determination of the percent dry weight, SOP: ACL-073 was used.

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detectors 1 and 9 are also intrinsic Ge detectors interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described above for detector 3. For detector 1 and 9, SOP: ACL-127 was followed.

Most samples were counted for a minimum of 1200 minutes to allow for adequate counting statistics.

3. DEVIATIONS FROM PROTOCOL

None.

4. QUALITY CONTROL SUMMARY

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cesium-137 standard, following SOP: ACL-075 for detector 3 and SOP: ACL-128 for detectors 1 and 9. The performance of the lab control standard was always within 2.5 percent of the expected values, as indicated in the Associated Documentation section.

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Date 2/20/96
Tony TenKate, Analyst
Radiological Analysis

Date 2/21/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Soil; JANUS Reactor Characterization Project
Submitted by: M. Robinet

Date Received: 1/11/96
Date Reported: 1/16/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)			
		^{214}Bi	^{226}Ra	^{232}Th	^{228}Th
S1-D	96-8063-01	1.3 ± 0.1	1.3 ± 0.1	0.9 ± 0.1	1.0 ± 0.1
S6-D	-02	1.5 ± 0.2	1.5 ± 0.2	0.9 ± 0.1	1.0 ± 0.1
S9-D	-03	2.2 ± 0.2	2.0 ± 0.2	0.8 ± 0.1	1.1 ± 0.1
W1-D	-04	1.7 ± 0.2	1.6 ± 0.2	1.0 ± 0.1	1.3 ± 0.1
W6-D	-05	1.3 ± 0.1	1.7 ± 0.2	<0.2	0.7 ± 0.07
W9-D	-06	1.6 ± 0.2	1.6 ± 0.2	0.8 ± 0.1	1.0 ± 0.1
	96-8063 Blank	0.4 ± 0.04	0.3 ± 0.03	<0.2	<0.2

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291.

Reference(s): CMT Logbook No. 938, Det. 2, 3, and 6, Pgs. 113 and 115; CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 73; CMT Logbook No. 1111, Pg. 88.

Copies To: M. Robinet
M. O'Conner
C. Sholleen
D. Green
P. Lindahl
D. Bowers
D. Graczyk
A. Boparai
L. TenKate
P. Postlethwait

Analyst(s): T. TenKate *T 2*
Addnl. Copies to: T. TenKate
F. Martino

L. Chromizky
ACL Results File
200 Results File

APPENDIX H

Geotechnical Data for Soil Borings

ARGONNE
NATIONAL
LABORATORY

RECEIVED
Health Physics Section

JAN 25 1996

Intra-Laboratory Memo

Ct: _____

Filed: _____

TO: M. Robinet ESH/HP

January 29, 1996

FROM: R. Ghilardi *RG*

SUBJECT: JANUS CHARACTERIZATION
SR 00010104

Enclosed herewith is one copy of the Boring Logs as prepared by the Claude H. Hurley Co. which are the results of the TB-1 and TB-2 Borings which they performed on 1/11/96.

As per your 1/25/96 telecon confirmation, all requested field work has been completed. The 3 contaminated containers will shortly be removed from the work site.

I will have this Service Request closed out on January 31, 1996 and shortly thereafter, submit the total costs to you. My initial review, indicates that the costs, including scaffolding will be less than the allocated \$31,000.

Thank you for the privilege to serve you. Please contact me (2-5093) if you have any questions.

CC: H. Miller

w/o encl.

M. Boehlen

J. Jones

R. Buric

SR: 00010104

CLAUDE H. HURLEY COMPANY

Consulting Soil and Foundation Engineers

175 WEST FIRST STREET
ELMHURST, ILLINOIS 60126
(708) 279-7762

January 19, 1996

Steve Carr Builders
8 North Loomis Street
Naperville, Illinois 60540

Attention: Mr. Nick Barza

Re: Janus Facility
Building 202
Argonne National Laboratory
HPN3-604-D

Gentlemen:

The Claude H. Hurley Company, Geotechnical Engineer has completed a study at the above referenced project site. The work was done per the terms of a January 4, 1996 Agreement with Steve Carr Builders, Contractor through Argonne National Laboratory, Owner.

Purpose of Study

The project includes work to characterize the site conditions for environmental concerns. The purpose of this study was to:

1. Obtain information on the profile stratigraphy and data on the properties of the profile soils.
2. Obtain samples of the profile materials for environmental analyses by the Owner.

Scope of Study

The scope of work included:

1. Subsurface exploration by making two borings and related field and laboratory geotechnical tests on the profile materials encountered.

Compilation of the geotechnical data on Boring Logs.

2. Obtaining environmental samples and submittal of the samples to the Owner for testing, analysis and evaluation.

Field Investigations. The field investigations included making two Test Borings at the location shown on the attached Plan, Fig. 1.

Field tests included making standard penetration tests, visual classification tests and hand penetrometer readings on the materials encountered.

Geotechnical samples were obtained for testing by the Hurley Company Laboratory. Environmental samples were obtained and submitted to the Owner for applicable testing, evaluation and analysis.

The groundwater conditions were measured during drilling and immediately after completion of drilling.

The results of the field operations are shown on the attached Boring Logs.

Laboratory investigations. Significant geotechnical properties of the materials encountered were determined in a laboratory testing program which included supplementary visual classification of the materials. Water content tests were made on all samples. Unconfined compression tests were made on all samples suitable for testing.

The results of the study are shown on the attached Boring Logs.

Thank you for the opportunity to be of service.

Very truly yours,

CLAUDE H. HURLEY COMPANY

Claude H. Hurley, P.E.
Engineering Director

CHH:nw

cc: R. Ghilardi (2)
N. Barza (2)

• TB-1
— Test Boring Location & Number

PLAN

Consulting Geotechnical Engineers

1

BORING LOG

BORING NO. TB-1

[illegible]

CLAUDE H. HURLEY COMPANY

BORING LOG

PROJECT NO. 3-604-D

BORING NO. TB-2

PROJECT JANUS CHARACTERIZATION ARGONNE NATIONAL LABORATORY

LOCATION	BUILDING 202	WEST SIDE, REFERENCE PLAN FIG. 1	ARGONNE,	ILLINOIS
	STRUCTURE		CITY	STATE

DRILLING CONTRACTOR D & G DRILLING, INC.

DATE OF DRILLING: STARTED 1-11-96 COMPLETED 1-11-96 SURFACE ELEVATION 102.6

DRILLED BY J. KODITEK LOGGED BY M. DENAULT

[illegible]

APPENDIX I

Analytical Results from Smears
ANL Analytical Chemistry Laboratory Data Package Summaries

Location of Filter (Smear) Samples

JANUS Sample Number	ACL Sample Number	Description	Sample Location
J-007E	96-8075-02	Filter	High Dose Room Reactor Face - α Spec
014-BAG	96-8086-01	Filter	Blank - α, γ Spec
014-RT-1	96-8086-02	Filter	Opening of Rabbit Tube - α, γ Spec
014-RT-2	96-8086-03	Filter	Outside Rabbit Tube - α, γ Spec
J-014RT	96-8075-03	Filter	Rabbit Tube - α, γ Spec
B1A	96-8075-01	Filter	Blank - α Spec
J-120-GB1	96-8075-04	Filter	Glove Box - α Spec
J-120-GB3	96-8075-05	Filter	Glove Box - α Spec
J-120-GB5	96-8075-06	Filter	Glove Box - α Spec
J-120-GB7	96-8075-07	Filter	Glove Box - α Spec
B1G	96-8073-01	Filter	Blank - Gamma Spec
J-120-GB2	96-8073-02	Filter	Glove Box - Gamma Spec
J-120-GB4	96-8073-03	Filter	Glove Box - Gamma Spec
J-120-GB6	96-8073-04	Filter	Glove Box - Gamma Spec
J-120-GB8	96-8073-05	Filter	Glove Box - Gamma Spec
J-120-GB10	96-8073-06	Filter	Glove Box - Gamma Spec
#1	96-8121-01	Tape/Paint	Glove Box - Gamma Spec
#2	96-8121-02	Tape/Paint	Glove Box - Gamma Spec
Tape/Paint #3	96-8122-01	Tape/Paint	Glove Box - Alpha Spec
Tape/Paint #4	96-8122-02	Tape/Paint	Glove Box - Alpha Spec

Location of Filter (Smear) Samples

JANUS Sample Number	ACL Sample Number	Description	Sample Location
B2G	96-8093-01	Smear	Blank - Gamma Spec
J010-PS Primary	96-8093-02A	Smear	Inside Primary System - Gamma Spec
J010-PS PW-24	96-8093-02B	Smear	Pump No PW24 - Gamma Spec
J010-PS PW-25	96-8093-02C	Smear	Pump No PW25 - Gamma Spec
J010-PS Skimmer	96-8093-02D	Smear	Internal Skimmer - Gamma Spec

February 19, 1996

CASE NARRATIVE

1. ALPHA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: B1A

2. INTRODUCTION

Thorium, uranium, and plutonium analyses were performed using isotope-dilution alpha spectroscopy. These filter paper samples were spiked with appropriate radiotracers, decomposed through combustion and acid digestion, and subsequently separated into elemental components through extraction chromatography and anion exchange chromatography as described in SOP:ACL-165. Planchets were prepared by electrodeposition and counted on the Kicksort Alpha Spectrometer with associated Ortec ADCAM and AST personal computer with Ortec software according to SOP:ACL-181.

3. DEVIATIONS FROM PROTOCOL

There were no deviations from the standard analytical protocols. However, a small quantity of thorium was present on the plutonium sample planchets due to breakthrough during the chemical separation steps. Thorium-228 interferes with the quantification of Pu-238. Therefore, the values reported for Pu-238 reflect a contribution from this Th-228 interference.

4. QUALITY CONTROL SUMMARY

Blank sample 96-8075-blk consists of a Whatman #42 filter paper and all reagents used in the sample preparation, and was taken through the same chemical procedure as the samples. The activity levels associated with this blank sample were very low, and normal. The alpha laboratory control sample was within 20% and 2 sigma of the expected results. No duplicate samples were analyzed because the total filter sample was consumed during analysis, and no duplicate samples were provided by the customer.

Date 20 Feb 96
Lesa L. Smith, Analyst
Radiological Analysis

Date 2/21/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

SAMPLE CROSS-REFERENCE LIST - ALPHA SPECTROSCOPY

**JANUS REACTOR CHARACTERIZATION PROJECT
SDG: B1A**

ACL Sample Number	Customer Sample Number
96-8075-01	B1A
96-8075-02	J-007E
96-8075-03	J-014RT
96-8075-04	J-120-GB1
96-8075-05	J-120-GB3
96-8075-06	J-120-GB5
96-8075-07	J-120-GB7

February 13, 1996

Matrix Spike Recoveries: SW-846 provides no QC limits for recoveries of matrix spike compounds for volatile organic analysis. Matrix spike and MSD recoveries were within the CLP (Contract Laboratory Program) QC limits for ten out of ten values reported; relative percent difference between MS and MSD were within the CLP QC limits for five out of five values reported.

4. DATA PACKAGE CLARIFICATIONS

Copies of pages from the VOA Sample Preparation Book V are included at the end of the data package.

Date 2/13/96
Laura L. Chromizky, Analyst
Volatile Organic Analysis

Date 2/13/96
Amrit S. Boparai, Group Leader
Organic Analysis Group

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: SN-T1

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8061-01

Date Received: 01/11/96

Sample Type: WATER.

Date Reported: 01/24/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L	Q
74-87-3-----	CHLOROMETHANE	10.00	U
75-01-4-----	VINYL CHLORIDE	10.00	U
74-83-9-----	BROMOMETHANE	10.00	U
75-00-3-----	CHLOROETHANE	10.00	U
75-35-4-----	1 1-DICHLOROETHENE	10.00	U
75-09-2-----	METHYLENE CHLORIDE	10.00	U
156-60-5-----	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3-----	1 1-DICHLOROETHANE	10.00	U
74-97-5-----	BROMOCHLOROMETHANE	10.00	U
67-66-3-----	CHLOROFORM	10.00	U
71-55-6-----	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5-----	CARBON TETRACHLORIDE	10.00	U
71-43-2-----	BENZENE	10.00	U
107-06-2-----	1 2-DICHLOROETHANE	10.00	U
79-01-6-----	TRICHLOROETHENE	10.00	U
78-87-5-----	1 2-DICHLOROPROPANE	10.00	U
75-27-4-----	BROMODICHLOROMETHANE	10.00	U
10061-02-0-----	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3-----	TOLUENE	10.00	U
10061-01-0-----	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5-----	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4-----	TETRACHLOROETHENE	10.00	U
124-48-1-----	DIBROMOCHLOROMETHANE	10.00	U
108-90-7-----	CHLOROBENZENE	10.00	U
100-41-4-----	ETHYL BENZENE	10.00	U
-----	m&p-XYLENE	10.00	U
95-47-6-----	o-XYLENE	10.00	U
100-42-5-----	STYRENE	10.00	U
75-25-2-----	BROMOFORM	10.00	U
79-34-5-----	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8-----	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4-----	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7-----	2 2-DICHLOROPROPANE	10.00	U
156-59-2-----	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6-----	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: SN-T1

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8061-01

Date Received: 01/11/96

Sample Type: WATER

Date Reported: 01/24/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L	Q
---------	----------	--	---

74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
95-49-8-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: SN-T1

Sample Date: 01/11/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8061-01

Date Received: 01/11/96

Sample Type: WATER

Date Reported: 01/24/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: B1-ST

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-01A

Date Received: 01/23/96

Sample Type: WATER.

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L	Q
74-87-3-----	CHLOROMETHANE	10.00	U
75-01-4-----	VINYL CHLORIDE	10.00	U
74-83-9-----	BROMOMETHANE	10.00	U
75-00-3-----	CHLOROETHANE	10.00	U
75-35-4-----	1 1-DICHLOROETHENE	10.00	U
75-09-2-----	METHYLENE CHLORIDE	10.00	U
156-60-5-----	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3-----	1 1-DICHLOROETHANE	10.00	U
74-97-5-----	BROMOCHLOROMETHANE	10.00	U
67-66-3-----	CHLOROFORM	4.22	J
71-55-6-----	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5-----	CARBON TETRACHLORIDE	10.00	U
71-43-2-----	BENZENE	10.00	U
107-06-2-----	1 2-DICHLOROETHANE	10.00	U
79-01-6-----	TRICHLOROETHENE	10.00	U
78-87-5-----	1 2-DICHLOROPROPANE	10.00	U
75-27-4-----	BROMODICHLOROMETHANE	5.75	J
10061-02-0-----	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3-----	TOLUENE	10.00	U
10061-01-0-----	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5-----	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4-----	TETRACHLOROETHENE	10.00	U
124-48-1-----	DIBROMOCHLOROMETHANE	5.59	J
108-90-7-----	CHLOROBENZENE	10.00	U
100-41-4-----	ETHYL BENZENE	10.00	U
-----	m&p-XYLENE	10.00	U
95-47-6-----	o-XYLENE	10.00	U
100-42-5-----	STYRENE	10.00	U
75-25-2-----	BROMOFORM	10.00	U
79-34-5-----	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8-----	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4-----	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7-----	2 2-DICHLOROPROPANE	10.00	U
156-59-2-----	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6-----	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: B1-ST

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-01A

Date Received: 01/23/96

Sample Type: WATER.

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:		Q
		(ug/L or ug/Kg)	ug/L	
74-95-3-----	DIBROMOMETHANE		10.00	U
142-28-9-----	1 3-DICHLOROPROPANE		10.00	U
106-93-4-----	1 2-DIBROMOETHANE		10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE		10.00	U
98-82-8-----	ISOPROPYLBENZENE		10.00	U
108-86-1-----	BROMOBENZENE		10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE		10.00	U
103-65-1-----	n PROPYLBENZENE		10.00	U
95-49-8-----	2 CHLOROTOLUENE		10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE		10.00	U
95-49-8-----	4 CHLOROTOLUENE		10.00	U
98-06-6-----	TERT BUTYLBENZENE		10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE		10.00	U
135-98-8-----	SEC-BUTYLBENZENE		10.00	U
99-87-6-----	p ISOPROPYLTOLUENE		10.00	U
541-73-1-----	1 3 DICHLOROBENZENE		10.00	U
106-46-7-----	1 4 DICHLOROBENZENE		10.00	U
104-51-8-----	n BUTYLBENZENE		10.00	U
95-50-1-----	1 2-DICHLOROBENZENE		10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE		10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE		10.00	U
87-68-3-----	HEXACHLOROBUTADIENE		10.00	U
91-20-3-----	NAPHTHALENE		10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE		10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: B1-ST

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-01A

Date Received: 01/23/96

Sample Type: WATER

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 109-87-5	Methane, dimethoxy-	7.130	246.20	NJ

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: TB-2

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-02

Date Received: 01/23/96

Sample Type: WATER

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/L
			Q
74-87-3	CHLOROMETHANE	10.00	U
75-01-4	VINYL CHLORIDE	10.00	U
74-83-9	BROMOMETHANE	10.00	U
75-00-3	CHLOROETHANE	10.00	U
75-35-4	1 1-DICHLOROETHENE	10.00	U
75-09-2	METHYLENE CHLORIDE	10.00	U
156-60-5	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3	1 1-DICHLOROETHANE	10.00	U
74-97-5	BROMOCHLOROMETHANE	10.00	U
67-66-3	CHLOROFORM	10.00	U
71-55-6	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5	CARBON TETRACHLORIDE	10.00	U
71-43-2	BENZENE	10.00	U
107-06-2	1 2-DICHLOROETHANE	10.00	U
79-01-6	TRICHLOROETHENE	10.00	U
78-87-5	1 2-DICHLOROPROPANE	10.00	U
75-27-4	BROMODICHLOROMETHANE	10.00	U
10061-02-0	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3	TOLUENE	10.00	U
10061-01-0	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4	TETRACHLOROETHENE	10.00	U
124-48-1	DIBROMOCHLOROMETHANE	10.00	U
108-90-7	CHLOROBENZENE	10.00	U
100-41-4	ETHYL BENZENE	10.00	U
	m&p-XYLENE	10.00	U
95-47-6	o-XYLENE	10.00	U
100-42-5	STYRENE	10.00	U
75-25-2	BROMOFORM	10.00	U
79-34-5	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7	2 2-DICHLOROPROPANE	10.00	U
156-59-2	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: TB-2

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-02

Date Received: 01/23/96

Sample Type: WATER.

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L	Q
---------	----------	--	---

74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
95-49-8-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: TB-2

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-02

Date Received: 01/23/96

Sample Type: WATER

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: 151-B1

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-03A

Date Received: 01/23/96

Sample Type: WATER.

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L	Q
74-87-3-----	CHLOROMETHANE	10.00	U
75-01-4-----	VINYL CHLORIDE	10.00	U
74-83-9-----	BROMOMETHANE	10.00	U
75-00-3-----	CHLOROETHANE	10.00	U
75-35-4-----	1 1-DICHLOROETHENE	10.00	U
75-09-2-----	METHYLENE CHLORIDE	10.00	U
156-60-5-----	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3-----	1 1-DICHLOROETHANE	10.00	U
74-97-5-----	BROMOCHLOROMETHANE	10.00	U
67-66-3-----	CHLOROFORM	10.00	U
71-55-6-----	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5-----	CARBON TETRACHLORIDE	10.00	U
71-43-2-----	BENZENE	10.00	U
107-06-2-----	1 2-DICHLOROETHANE	10.00	U
79-01-6-----	TRICHLOROETHENE	10.00	U
78-87-5-----	1 2-DICHLOROPROPANE	10.00	U
75-27-4-----	BROMODICHLOROMETHANE	10.00	U
10061-02-0-----	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3-----	TOLUENE	10.00	U
10061-01-0-----	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5-----	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4-----	TETRACHLOROETHENE	10.00	U
124-48-1-----	DIBROMOCHLOROMETHANE	10.00	U
108-90-7-----	CHLOROBENZENE	10.00	U
100-41-4-----	ETHYL BENZENE	10.00	U
-----	m&p-XYLENE	10.00	U
95-47-6-----	o-XYLENE	10.00	U
100-42-5-----	STYRENE	10.00	U
75-25-2-----	BROMOFORM	10.00	U
79-34-5-----	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8-----	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4-----	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7-----	2 2-DICHLOROPROPANE	10.00	U
156-59-2-----	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6-----	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: 151-B1

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-03A

Date Received: 01/23/96

Sample Type: WATER

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/L
			Q
74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
95-49-8-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: 151-B1

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-03A

Date Received: 01/23/96

Sample Type: WATER.

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: 152-B1

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-04A

Date Received: 01/23/96

Sample Type: WATER

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L	Q
74-87-3-----	CHLOROMETHANE	10.00	U
75-01-4-----	VINYL CHLORIDE	10.00	U
74-83-9-----	BROMOMETHANE	10.00	U
75-00-3-----	CHLOROETHANE	10.00	U
75-35-4-----	1 1-DICHLOROETHENE	10.00	U
75-09-2-----	METHYLENE CHLORIDE	10.00	U
156-60-5-----	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3-----	1 1-DICHLOROETHANE	10.00	U
74-97-5-----	BROMOCHLOROMETHANE	10.00	U
67-66-3-----	CHLOROFORM	2.39	J
71-55-6-----	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5-----	CARBON TETRACHLORIDE	10.00	U
71-43-2-----	BENZENE	10.00	U
107-06-2-----	1 2-DICHLOROETHANE	10.00	U
79-01-6-----	TRICHLOROETHENE	10.00	U
78-87-5-----	1 2-DICHLOROPROPANE	10.00	U
75-27-4-----	BROMODICHLOROMETHANE	5.06	J
10061-02-0-----	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3-----	TOLUENE	10.00	U
10061-01-0-----	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5-----	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4-----	TETRACHLOROETHENE	10.00	U
124-48-1-----	DIBROMOCHLOROMETHANE	5.76	J
108-90-7-----	CHLOROBENZENE	10.00	U
100-41-4-----	ETHYL BENZENE	10.00	U
-----	m&p-XYLENE	10.00	U
95-47-6-----	o-XYLENE	10.00	U
100-42-5-----	STYRENE	10.00	U
75-25-2-----	BROMOFORM	10.00	U
79-34-5-----	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8-----	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4-----	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7-----	2 2-DICHLOROPROPANE	10.00	U
156-59-2-----	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6-----	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: 152-B1

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-04A

Date Received: 01/23/96

Sample Type: WATER

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L	Q
74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
95-49-8-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: 152-B1

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8077-04A

Date Received: 01/23/96

Sample Type: WATER

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====

February 15, 1996

CASE NARRATIVE

1. SEMIVOLATILE ORGANIC DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: C-ST
Instrument: Hewlett Packard 5890 Ser II GC/5989 MS with Unix-Based Target 3.1 Software

2. INTRODUCTION

Sample preparation is based on U.S. EPA Method 3510B (SW-846, Revision 1, September 1994). The analytical method used is based on EPA Method 8270B (SW-846, Revision 1, September 1994) for semivolatile organic compounds. The methods described are appropriate for the determination of 92 semivolatile organic compounds that are partitioned into an organic solvent and are amenable to gas chromatography. The target compounds do not include PCB/Pesticides.

The enclosed data package contains data for three water samples, one matrix spike (MS) sample, one matrix spike duplicate (MSD) sample and one laboratory blank. These samples were collected from the Janus Reactor, Argonne National Laboratory-East, and were received on January 23, 1996.

3. SUMMARY COMMENTS

Holding Time: Holding time was met for all the samples.

GC/MS Tuning: All samples were analyzed within 12 h of a DFTPP tune, which met the method tuning criteria.

Instrument Calibration: Initial calibration met the QC criteria with the exception of hexachlorocyclopentadiene, for which the relative response factor was less than 0.05. In the continuing calibration, the relative response factors of hexachlorocyclopentadiene and 2,4-dinitrophenol were less than 0.05, and the % differences of pentachlorophenol and di-n-octylphthalate were out of the QC limits. However, this should not affect the data quality since these compounds were not detected in the samples.

Internal Standard Area: Internal standard (IS) area were within the QC limits for 36 out of 36 values reported.

Laboratory Blank: Some TICs were found in the laboratory blank as well as in the samples.

Since the laboratory blank did not contain any of the target analytes it meet method criteria.

Surrogate Recoveries: The surrogate recoveries were within the QC limits for 35 out of 36 values reported.

Matrix Spikes: All of the MS and MSD recoveries were within the CLP QC limits for 22 out of 22 values reported; relative percent difference (RPD) between MS and MSD were within the CLP QC limits for 11 out of 11 values reported.

4. DATA PACKAGE CLARIFICATIONS

Estimated Quantitation Limits (EQLs): The EQLs for all the target compounds are based on 10 ng on column (10 µg/L for water sample) except for the following target compounds for which the EQLs are 20 ng on column (20 µg/L for water sample): methyl methanesulfonate, hexachlorocyclopentadiene, 2,4-dinitrophenol, 4-nitrophenol, α,α-dimethylphenethylamine, and benzidine. The EQL values reported in this data package meet the EQL criteria of EPA Method 8270B.

N-nitrosodiphenylamine and Diphenylamine: N-nitrosodiphenylamine (N-nitrosoDPA) can not be separated from diphenylamine as stated in EPA Method 8270B. Since these two compounds co-elute, they are reported as N-nitroso DPA and diphenylamine on the Quantitation Reports and Form I.

Date 2/16/96
Yifen Tsai, Analyst
Semivolatile Organic Analysis

Date 2/16/96
Amrit S. Boparai, Group Leader
Organic Analysis Group

1 B

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: C-ST
Sample Location:
Lab Sample ID: 96-8078-01
Sample Matrix: WATER
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2896
Sample Date: JAN/23/96
Sample Point:
Date Received: JAN/23/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/L	Q
62-75-9-----	N-Nitrosodimethylamine	10.0	U
109-06-8-----	2-Picoline	10.0	U
66-27-3-----	Methyl methansulfonate	20.0	U
62-50-0-----	Ethyl methansulfonate	10.0	U
108-95-2-----	Phenol	10.0	U
62-53-3-----	Aniline	10.0	U
111-44-4-----	bis(2-Chloroethyl) ether	10.0	U
95-57-8-----	2-Chlorophenol	10.0	U
541-73-1-----	1,3-Dichlorobenzene	10.0	U
106-46-7-----	1,4-Dichlorobenzene	10.0	U
100-51-6-----	Benzyl alcohol	10.0	U
95-50-1-----	1,2-Dichlorobenzene	10.0	U
95-48-7-----	2-Methylphenol	10.0	U
108-60-1-----	bis(2-Chloroisopropyl) ether	10.0	U
98-86-2-----	Acetophenone	10.0	U
106-44-5-----	4-Methylphenol	10.0	U
621-64-7-----	N-nitroso-di-n-propylamine	10.0	U
67-72-1-----	Hexachloroethane	10.0	U
98-95-3-----	Nitrobenzene	10.0	U
100-75-4-----	N-Nitrosopiperidine	10.0	U
78-59-1-----	Isophorone	10.0	U
88-75-5-----	2-Nitrophenol	10.0	U
105-67-9-----	2,4-Dimethyphenol	10.0	U
111-91-1-----	bis(2-Chloroethoxy) methane	10.0	U
65-85-0-----	Benzoic acid	10.0	U
120-83-2-----	2,4-Dichlorophenol	10.0	U
122-09-8-----	a,a-Dimethylphenethylamine	20.0	U
120-82-1-----	1,2,4-Trichlorobenzene	10.0	U
91-20-3-----	Naphthalene	10.0	U
106-47-8-----	4-Chloroaniline	10.0	U
87-65-0-----	2,6-Dichlorophenol	10.0	U
87-68-3-----	Hexachlorobutadiene	10.0	U
924-16-3-----	N-Nitrosodibutylamine	10.0	U
59-50-7-----	4-Chloro-3-methylphenol	10.0	U
91-57-6-----	2-Methylnaphthalene	10.0	U
77-47-4-----	Hexachlorocyclopentadiene	20.0	U
95-94-3-----	1,2,4,5-Tetrachlorobenzene	10.0	U

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: JANUS Filters
Submitted by: C. Sholeen

Date Received: 1/23/96
Date Reported: 2/7/96

Submitter's Sample No.	ACL Sample No.	(pCi/Filter $\pm 2\sigma$)	
		$^{239/240}\text{Pu}$	$^{238}\text{Pu}^*$
B1A	96-8075-01	0.02 $\pm$ 0.01	0.04 $\pm$ 0.02
J-007E	-02	0.02 $\pm$ 0.01	0.02 $\pm$ 0.01
J-014RT	-03	0.01 $\pm$ 0.01	<0.02
J-120-GB1	-04	<0.01	<0.02
J-120-GB3	-05	2.0 $\pm$ 0.2	0.15 $\pm$ 0.04
J-120-GB5	-06	<0.01	0.04 $\pm$ 0.02
J-120-GB7	-07	<0.01	0.02 $\pm$ 0.01
	Blank	0.01 $\pm$ 0.01	0.04 $\pm$ 0.01

* Value reflects contribution from ^{228}Th present in spectra due to small breakthrough of Thorium in chemical separation steps.

NOTE: Uncertainties (σ) based upon propagation of counting statistical error. Less than (<) values are 3.29σ .

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. Smith at 2- 1890 .

Reference(s): CMT Laboratory Notebook No. 1044, Pgs. 93-94, and 100.

Copies To: C. Sholeen
M. Robinet
M. O'Connor
D. Geraghty
D. Green
D. Bowers
P. Lindahl
D. Graczyk
F. Martino
L. Smith

Analyst(s): L. Smith

Addnl. Copies:
ACL Results File
200 Results File

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: JANUS Filters
Submitted by: C. Sholeen

Date Received: 1/23/96
Date Reported: 2/7/96

Submitter's Sample No.	ACL Sample No.	(pCi/Filter $\pm 2\sigma$)				
		^{232}Th	^{230}Th	^{238}U	$^{235/236}\text{U}$	$^{233/234}\text{U}$
B1A	96-8075-01	<0.01	0.02 ± 0.01	<0.01	<0.01	0.02 ± 0.01
J-007E	-02	<0.01	0.05 ± 0.02	<0.01	<0.01	<0.01
J-014RT	-03	<0.01	0.02 ± 0.01	<0.01	<0.01	<0.01
J-120-GB1	-04	<0.01	0.03 ± 0.01	0.02 ± 0.01	<0.01	0.08 ± 0.02
J-120-GB3	-05	<0.01	<0.01	<0.01	<0.01	<0.01
J-120-GB5	-06	<0.01	0.02 ± 0.01	<0.01	<0.01	<0.02
J-120-GB7	-07	<0.01	<0.01	<0.01	<0.01	0.03 ± 0.01
	-Blank	<0.01	0.02 ± 0.01	<0.01	<0.01	<0.01
NOTE: Uncertainties (σ) are based upon propagation of counting statistical error. Less than (<) values are 3.29σ .						

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. Smith at 2- 1890 .

Reference(s): CMT Laboratory Notebook No. 1044, Pgs. 93-94, and 100.

Copies To: C. Sholeen
M. Robinet
M. O'Connor
D. Geraghty
D. Green
D. Bowers
P. Lindahl
D. Graczyk
F. Martino
L. Smith

Analyst(s): L. Smith

JS

Addnl. Copies:
ACL Results File
200 Results File

February 19, 1996

CASE NARRATIVE

1. ALPHA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: 014-BAG

2. INTRODUCTION

Thorium, uranium, and plutonium analyses were performed using isotope-dilution alpha spectroscopy. These filter paper samples were spiked with appropriate radiotracers, decomposed through combustion and acid digestion, and subsequently separated into elemental components through extraction chromatography and anion exchange chromatography as described in SOP: ACL-165. Planchet were prepared by electrodeposition and counted on the Kickstart Alpha Spectrometer with associated Ortec ADCAM and AST personal computer with Ortec software according to SOP: ACL-181.

3. DEVIATIONS FROM PROTOCOL

There were no deviations from the standard analytical protocols. However, a small quantity of thorium was present on the plutonium sample planchet due to breakthrough during the chemical separation steps. Thorium-228 interferes with the quantification of Pu-238. Therefore, the values reported for Pu-238 reflect a contribution from this Th-228 interference.

4. QUALITY CONTROL SUMMARY

Blank sample 96-8086-blk consists of a Whatman #42 filter paper and all reagents used in the sample preparation, and was taken through the same chemical procedure as the samples. The activity levels associated with this blank sample were very low, and normal. Results for the alpha laboratory control sample were within 20% and 2 sigma of the expected results. No duplicate samples were analyzed because the total filter sample was consumed during analysis, and no duplicate samples were provided by the customer.

Date 20 Feb 96
Lesa L. Smith, Analyst
Radiological Analysis

Date 2/21/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

SAMPLE CROSS-REFERENCE LIST - ALPHA SPECTROSCOPY

**JANUS REACTOR CHARACTERIZATION PROJECT
SDG: 014-BAG**

ACL Sample Number	Customer Sample Number
96-8086-01	014-BAG
96-8086-02	014-RT-1
96-8086-03	014-RT-2

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Filters, JANUS Reactor Characterization Project

Date Received: 1/29/96

Submitted by: C. Sholeen

Date Reported: 2/13/96

Submitter's Sample No.	ACL Sample No.	(pCi/Filter $\pm 2\sigma$)						
		^{232}Th	^{230}Th	^{238}U	$^{225/236}\text{U}$	$^{233/234}\text{U}$	$^{239/240}\text{Pu}$	$^{238}\text{Pu}^*$
014-BAG	96-8086-01	<0.01	0.04 $\pm$ 0.02	<0.01	<0.02	<0.01	<0.02	0.03 $\pm$ 0.02
014-RT-1	-02	<0.01	0.02 $\pm$ 0.01	0.03 $\pm$ 0.01	<0.01	0.04 $\pm$ 0.01	0.11 $\pm$ 0.02	0.04 $\pm$ 0.02
014-RT-2	-03	<0.02	0.02 $\pm$ 0.01	0.35 $\pm$ 0.03	0.01 $\pm$ 0.01	0.38 $\pm$ 0.03	0.60 $\pm$ 0.07	0.04 $\pm$ 0.02
	Blank	<0.01	0.04 $\pm$ 0.02	<0.01	<0.01	<0.01	<0.01	<0.05

* Values reflect contribution from ^{228}Th present in spectra due to small break-through of thorium in chemical separation steps.

NOTE: Uncertainties (σ) based upon propagation of counting statistical error. Less than (<) values are 3.29σ .

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. Smith at 2- 1890

Reference(s): CMT Notebook No. 1044, Pgs. 98-100, and 103.

Copies To: C. Sholeen
M. Robinet
M. O'Connor
/hlt D. Geraghty
2/13/96 D. Green

D. Bowers
P. Lindahl
D. Graczyk
F. Martino
L. Smith

Analyst(s): L. Smith

Addnl. Copies:
ACL Results File
200 Results File

March 4, 1996

CASE NARRATIVE

1. RADIOLOGICAL ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: B1G

2. INTRODUCTION

Gamma spectroscopy analyses were performed on the following smears (also referred to as filters or filter papers):

<u>Janus Sample Number:</u>	<u>ACL Number:</u>	<u>Description:</u>
B1G	96-8073-01	Filter paper
J-120-GB2	96-8073-02	Filter paper
J-120-GB4	96-8073-03	Filter paper
J-120-GB6	96-8073-04	Filter paper
J-120-GB8	96-8073-05	Filter paper
J-120-GB10	96-8073-06	Filter paper
014-BAG	96-8086-01	Filter
014-RT-1	96-8086-02	Filter
014-RT-2	96-8086-03	Filter
B2G	96-8093-01	Smear
J010-PS Primary	96-8093-02A	Smear
J010-PS PW-24	96-8093-02B	Smear
J010-PS PW-25	96-8093-02C	Smear
J010-PS Skimmer	96-8093-02D	Smear

Standard operating procedures SOP: ACL-075 (detector #3) and SOP: ACL-128 (detector #9) were followed for the preparation of each sample for gamma spec analysis. Smears were counted as point sources at a distance of 10 cm from the detector.

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detectors 9 is also an intrinsic Ge detector interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described above for detector 3. For detector 9, SOP: ACL-127 was followed.

Most samples were counted for a minimum of 500 minutes to allow for adequate counting statistics.

3. DEVIATIONS FROM PROTOCOL

None.

4. QUALITY CONTROL

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cesium-137 standard, following SOP: ACL-075 for detector 3 and SOP: ACL-128 for detector 9. The performance of the lab control standard was always within 2.5 percent of the expected values, as indicated in the Associated Documentation section.

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Date 3/5/96
Tony TenKate, Analyst
Radiological Analysis

Date 3/5/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Filter Paper; JANUS Reactor Characterization Project
Submitted by: C. Sholeen

Date Received: 1/23/96

Date Reported: 2/28/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/Filter)	
		<u>^{226}Ra</u>	<u>^{232}Th</u>
B1G	96-8073-01	<10	<10
J-120-GB2	-02	<10	<10
J-120-GB4	-03	<10	<10
J-120-GB6	-04	<10	<10
J-120-GB8	-05	<10	<10
J-120-GB10	-06	<10	<10

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291 .

Reference(s): CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115 and 117; CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 75.

Copies To: C. Sholeen
M. Robinet
D. Geraghty
M. O'Connor
D. Green
D. Bowers
P. Lindahl
D. Graczyk
F. Martino
T. TenKate

Analyst(s): T. TenKate
J. Yaeger *T²*

Addnl. Copies:
J. Yaeger
ACL Results File
200 Results File

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Filters; JANUS Reactor Characterization Project

Date Received: 1/29/96

Submitted by: C. Sholeen

Date Reported: 2/28/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/Filter)			
		<u>⁶⁰Co</u>	<u>¹⁵²Eu</u>	<u>¹⁵⁴Eu</u>	<u>¹³⁷Cs</u>
014-BAG	96-8086-01	<10	<10	<10	<10
014-RT-1	-02	1005 ± 100	380 ± 38	<10	<10
014-RT-2	-03	4410 ± 440	3375 ± 340	67 ± 7	260 ± 26

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115; CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 73.

Copies To: C. Sholeen
M. Robinet
D. Geraghty
M. O'Connor
D. Green

D. Bowers
P. Lindahl
D. Graczyk
F. Martino
T. TenKate

Analyst(s): T. TenKate
J. Yaeger *T²*

Addnl. Copies:
J. Yaeger
ACL Results File
200 Results File

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Smears; JANUS Reactor Characterization Project
Submitted by: D. Geraghty

Date Received: 2/14/96
Date Reported: 2/27/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/Smear)
		<u>⁶⁰Co</u>
B2G	96-8093-01	<10
J010-PS Primary	-02A	305 ± 31
J010-PS PW-24	-02B	28 ± 3
J010-PS PW-25	-02C	<10
J010-PS Skimmer	-02D	330 ± 33

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 117; CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 75.

Copies To: D. Geraghty
M. Robinet
C. Sholeen
M. O'Connor
D. Green

D. Bowers
P. Lindahl
D. Graczyk
F. Martino
T. TenKate

Analyst(s): T. TenKate
J. Yaeger *T2*

Addnl. Copies:
J. Yaeger
ACL Results File
200 Results File

May 6, 1996

CASE NARRATIVE**1. ALPHA SPECTROSCOPY DATA PACKAGE**

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: Tape/Paint #3

2. INTRODUCTION

Thorium, uranium, and plutonium analyses were performed using isotope-dilution alpha spectroscopy. The tape/paint samples were placed in a muffle furnace to combust organic material, digested with acid, spiked with appropriate radiotracers, and subsequently separated into elemental components through extraction chromatography and anion exchange chromatography as described in SOP:ACL-165. Planchets were prepared by electrodeposition and counted on the Kickstart Alpha Spectrometer with associated Ortec ADCAM and AST personal computer with Ortec software according to SOP:ACL-181.

3. DEVIATIONS FROM PROTOCOL

There were no deviations from the standard analytical protocols.

4. QUALITY CONTROL SUMMARY

Blank sample 96-8122-blk consists of all reagents used in the sample preparation, and was taken through the same chemical procedure as the samples. The activity levels associated with this blank sample were very low, and normal. The uranium, plutonium, and thorium results for the alpha laboratory control sample, 96-8122-spk, were within 20% and 2 sigma of the expected results. No duplicate samples were analyzed due to the nature of the samples.

Date 5/6/96
Lesa L. Smith, Analyst
Radiological Analysis

Date 5/9/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

SAMPLE CROSS-REFERENCE LIST - ALPHA SPECTROSCOPY**JANUS REACTOR CHARACTERIZATION PROJECT****SDG: Tape/Paint #3**

ACL Sample Number	Customer Sample Number
96-8122-01	Tape/Paint #3
96-8122-02	Tape/Paint #4

May 6, 1996

QC SUMMARY - ALPHA SPECTROSCOPY**JANUS REACTOR CHARACTERIZATION PROJECT****SDG: Tape/Paint #3**

A quality control sample, 96-8122-sp, was prepared by spiking a Whatmann #42 filter paper with known quantities of Th-230, U-236, and Pu-239. This QC sample was subsequently spiked with appropriate radiotracers and processed through SOP:ACL-165 with the Janus samples. The uranium, plutonium, and thorium results were within 20% and 2 sigma of the expected results. The data is summarized below:

Isotope	Tracer ID	"Accepted" Value ^a	Analytical Result ^a	Units
Th-230	²³⁰ Th (02.24.88)B	3.13 ± 0.22	3.02 ± 0.22	pCi
U-236	²³⁶ U (09.14.94)	3.86 ± 0.20	3.59 ± 0.21	pCi
Pu-239	²³⁹ Pu (1.18.90)	1.20 ± 0.16	1.25 ± 0.09	pCi

^a Results are reported at 2 sigma uncertainty.

REPORT OF ANALYTICAL RESULTS

Sample Material: JANUS: Tape/Paint
Submitted by: M. Robinet

Date Received: 4/11/96
Date Reported: 5/6/96

Submitter's Sample No.	ACL Sample No.	Alpha Spectrometry (pCi/g $\pm 2\sigma$)					
		^{232}Th	^{230}Th	^{238}U	$^{235/236}\text{U}$	$^{233/234}\text{U}$	$^{239/240}\text{U}$
Tape/Paint #3	96-8122-01	0.06 $\pm$ 0.01	0.05 $\pm$ 0.01	0.03 $\pm$ 0.01	<0.01	0.05 $\pm$ 0.01	<0.01
Tape/Paint #4	-02	0.06 $\pm$ 0.01	0.09 $\pm$ 0.01	0.04 $\pm$ 0.01	<0.01	0.08 $\pm$ 0.01	<0.01

NOTE: Uncertainties (σ) based upon propagation of counting statistical error. Less than values (<) are 3.29σ .

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. Smith at 2- 1890

Reference(s): CMT Notebook No. 1044, Pg. 142 and 145.

Copies To: M. Robinet
J. Cooney
D. Geraghty
D. Green
D. Bowers

P. Lindahl
F. Martino
T. TenKate
L. Smith
ACL Results File

Analyst(s): L. Smith

July 10, 1996

CASE NARRATIVE

1. GAMMA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG No.: #1 (Tape/Paint Chips)

2. INTRODUCTION

Gamma spectroscopy analyses were performed on two tape, paint samples: Janus sample no. tape, paint #1 and tape, paint #2. Standard operating procedure ACL-072 was followed for the preparation of each tape/paint sample for gamma spec analysis.

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detector 9 is also an intrinsic Ge detector and is interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described above for detector 3. For detector 9, SOP: ACL-127 was followed.

Most samples were counted for a minimum of 500 minutes to allow for adequate counting statistics.

3. QUALITY CONTROL SUMMARY

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cesium-137 standard, following SOP: ACL-075 for detector 3 and SOP: ACL-128 for detector 9. The performance of the lab control standard was always within 2.5 percent of the expected value, as indicated in the Associated Documentation section.

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

July 10, 1996

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Tony TenKate Date 7/15/96
Tony TenKate, Analyst
Radiological Analysis

D. L. Bowers Date 7/16/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Tape/Paint; JANUS Reactor Characterization Project Date Received: 4/12/96
Submitted by: M. Robinet Date Reported: 5/31/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)	
		<u>¹³⁷Cs</u>	<u>⁶⁰Co</u>
#1	96-8121-01	<0.2	<0.2
#2	-02	0.32 ± 0.03	<0.2

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 79; CMT Logbook No. 1111, Pg. 107.

Copies To: M. Robinet P. Lindahl
D. Geraghty F. Martino
C. Sholeen L. Smith
/hlt D. Green T. TenKate
5/31/96 D. Bowers ACL Results File

Analyst(s): T. TenKate

T²
Addnl. Copies:
200 Results File

APPENDIX J

Data from Analyses for Water Oil and Sludge
ANL Analytical Chemistry Laboratory Data Package Summaries

Location of Water, Oil and Sludge Samples			
JANUS Sample Number	ACL Sample Number	Description	Sample Location
pH, Metals and Gamma Spectroscopy Samples			
400S	96-8071-01	Fines & Sludge	Cooling Tower Sediment
A-ST	96-8076-01	Water	Septic Tank
151-A	96-8076-02	Water	Low Dose Prep Room West Sump Pump
152-A	96-8076-03	Water	Low Dose Prep Room East Sump Pump
Volatile Organics Samples			
TB-2	96-8077-02	Water	Trip Blank #2
SN-T1	96-8061-01	Water	Trip Blank
B1-ST	96-8077-01A	Water	Septic Tank
151-B1	96-8077-03A	Water	Low Dose Prep Room West Sump Pump
152-B1	96-8077-04A	Water	Low Dose Prep Room East Sump Pump
Semivolatile Organics and PCB Samples			
010-G	96-8085-01	oil	Gasometer oil
C-ST	96-8078-01	Water	Septic Tank
151-C	96-8078-02	Water	Low Dose Prep Room West Sump Pump
152-C	96-8078-03	Water	Low Dose Prep Room East Sump Pump
Cyanide and Sulfide Samples			
D-ST	96-8079-01	Water	Septic Tank
151-D	96-8079-02	Water	Low Dose Prep Room West Sump Pump
152-D	96-8079-03	Water	Low Dose Prep Room East Sump Pump
Phenols and Total Organic Carbon Samples			
E-ST	96-8080-01	Water	Septic Tank
151-E	96-8080-02	Water	Low Dose Prep Room West Sump Pump
152-E	96-8080-03	Water	Low Dose Prep Room East Sump Pump

JANUS Retention Tank Sampling Results¹

Sample Date: Matrix: Building: Tank I.D.: Sample I.D.:	9-30-94 Sludge 202 ABC-5/6 ANLRTW04SS	9-29-94 Sludge 202 ABC-7/8 ANLRTW05SS	Sample Date: Matrix: Building: Tank I.D.: Sample I.D.:	9-30-94 Sludge 202 ABC-5/6 ANLRTW04SS	9-29-94 Sludge 202 ABC-7/8 ANLRTW05SS
<u>RCRA Characterization</u> <u>TCLP Volatiles (mg/L)</u>			<u>Ignitability</u> ² Not Ignit- able ² Not Ignit- able		
tetrachloroethene	BDL	BDL	<u>Radiochemistry</u> <u>Radionuclides (pCi/g)</u>		
Chlorobenzene	BDL	BDL	Gross Alpha	10.5	26.9
<u>TCLP Semivolatiles (mg/L)</u>			Gross Beta	35.7	60.8
Pyridine	BDL	BDL	Plutonium-238	0.0	BDL
3- and/or 4-Methylphenol	BDL	BDL	Plutonium-239	0.30	0.64
<u>TCLP Metals (mg/L)</u>			Americium-241	1.0	0.80
Arsenic	BDL	BDL	Strontium-90	BDL	BDL
Barium	0.656	0.932	Uranium-234	2.7	5.1
Cadmium	BDL	BDL	Uranium-235	0.08	0.27 J
Chromium	BDL	0.0247	Uranium-238	4.9	7.2
Lead	0.0197	0.0465	<u>Gamma Ray Spec (pCi/g)</u>		
Mercury	BDL	0.0013	Americium-241 by Gamma	ND	ND
Selenium	BDL	BDL	Cesium-137 by Gamma	3.6	.21
Silver	0.00081 J	0.0127	Cobalt-60 by Gamma	10.3	0.15
<u>TCLP Pesticides (mg/L)</u>			Iodine-129 by Gamma	ND	ND
gamma-BHC (Lindane)	BDL	BDL	Potassium-40 by Gamma	ND	1.6
<u>Reactivity</u>			Protactinium-234m by Gamma	ND	ND
Cyanide, Reactive (mg/kg)	BDL	BDL	Thorium-234 by Gamma	ND	ND
Corrosivity by pH (pH)	6.9	6.4	Uranium-235 by Gamma	ND	ND
Sulfide, Reactive (mg/kg)	BDL	4.2	Cobalt-57 by Gamma	ND	ND
<u>Mercury, Total (mg/kg)</u>	448.0	68400.0 J	Europium-152 by Gamma	ND	ND
<u>PCBs (mg/L)</u>			Thallium-208 by Gamma	ND	ND
Aroclor-1248	BDL	BDL	Bismuth-214 by Gamma	ND	ND
Aroclor-1254	6.8	17	Lead-214 by Gamma	ND	ND
Aroclor-1260	BDL	BDL	Europium-155 by Gamma	ND	ND
	6.80	17.00	Actinium-228 by Gamma	ND	ND

¹ - Date taken from "Laboratory Wastewater Retention Tank Sampling and Analysis Report Volume 1"

² - Flame turned orange

BDL - Below detection limit.

ND - Not Detected

February 26, 1996

CASE NARRATIVE

1. PCB DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: 010-G

Instrument: HP5890A Series II Gas Chromatograph/ Electron Capture Detector with HP 7673A Automatic Sampler, Electronic Pressure Control, and On-Column Injection; HP ChemStation Software

2. INTRODUCTION

An oil sample from the JANUS Reactor site received January 29, 1996, was analyzed for PCBs using the EPA SW-846 Method 8081 (RCRA) protocol (Revision 0, September 1994). The enclosed data package contains data for one oil sample, one matrix spike sample (MS), one matrix spike duplicate sample (MSD), and one laboratory blank (ABLK). The samples were prepared and analyzed within the specified RCRA holding times.

Since only PCBs were requested, the EPA Contract Laboratory Program (CLP) forms were modified to meet the needs of EPA SW-846 Method 8081 and for reporting PCB data.

3. SUMMARY COMMENTS

PCB Analysis Data Form: These data forms lists the target analytes and the quantitation limits for each one. PCBs were not detected in the samples presented in this data package.

PCB Surrogate Recovery: Surrogate recoveries reported within this data package are within QC limits. QC limits are based upon CLP (Contract Laboratory Program) limits.

Matrix Spike/Matrix Spike Duplicate Recovery: All matrix spike and matrix spike duplicate recoveries reported within this data package are acceptable.

PCB Initial Calibration A Form: This form lists the retention times and calibration factors of Aroclor 1016/1260 (Aroclor 1660) calibration peaks for the 5-point calibration curve. The %RSD of all the calibration peaks was within the specified Method 8081 QC limits.

PCB Initial Calibration B Form: This form lists the retention times and calibration factors of Aroclors 1221, 1232, 1242, 1248, and 1254.

PCB Initial Calibration C Form: This form lists the retention times and calibration factors of the surrogates, TCMX and DCBP, from the initial calibration. The %RSD for TCMX and DCBP was within the specified Method 8081 QC limits.

PCB Continuing Calibration Check: This form lists the retention times and calibration factors of the Aroclor 1016/1260 continuing calibration. The % Difference of the calibration peaks was within the specified Method 8081 QC limit

PCB Florisil Cartridge Check: This form indicates the recovery of analytes from a specified Florisil lot number. All compounds tested had acceptable recovery from Florisil Lot #1589FL.

PCB Analytical Sequence Form: This form lists the analytical sequence, date and time of analysis for the samples presented in this data package. Surrogate retention time QC information is also provided for the analytical sequence. Surrogates for the blank, sample, matrix spike, and matrix spike duplicate were outside of the retention time windows. The retention time shift may be the result of the sample matrix since the calibration standards before and after the samples were within the retention time windows.

4. DATA PACKAGE CLARIFICATIONS

EPA Method 8081 specifies a matrix spike solution that contains various pesticides. However, since only PCB analysis was requested, the matrix spike solution used for spiking samples contained in this data package consisted of Aroclors 1016 and 1260.

In order to accommodate changes in retention time during analysis, Method 8081 recommends obtaining data on standards over the course of 72 hours. The method states that shorter times could lead to tighter retention time windows. The retention time windows reported in this data package were established by running standards over the course of 51 hours. Method 8081 recommends using retention time windows for initial identification of compounds, however, the experience of the analyst should be taken into account when interpreting chromatograms and identification will be confirmed on a second column.

Every lot of Florisil cartridges to be used in sample cleanup is required to be tested for acceptable analyte recovery. Florisil lot number 1589FL was previously tested June 14, 1995 for recovery of Aroclor 1260 and the surrogates, TCMX and DCBP. Recovery of all three analytes was found to be acceptable. Florisil lot number 1589FL was also used for samples included in this data package. To ensure that no change in the quality and integrity of the Florisil cartridge had occurred, lot number 1589FL was again tested on February 2, 1996 for recovery of surrogates, Aroclors 1016 and 1260. Recovery of analytes was acceptable and is presented in this data package.

Samples were prepared based on SW-846 Method 3580A, Waste Dilution, (Revision 1, July 1992). A sample size of 0.5 grams was used and extract cleanup was performed using a 1.0 gram Florisil cartridge.

Pamela D. Postlethwait Date 27-Feb-96
Pam Postlethwait, Analyst
PCB/Pesticide Analysis

Amrit S. Boparai Date 2/27/96
Amrit S. Boparai, Group Leader
Organic Analysis Group

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

010-G

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: 010-G

Matrix: (soil/water) Oil

Lab Sample ID: 96-8085-01

Sample wt/vol: 0.51 (g/mL) g

Lab File ID: 023F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/29/96

Extraction: (SepF/Cont/Sonc) _____

Date Extracted: _____

Concentrated Extract Volume: 10,000 µL

Date Analyzed: 2/2/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) N

Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	Concentration Units (µg/L or µg/Kg) <u>µg/Kg</u>	Q
12674-11-2	Aroclor 1016	2000	U
11104-28-2	Aroclor 1221	4000	U
11141-16-5	Aroclor 1232	2000	U
53469-21-9	Aroclor 1242	2000	U
12672-29-6	Aroclor 1248	2000	U
11097-69-1	Aroclor 1254	2000	U
11096-82-5	Aroclor 1260	2000	U

January 26, 1996

CASE NARRATIVE - Water pH

1. INORGANIC ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: A-ST (ACL 96-8076)

Number of Pages: 2

2. INTRODUCTION

Three water samples from the JANUS Reactor facility were analyzed to determine pH as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Each water sample was analyzed to determine pH by Method 9040B ("pH, Electrometric Measurement") in the U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, Update IIB, January 1995. This method represents the current promulgated method for determination of water pH and was applied in place of Method 9040 ("pH Electrometric Measurement"), which was specified in the characterization plan. This report contains results and raw data from the pH determinations on these waters.

3. METHODS

The method applied to the analysis described in this package is as listed in the following table:

Method for Water pH in JANUS Facility Characterization Samples		
Samples	Parameter Determined	Method (SW-846)
Waters, JANUS Facility	pH Measured at Temperature (C)	9040B (pH, Electrometric Measurement)

4. CLARIFICATIONS AND COMMENTS

Equipment: Measurements of the water pH were made with a Brinkman/Metrohm Model 605 pH meter.

Method Deviations: No deviations from the specified method were noted during execution of the measurements or review of the data.

Holding Time: Samples in this SDG were collected on January 23, 1996, and analyzed on January 24. Hence, samples were analyzed within 24 hours of collection.

5. QUALITY CONTROL

Quality control measurements appropriate to Method 9040B were performed when samples were analyzed. These included calibration of the pH meter with standard buffer solutions (pH 4.00 and 10.00), verification of calibration with an additional buffer having a value between the calibration buffers (pH 7.00), and measurements on duplicate portions of one sample. Results of the QC measurements are presented on the Report of Analytical Results form together with results for each sample. Data generated during the analyses (copy of logbook page) are included in this package. Chain of Custody forms for the samples are collected at the back of this report.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to evaluate pH of the waters showed no values outside the range defining nonhazardous classification. Values of the pH ranged from 8.28 to 8.67. Results for the duplicate determinations agreed within the combined uncertainties for the two measurements.

Date 1-27-96
Donald G. Graczyk,
Laboratory Supervisor

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Waters from JANUS Characterization

Date Received: 1/23/96

Submitted by: D. Geraghty

Date Reported: 1/25/96

Submitter's Sample No.	ACL Sample No.	Date Collected	Date Analyzed	pH Measured at 26°C ^a
A-ST	96-8076-01	1/23/96	1/24/96	8.30 ± 0.10
151-A	-02	1/23/96	1/24/96	8.63 ± 0.10
	-02 Duplicate ^b	1/23/96	1/24/96	8.67 ± 0.10
152-A	-03	1/23/96	1/24/96	8.28 ± 0.10
<p>Laboratory Quality Standard, Fisher Scientific Buffer Solution:</p> <p>Expected pH: 7.00 Found pH: 7.00</p> <p>^a pH determinations were performed according to U.S. EPA SW-846 Method 9040B.</p> <p>^b Laboratory duplicate sample.</p>				

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call

A. Essling _____ at 2- 3493

Reference(s): A. Essling Logbook No. 1310, pg. 134.

Copies To: M. Robinet
M. O'Connor
C. Sholeen
D. Green
D. Graczyk

P. Lindahl
F. Martino
ACL Results File
ACL 200 File
Janus Project File

Analyst(s): A. Essling

CASE NARRATIVE -Metals in Water

1. INORGANIC ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: A-ST (ACL 96-8076)

Number of Pages: 5

2. INTRODUCTION

Three water samples from the JANUS Reactor facility were analyzed to determine 23 metallic analytes as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Results of these metals determinations and for associated Quality Control (QC) parameters are presented in the format described in the U.S. EPA Contract Laboratory Program (CLP) Statement of Work for Inorganic Analysis (SOW) ILM03.0. Qualifiers and flags associated with data on the CLP forms are assigned in accordance with the CLP SOW and QC data were evaluated against criteria established in this SOW, as well.

Forms for this data package were generated with software purchased from Ward Scientific, Ltd. ("Environmental Data Reporting Software," Version 2.73 or Version 2.91).

Analytes determined for samples in this SDG included those metals listed in the U.S. EPA CLP Target Analyte List (23 metals normally reported on the CLP forms).

3. METHODS

Methods applied to the analysis of these samples were selected to conform to the JANUS Facility Characterization Plan and the detection limit requirements communicated to our laboratory by the Project Manager. The methods used are summarized in Table 1 and are as described in the U.S. EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846 [3rd Edition, November 1986, and Final Updates I (7/92) or II (9/94)].

Methods for Metal Determinations in JANUS Facility Characterization Water Samples		
Analyte	Sample Preparation	Sample Analysis*
Antimony	Method 3015	Method 7041 (GFAA)
Arsenic	Method 3015	Method 7060A (GFAA)
Lead	Method 3015	Method 7421 (GFAA)
Mercury	Method 7470A	Method 7470A (CVAA)
Selenium	Method 3015	Method 7740 (GFAA)
Thallium	Method 3015	Method 7841 (GFAA)
Other Metals	Method 3015	Method 6010A (ICP)

* GFAA = Graphite Furnace Atomic Absorption; CVAA = Cold Vapor Atomic Absorption; ICP = Inductively Coupled Plasma-Atomic Emission.

Samples prepared by Method 3015 ("Microwave Assisted Acid Digestion of Aqueous Samples and Extracts") may be analyzed for all the specified metals, except mercury. The digestion procedure from Method 7470A was used to prepare samples for the mercury determinations.

4. CLARIFICATIONS AND COMMENTS

A. ICP Analyses

Equipment: ICP analysis of sample digestates was performed with an Instruments S.A. Model JY86 ICP Spectrometer System consisting of a JY-48 polychromator system and a JY-38 scanning monochromator system. For this SDG, the elements Na, K, Ag, and V were determined with the JY-38 monochromator; the remaining ICP elements were determined with the JY-48 polychromator.

ICP Raw Data: Sample concentrations in the ICP raw data printouts are in units of $\mu\text{g/L}$ except for Na and K data from the JY-38 system, which are in units of mg/L . Data reported for Al, Ca, Fe, and Mg are taken from channels Al1, Ca1, Fe1, and Mg1, respectively.

ICP Method Deviations:

- (1) No duplicate results are available from the ICP data for Na and K. Because these elements were determined in a separate ICP run and were not among the elements added to the spike and spike duplicate samples, the spike and spike duplicate were left out of the run sequence. This omission resulted in

the replicate data not being available. Because these elements are typically very well behaved during digestion and measurement, this omission should not compromise the usability of the Na and K results for these samples.

- (2) The elements Ca, Mg, Na, and K were not present in the aqueous Laboratory Control Sample (LCSW). The LCSW was prepared by adding a portion of spiking solution to reagent water and carrying this mixture through the digestion and analysis along with the samples. Until data were being compiled, it was not realized that this LCSW preparation did not include those elements not required in the spiking protocol but specified to be present in the LCSW. Because all the missing elements are extremely well behaved in solution, their omission in the LCSW results should not compromise the usability of data for them in the field samples.
- (3) Silver recovery (70.8%) was low in the LCSW. Silver and antimony are exempted in the CLP SOW regarding redigestion and reanalysis of samples when an element in the LCSW falls outside the 80 to 120% control limits and this low recovery for Ag is acceptable. It might, however, suggest that the results for Ag in this SDG might be biased somewhat low. Because all results for Ag in the field samples were below detection limits, there is strong reason to believe that Ag is a very minor constituent in the field samples if it is present at all. The somewhat low recovery obtained with the LCSW does not substantively change this conclusion.

B. Graphite Furnace Atomic Absorption (GFAA) Analyses

Equipment: GFAA analysis of sample digestates employed a Perkin-Elmer 5100 AA Spectrophotometer equipped with Zeeman background correction and an autosampler.

GFAA Method Deviations: Antimony recovery in the Aqueous Laboratory Control Sample (LCSW) was 154.6%, above the 120% upper control limit. Antimony is exempted in the CLP SOW regarding redigestion and reanalysis of samples when an element in the LCSW falls outside the 80 to 120% control limits. Because Sb recovery was high in this LCS, and all the field samples showed Sb levels below detection limits, the Sb recovery should not affect the credibility of the sample results.

No other deviations from the specified methods were noted during execution of the GFAA measurements or review of the GFAA data.

C. Cold Vapor Atomic Absorption (CVAA) Analyses

Equipment: The CVAA determination of mercury was performed with a Leeman Labs, Inc. Model PS200 Automated Mercury Analyzer System. The IDL for Hg with this system is 0.02 µg/L. This value shows on the forms as 0.0 µg/L owing to rounding by the report-generation software. Results for Hg in the field samples are adjusted to account for dilution of the samples to a uniform volume (200 mL) prior to instrumental analysis. Thus, the 0.02 µg/L IDL translates to an IDL of 0.04 µg/L for results reported on the Forms 1.

CVAA Method Deviations: No deviations from the specified methods were noted during execution of the CVAA measurements or review of the CVAA data.

Mercury Holding Time: Samples in this SDG were collected on January 23, 1996; were digested on January 24; and were analyzed on January 25. Hence, the holding time requirement for mercury (28 days) was met.

5. QUALITY CONTROL

Quality assurance data generated in the course of analyses associated with this SDG are summarized on the appropriate forms included in the CLP-type data package. All QC parameters are within acceptance criteria established in the CLP SOW except the following:

- (1) Those deviations called out in the Method Deviations sections of the foregoing discussion and comments.
- (2) Matrix spike recoveries for selenium and silver:

With selenium, both the spike and spike duplicate samples showed recoveries (72.9 and 74.4%) just below the 75% lower control limit. Results reported for Se in this SDG are, therefore, flagged with the "N" qualifier to indicate the possible presence of a matrix interference on the sample digestion or analysis. Selenium results might be biased low as a result of this interference.

For silver, both the predigestion spike recoveries (65.8 and 59.8%) and the post-digestion spike recovery (41.0%) were low. The results for Ag in this SDG are also flagged with the "N" qualifier to indicate a possible matrix effect on the digestions or measurements related to this element. Results reported for silver might be biased low.

- (3) Serial dilution flags for copper, and zinc: Results for copper and zinc are flagged with the "E" qualifier as a result of an RPD greater than 10% for the ICP serial dilution. This flag is assigned in the CLP SOW to provide an alert to a possible chemical or physical interference on the ICP measurement. The RPD observed for

the serial dilution of Cu (16.4%), and Zn (11.8%) in this SDG might suggest such an interference; this suspected interference should be considered when the data for these elements are interpreted.

Chain of Custody forms for the samples in this SDG are collected in this data package just after this Case Narrative.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to determine metals in the samples in this SDG are summarized on the Inorganic Analyses Data Sheets (Forms 1) in the accompanying data package. Major constituents in these waters (particularly Ca, Mg, Na, K) are typical of Argonne's domestic water supply. Trace constituent metals that are present in measurable (albeit small) concentrations include Cr, Cu, Fe, Pb, Hg, Mn, and Zn. Although well below levels that might classify these waters as hazardous waste, these should be given consideration when disposal of the waters is planned.

Date 2-28-96

Donald G. Graczyk,
Laboratory Supervisor

Lab Name: ARGONNE_NATL_LAB_EAST_____ Contract: _____
Lab Code: ANLE_____ Case No.: _____ SAS No.: _____ SDG No.: 151-A-_____
Matrix (soil/water): WATER_____ Lab Sample ID: 96807601_____
Level (low/med): LOW_____ Date Received: 01/23/96_____
% Solids: 0.0_____

Concentration Units (ug/L or mg/kg dry weight): UG/L

[illegible]

Color Before: LT. TAN Clarity Before: CLOUDY Texture: _____
Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:

151-A

SDG No.: 151-A

Lab Sample ID: 96807602

Date Received: 01/23/96

[illegible]

omments:

152-A

Lab Name: ARGONNE_NATL_LAB_EAST_____ Contract: _____
Lab Code: ANLE_____ Case No.: _____ SAS No.: _____ SDG No.: 151-A-_____
Matrix (soil/water): WATER_____ Lab Sample ID: 96807603
Level (low/med): LOW_____ Date Received: 01/23/96
% Solids: _____ 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

[illegible]

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

March 4, 1996

CASE NARRATIVE

1. GAMMA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: A-ST

2. INTRODUCTION

Gamma spectroscopy analyses were performed on three water samples: A-ST, 151-A, and 152-A, and one sludge sample: 400 S. Sample 152-A was done in duplicate. Standard operating procedure ACL-072 was followed for the preparation of each sample for gamma spec analysis.

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detectors 9 is also an intrinsic Ge detector interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described above for detector 3. For detector 9, SOP: ACL-127 was followed.

Most samples were counted for a minimum of 1000 minutes to allow for adequate counting statistics.

3. DEVIATIONS FROM PROTOCOL:

None.

4. QUALITY CONTROL

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cesium-137 standard, following SOP: ACL-075 for detector 3 and SOP: ACL-128 for detector 9. The performance of the lab control standard was always within 2.5 percent of the expected values, as indicated in the Associated Documentation section. The results of the duplicate samples were statistically the same.

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Tony TenKate Date 3/5/96
Tony TenKate, Analyst
Radiological Analysis

Delbert L. Bowers Date 3/5/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Water, JANUS Reactor Characterization Project
Submitted by: D. Geraghty

Date Received: 1/23/96
Date Reported: 2/20/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)			
		<u>^{214}Bi</u>	<u>^{226}Ra</u>	<u>^{232}Th</u>	<u>^{228}Th</u>
A-ST	96-8076-01	<0.2	<0.2	<0.2	<0.2
151-A	-02	<0.2	<0.2	<0.2	<0.2
152-A	-03	<0.2	<0.2	<0.2	<0.2
152-A	-03 Dup.	<0.2	<0.2	<0.2	<0.2

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1111, Pg. 93; CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115;

CMT Logbook No. 1111, Det. 1, 9, and 10, Pg. 73.

Copies To: D. Geraghty
M. Robinet
C. Sholeen
M. O'Connor
D. Green
D. Bowers
P. Lindahl
D. Graczyk
F. Martino
T. TenKate

Analyst(s): T. TenKate
J. Yaeger *T²*

Addnl. Copies:
J. Yaeger
ACL Results File
200 Results File

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Core Fines, Sludge; JANUS Reactor Characterization Date Received: 1/23/96
Submitted by: C. Sholeen Date Reported: 2/26/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)		
		<u>²¹⁴Bi</u>	<u>²²⁶Ra</u>	<u>²²⁸Th</u>
400S	96-8071-01	0.24 ± 0.02	0.39 ± 0.04	0.39 ± 0.04

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1111, Pg. 90; CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115.

Copies To: C. Sholeen M. Robinet M. O'Connor /hlt D. Geraghty 2/26/96 D. Green	D. Bowers P. Lindahl D. Graczyk F. Martino T. TenKate	Analyst(s): T. TenKate <i>T²</i> J. Yaeger	Addnl. Copies: J. Yaeger ACL Results File 200 Results File
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February 13, 1996

CASE NARRATIVE

1. VOLATILE ORGANICS DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: SN-T1

Instrument: HP5970 GC/MSD-1; HP UNIX System Software; Tekmar Purge and Trap Model 4000 Dynamic Headspace Concentrator with Automatic Laboratory Sampler

2. INTRODUCTION

Analyses of samples for volatile organic compounds, which are reported in this data package, were performed using Method 8260A in the EPA Document SW-846 (Final Update II, Revision 1, September 1994).

The enclosed data package contains data for six water samples, one matrix spike (MS) sample, one matrix spike duplicate (MSD) sample, and two method blanks. The samples were collected from the Janus Reactor site and were received on January 11, 23, and 29, 1996.

The samples were stored at 4°C until the analyses were performed on the dates given on the attached bench sheets.

3. SUMMARY COMMENTS

Holding Time: Holding time was met for all samples included in this data package.

GC/MS Tuning: All samples were analyzed within 12 hours of a BFB tune which met tuning criteria.

Instrument Calibrations: All instrumental calibrations met SW-846 criteria.

Laboratory Blanks: The laboratory blanks were found to be within SW-846 criteria.

Surrogate Recoveries: All of the surrogate recoveries reported in this data package were within SW-846 QC limits.

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: C-ST
 Sample Location:
 Lab Sample ID: 96-8078-01
 Sample Matrix: WATER
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan2896
 Sample Date: JAN/23/96
 Sample Point:
 Date Received: JAN/23/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/L	Q
88-06-2-----	2,4,6-Trichlorophenol	10.0	U
95-95-4-----	2,4,5-Trichlorophenol	10.0	U
91-58-7-----	2-Chloronaphthalene	10.0	U
90-13-1-----	1-Chloronaphthalene	10.0	U
88-74-4-----	2-Nitroaniline	10.0	U
131-11-3-----	Dimethyl phthalate	10.0	U
606-20-2-----	2,6-Dinitrotoluene	10.0	U
208-96-8-----	Acenaphthylene	10.0	U
-----	3-Nitroaniline	10.0	U
83-32-9-----	Acenaphthene	10.0	U
51-28-5-----	2,4-Dinitrophenol	20.0	U
100-02-7-----	4-Nitrophenol	20.0	U
608-93-5-----	Pentachlorobenzene	10.0	U
121-14-2-----	2,4-Dinitrotoluene	10.0	U
91-59-8-----	2-Naphthylamine	10.0	U
58-90-2-----	2,3,4,6-Tetrachlorophenol	10.0	U
134-32-7-----	1-Naphthylamine	10.0	U
84-66-2-----	Diethylphthalate	10.0	U
86-73-7-----	Fluorene	10.0	U
7005-72-3-----	4-Chlorophenyl phenyl ether	10.0	U
100-01-6-----	4-Nitroaniline	10.0	U
534-52-1-----	4,6-Dinitro-2-methylphenol	10.0	U
132-64-9-----	Dibenzofuran	10.0	U
-----	N-NitrosoDPA & Diphenylamine	5.0	U
122-66-7-----	1,2-Diphenylhydrazine	10.0	U
62-44-2-----	Phenacetin	10.0	U
101-55-3-----	4-Bromophenyl phenyl ether	10.0	U
118-74-1-----	Hexachlorobenzene	10.0	U
87-86-5-----	Pentachlorophenol	10.0	U
82-68-8-----	Pentachloronitrobenzene	10.0	U
92-67-1-----	4-Aminobiphenyl	10.0	U
23950-58-5-----	Pronamide	10.0	U
85-01-8-----	Phenanthrene	10.0	U
120-12-7-----	Anthracene	10.0	U
84-74-2-----	Di-n-butylphthalate	10.0	U
206-44-0-----	Fluoranthene	10.0	U
92-87-5-----	Benzidine	20.0	U

1 D

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: C-ST
Sample Location:
Lab Sample ID: 96-8078-01
Sample Matrix: WATER
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2896
Sample Date: JAN/23/96
Sample Point:
Date Received: JAN/23/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/L	Q
129-00-0-----	Pyrene	10.0	U
60-11-7-----	p-Dimethylaminoazobenzene	10.0	U
85-68-7-----	Butylbenzylphthalate	10.0	U
91-94-1-----	3,3'-Dichlorobenzidine	10.0	U
56-55-3-----	Benzo (a) anthracene	10.0	U
117-81-7-----	bis (2-Ethylhexyl) phthalate	10.0	U
218-01-9-----	Chrysene	10.0	U
117-84-0-----	Di-n-octylphthalate	10.0	U
205-99-2-----	Benzo (b) fluoranthene	10.0	U
207-08-9-----	Benzo (k) fluoranthene	10.0	U
50-32-8-----	Benzo (a) pyrene	10.0	U
56-49-5-----	3-Methylcholanthrene	10.0	U
224-42-0-----	Dibenz (a, j) acridine	10.0	U
193-39-5-----	Indeno (1, 2, 3-cd) pyrene	10.0	U
53-70-3-----	Dibenzo (a, h) anthracene	10.0	U
191-24-2-----	Benzo (g, h, i) perylene	10.0	U
=====		=====	=====
367-12-4-----	2-Fluorophenol	104	
4165-62-2-----	Phenol-d5	66.0	
4165-60-0-----	Nitrobenzene-d5	81.4	
321-60-8-----	2-Fluorobiphenyl	79.4	
118-79-6-----	2, 4, 6-Tribromophenol	158	
98904-43-9-----	Terphenyl-d14	92.2	

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: C-ST
 Sample Location:
 Lab Sample ID: 96-8078-01
 Sample Matrix: WATER
 Analysis Type: SV

Client SDG: 4jan2896
 Sample Date: JAN/23/96
 Sample Point:
 Date Received: JAN/23/96

Level: LOW

Number TICs found: 16

CONCENTRATION UNITS:
 (ug/L or ug/KG) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 75-85-4	2-Butanol, 2-methyl-	4.183	76.8	NJB
2. 563-80-4	2-Butanone, 3-methyl-	4.492	59.6	NJB
3. 594-36-5	Butane, 2-chloro-2-methyl-	4.616	17.1	NJB
4. 110-83-8	Cyclohexene	4.905	4.7	NJB
5.	Unknown	4.987	5.6	JB
6.	Unknown	10.362	13.0	JB
7.	Unknown	10.754	6.5	JB
8.	Unknown	11.393	38.2	JB
9.	Unknown	11.764	5.8	JB
10. 2050-95-5	1-Butanol, 3-methyl-, carbonate (2:1)	12.239	11.8	NJB
11. 4291-79-6	Cyclohexane, 1-methyl-2- propyl-	12.301	27.3	NJB
12. 3173-53-3	Cyclohexane, isocyanato-	13.827	5.6	NJ
13. 59-48-3	2H-Indol-2-one, 1,3- dihydro-	26.673	10.9	NJ
14.	Unknown	26.839	5.8	J
15. 19901-86-1	2-Oxazolidinone, 5-methyl- 4-phenyl-	27.560	11.1	NJ
16. 120-32-1	Phenol, 4-chloro-2- (phenylmethyl)-	32.676	19.6	NJ

1B

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: 151-C
 Sample Location:
 Lab Sample ID: 96-8078-02
 Sample Matrix: WATER
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan2896
 Sample Date: JAN/23/96
 Sample Point:
 Date Received: JAN/23/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/L	Q
62-75-9-----	N-Nitrosodimethylamine_____	10.0	U
109-06-8-----	2-Picoline_____	10.0	U
66-27-3-----	Methyl methansulfonate_____	20.0	U
62-50-0-----	Ethyl methansulfonate_____	10.0	U
108-95-2-----	Phenol_____	10.0	U
62-53-3-----	Aniline_____	10.0	U
111-44-4-----	bis(2-Chloroethyl) ether_____	10.0	U
95-57-8-----	2-Chlorophenol_____	10.0	U
541-73-1-----	1,3-Dichlorobenzene_____	10.0	U
106-46-7-----	1,4-Dichlorobenzene_____	10.0	U
100-51-6-----	Benzyl alcohol_____	10.0	U
95-50-1-----	1,2-Dichlorobenzene_____	10.0	U
95-48-7-----	2-Methylphenol_____	10.0	U
108-60-1-----	bis(2-Chloroisopropyl) ether_____	10.0	U
98-86-2-----	Acetophenone_____	10.0	U
106-44-5-----	4-Methylphenol_____	10.0	U
621-64-7-----	N-nitroso-di-n-propylamine_____	10.0	U
67-72-1-----	Hexachloroethane_____	10.0	U
98-95-3-----	Nitrobenzene_____	10.0	U
100-75-4-----	N-Nitrosopiperidine_____	10.0	U
78-59-1-----	Isophorone_____	10.0	U
88-75-5-----	2-Nitrophenol_____	10.0	U
105-67-9-----	2,4-Dimethyphenol_____	10.0	U
111-91-1-----	bis(2-Chloroethoxy) methane_____	10.0	U
65-85-0-----	Benzoic acid_____	10.0	U
120-83-2-----	2,4-Dichlorophenol_____	10.0	U
122-09-8-----	a,a-Dimethylphenethylamine_____	20.0	U
120-82-1-----	1,2,4-Trichlorobenzene_____	10.0	U
91-20-3-----	Naphthalene_____	10.0	U
106-47-8-----	4-Chloroaniline_____	10.0	U
87-65-0-----	2,6-Dichlorophenol_____	10.0	U
87-68-3-----	Hexachlorobutadiene_____	10.0	U
924-16-3-----	N-Nitrosodibutylamine_____	10.0	U
59-50-7-----	4-Chloro-3-methylphenol_____	10.0	U
91-57-6-----	2-Methylnaphthalene_____	10.0	U
77-47-4-----	Hexachlorocyclopentadiene_____	20.0	U
95-94-3-----	1,2,4,5-Tetrachlorobenzene_____	10.0	U

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: 151-C
Sample Location:
Lab Sample ID: 96-8078-02
Sample Matrix: WATER
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2896
Sample Date: JAN/23/96
Sample Point:
Date Received: JAN/23/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/L	Q
88-06-2-----	2,4,6-Trichlorophenol	10.0	U
95-95-4-----	2,4,5-Trichlorophenol	10.0	U
91-58-7-----	2-Chloronaphthalene	10.0	U
90-13-1-----	1-Chloronaphthalene	10.0	U
88-74-4-----	2-Nitroaniline	10.0	U
131-11-3-----	Dimethyl phthalate	10.0	U
606-20-2-----	2,6-Dinitrotoluene	10.0	U
208-96-8-----	Acenaphthylene	10.0	U
-----	3-Nitroaniline	10.0	U
83-32-9-----	Acenaphthene	10.0	U
51-28-5-----	2,4-Dinitrophenol	20.0	U
100-02-7-----	4-Nitrophenol	20.0	U
608-93-5-----	Pentachlorobenzene	10.0	U
121-14-2-----	2,4-Dinitrotoluene	10.0	U
91-59-8-----	2-Naphthylamine	10.0	U
58-90-2-----	2,3,4,6-Tetrachlorophenol	10.0	U
134-32-7-----	1-Naphthylamine	10.0	U
84-66-2-----	Diethylphthalate	10.0	U
86-73-7-----	Fluorene	10.0	U
7005-72-3-----	4-Chlorophenyl phenyl ether	10.0	U
100-01-6-----	4-Nitroaniline	10.0	U
534-52-1-----	4,6-Dinitro-2-methylphenol	10.0	U
132-64-9-----	Dibenzofuran	10.0	U
-----	N-NitrosoDPA & Diphenylamine	5.0	U
122-66-7-----	1,2-Diphenylhydrazine	10.0	U
62-44-2-----	Phenacetin	10.0	U
101-55-3-----	4-Bromophenyl phenyl ether	10.0	U
118-74-1-----	Hexachlorobenzene	10.0	U
87-86-5-----	Pentachlorophenol	10.0	U
82-68-8-----	Pentachloronitrobenzene	10.0	U
92-67-1-----	4-Aminobiphenyl	10.0	U
23950-58-5-----	Pronamide	10.0	U
85-01-8-----	Phenanthrene	10.0	U
120-12-7-----	Anthracene	10.0	U
84-74-2-----	Di-n-butylphthalate	10.0	U
206-44-0-----	Fluoranthene	10.0	U
92-87-5-----	Benzidine	20.0	U

1 D

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: 151-C
Sample Location:
Lab Sample ID: 96-8078-02
Sample Matrix: WATER
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2896
Sample Date: JAN/23/96
Sample Point:
Date Received: JAN/23/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:		Q
		(ug/L or ug/KG)	ug/L	
129-00-0-----	Pyrene	10.0	U	
60-11-7-----	p-Dimethylaminoazobenzene	10.0	U	
85-68-7-----	Butylbenzylphthalate	10.0	U	
91-94-1-----	3,3'-Dichlorobenzidine	10.0	U	
56-55-3-----	Benzo(a)anthracene	10.0	U	
117-81-7-----	bis(2-Ethylhexyl)phthalate	10.0	U	
218-01-9-----	Chrysene	10.0	U	
117-84-0-----	Di-n-octylphthalate	10.0	U	
205-99-2-----	Benzo(b)fluoranthene	10.0	U	
207-08-9-----	Benzo(k)fluoranthene	10.0	U	
50-32-8-----	Benzo(a)pyrene	10.0	U	
56-49-5-----	3-Methylcholanthrene	10.0	U	
224-42-0-----	Dibenz(a,j)acridine	10.0	U	
193-39-5-----	Indeno(1,2,3-cd)pyrene	10.0	U	
53-70-3-----	Dibenzo(a,h)anthracene	10.0	U	
191-24-2-----	Benzo(g,h,i)perylene	10.0	U	
=====		=====	=====	
367-12-4-----	2-Fluorophenol	119		
4165-62-2-----	Phenol-d5	78.0		
4165-60-0-----	Nitrobenzene-d5	93.5		
321-60-8-----	2-Fluorobiphenyl	74.1		
118-79-6-----	2,4,6-Tribromophenol	169		
98904-43-9-----	Terphenyl-d14	111		

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: 151-C
Sample Location:
Lab Sample ID: 96-8078-02
Sample Matrix: WATER
Analysis Type: SV

Client SDG: 4jan2896
Sample Date: JAN/23/96
Sample Point:
Date Received: JAN/23/96

Level: LOW

Number TICs found: 5

CONCENTRATION UNITS:
(ug/L or ug/KG) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 75-85-4	2-Butanol, 2-methyl-	4.162	10.4	NJB
2. 563-80-4	2-Butanone, 3-methyl-	4.492	91.8	NJB
3. 594-36-5	Butane, 2-chloro-2-methyl-	4.595	10.9	NJB
4.	Unknown	5.008	20.3	JB
5.	Unknown	8.509	4.6	J

1B

TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: 152-C
Sample Location:
Lab Sample ID: 96-8078-03
Sample Matrix: WATER
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2896
Sample Date: JAN/23/96
Sample Point:
Date Received: JAN/23/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/L	Q
62-75-9-----	N-Nitrosodimethylamine	10.0	U
109-06-8-----	2-Picoline	10.0	U
66-27-3-----	Methyl methansulfonate	20.0	U
62-50-0-----	Ethyl methansulfonate	10.0	U
108-95-2-----	Phenol	10.0	U
62-53-3-----	Aniline	10.0	U
111-44-4-----	bis(2-Chloroethyl) ether	10.0	U
95-57-8-----	2-Chlorophenol	10.0	U
541-73-1-----	1,3-Dichlorobenzene	10.0	U
106-46-7-----	1,4-Dichlorobenzene	10.0	U
100-51-6-----	Benzyl alcohol	10.0	U
95-50-1-----	1,2-Dichlorobenzene	10.0	U
95-48-7-----	2-Methylphenol	10.0	U
108-60-1-----	bis(2-Chloroisopropyl) ether	10.0	U
98-86-2-----	Acetophenone	10.0	U
106-44-5-----	4-Methylphenol	10.0	U
621-64-7-----	N-nitroso-di-n-propylamine	10.0	U
67-72-1-----	Hexachloroethane	10.0	U
98-95-3-----	Nitrobenzene	10.0	U
100-75-4-----	N-Nitrosopiperidine	10.0	U
78-59-1-----	Isophorone	10.0	U
88-75-5-----	2-Nitrophenol	10.0	U
105-67-9-----	2,4-Dimethyphenol	10.0	U
111-91-1-----	bis(2-Chloroethoxy) methane	10.0	U
65-85-0-----	Benzoic acid	10.0	U
120-83-2-----	2,4-Dichlorophenol	10.0	U
122-09-8-----	a,a-Dimethylphenethylamine	20.0	U
120-82-1-----	1,2,4-Trichlorobenzene	10.0	U
91-20-3-----	Naphthalene	10.0	U
106-47-8-----	4-Chloroaniline	10.0	U
87-65-0-----	2,6-Dichlorophenol	10.0	U
87-68-3-----	Hexachlorobutadiene	10.0	U
924-16-3-----	N-Nitrosodibutylamine	10.0	U
59-50-7-----	4-Chloro-3-methylphenol	10.0	U
91-57-6-----	2-Methylnaphthalene	10.0	U
77-47-4-----	Hexachlorocyclopentadiene	20.0	U
95-94-3-----	1,2,4,5-Tetrachlorobenzene	10.0	U

1C

TARGET COMPOUNDS

Client Name: M. ROBINET
 Client Sample ID: 152-C
 Sample Location:
 Lab Sample ID: 96-8078-03
 Sample Matrix: WATER
 Analysis Type: SV
 Data Type: MS DATA
 Misc Info:

Client SDG: 4jan2896
 Sample Date: JAN/23/96
 Sample Point:
 Date Received: JAN/23/96
 Quant Type: ISTD
 Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ug/L	Q
88-06-2-----	2,4,6-Trichlorophenol	10.0	U
95-95-4-----	2,4,5-Trichlorophenol	10.0	U
91-58-7-----	2-Chloronaphthalene	10.0	U
90-13-1-----	1-Chloronaphthalene	10.0	U
88-74-4-----	2-Nitroaniline	10.0	U
131-11-3-----	Dimethyl phthalate	10.0	U
606-20-2-----	2,6-Dinitrotoluene	10.0	U
208-96-8-----	Acenaphthylene	10.0	U
-----	3-Nitroaniline	10.0	U
83-32-9-----	Acenaphthene	10.0	U
51-28-5-----	2,4-Dinitrophenol	20.0	U
100-02-7-----	4-Nitrophenol	20.0	U
608-93-5-----	Pentachlorobenzene	10.0	U
121-14-2-----	2,4-Dinitrotoluene	10.0	U
91-59-8-----	2-Naphthylamine	10.0	U
58-90-2-----	2,3,4,6-Tetrachlorophenol	10.0	U
134-32-7-----	1-Naphthylamine	10.0	U
84-66-2-----	Diethylphthalate	10.0	U
86-73-7-----	Fluorene	10.0	U
7005-72-3-----	4-Chlorophenyl phenyl ether	10.0	U
100-01-6-----	4-Nitroaniline	10.0	U
534-52-1-----	4,6-Dinitro-2-methylphenol	10.0	U
132-64-9-----	Dibenzofuran	10.0	U
-----	N-NitrosoDPA & Diphenylamine	5.0	U
122-66-7-----	1,2-Diphenylhydrazine	10.0	U
62-44-2-----	Phenacetin	10.0	U
101-55-3-----	4-Bromophenyl phenyl ether	10.0	U
118-74-1-----	Hexachlorobenzene	10.0	U
87-86-5-----	Pentachlorophenol	10.0	U
82-68-8-----	Pentachloronitrobenzene	10.0	U
92-67-1-----	4-Aminobiphenyl	10.0	U
23950-58-5-----	Pronamide	10.0	U
85-01-8-----	Phenanthrene	10.0	U
120-12-7-----	Anthracene	10.0	U
84-74-2-----	Di-n-butylphthalate	10.0	U
206-44-0-----	Fluoranthene	10.0	U
92-87-5-----	Benzidine	20.0	U

1 D
TARGET COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: 152-C
Sample Location:
Lab Sample ID: 96-8078-03
Sample Matrix: WATER
Analysis Type: SV
Data Type: MS DATA
Misc Info:

Client SDG: 4jan2896
Sample Date: JAN/23/96
Sample Point:
Date Received: JAN/23/96
Quant Type: ISTD
Level: LOW

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/KG)	ug/L
			Q
129-00-0-----	Pyrene	10.0	U
60-11-7-----	p-Dimethylaminoazobenzene	10.0	U
85-68-7-----	Butylbenzylphthalate	10.0	U
91-94-1-----	3,3'-Dichlorobenzidine	10.0	U
56-55-3-----	Benzo(a)anthracene	10.0	U
117-81-7-----	bis(2-Ethylhexyl)phthalate	10.0	U
218-01-9-----	Chrysene	10.0	U
117-84-0-----	Di-n-octylphthalate	10.0	U
205-99-2-----	Benzo(b)fluoranthene	10.0	U
207-08-9-----	Benzo(k)fluoranthene	10.0	U
50-32-8-----	Benzo(a)pyrene	10.0	U
56-49-5-----	3-Methylcholanthrene	10.0	U
224-42-0-----	Dibenz(a,j)acridine	10.0	U
193-39-5-----	Indeno(1,2,3-cd)pyrene	10.0	U
53-70-3-----	Dibenzo(a,h)anthracene	10.0	U
191-24-2-----	Benzo(g,h,i)perylene	10.0	U
=====		=====	=====
367-12-4-----	2-Fluorophenol	89.2	
4165-62-2-----	Phenol-d5	11.3	
4165-60-0-----	Nitrobenzene-d5	80.5	
321-60-8-----	2-Fluorobiphenyl	76.9	
118-79-6-----	2,4,6-Tribromophenol	134	
98904-43-9-----	Terphenyl-d14	129	

1E

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: M. ROBINET
Client Sample ID: 152-C
Sample Location:
Lab Sample ID: 96-8078-03
Sample Matrix: WATER
Analysis Type: SV

Client SDG: 4jan2896
Sample Date: JAN/23/96
Sample Point:
Date Received: JAN/23/96

Level: LOW

Number TICs found: 16

CONCENTRATION UNITS:
(ug/L or ug/KG) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 75-85-4	2-Butanol, 2-methyl-	4.183	72.0	NJB
2. 563-80-4	2-Butanone, 3-methyl-	4.492	60.8	NJB
3. 594-36-5	Butane, 2-chloro-2-methyl-	4.595	16.8	NJB
4. 1569-50-2	3-Penten-2-ol	4.987	4.9	NJ
5.	Unknown	5.193	5.1	J
6.	Unknown	8.162	29.7	J
7.	Unknown	10.347	9.8	J
8.	Unknown	10.739	5.6	J
9.	Unknown	11.378	32.9	J
10.	Unknown	11.749	12.4	J
11. 2050-95-5	1-Butanol, 3-methyl-, carbonate (2:1)	12.224	13.6	NJB
12. 4291-79-6	Cyclohexane, 1-methyl-2- propyl-	12.286	22.3	NJB
13. 92639-28-6	6-Chloro-2-heptene	13.441	58.2	NJ
14.	Unknown	15.193	13.9	J
15.	Unknown phthalate	40.575	16.0	JM
16. 28553-12-0	1,2-Benzenedicarboxylic acid disononyl ester	40.616	16.7	NJ

February 20, 1996

CASE NARRATIVE

1. PCB DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: C-ST

Instrument: HP5890A Series II Gas Chromatograph/ Electron Capture Detector with HP 7673A Automatic Sampler, Electronic Pressure Control, and On-Column Injection; HP ChemStation Software

2. INTRODUCTION

Water samples from the JANUS Reactor site received January 23, 1996, were analyzed for PCBs using the EPA SW-846 Method 8081 (RCRA) protocol (Revision 0, September 1994). The enclosed data package contains data for three water samples, one matrix spike sample (MS), one matrix spike duplicate sample (MSD), and one laboratory blank (ABLK). The samples were extracted and analyzed within the specified RCRA holding times.

Since only PCBs were requested, the EPA Contract Laboratory Program (CLP) forms were modified to meet the needs of EPA SW-846 Method 8081 and for reporting PCB data.

3. SUMMARY COMMENTS

PCB Analysis Data Form: These data forms lists the target analytes and the quantitation limits for each one. PCBs were not detected in the samples presented in this data package.

PCB Surrogate Recovery: Surrogate recoveries reported within this data package are within QC limits. QC limits are based upon CLP (Contract Laboratory Program) limits.

Matrix Spike/Matrix Spike Duplicate Recovery: All matrix spike and matrix spike duplicate recoveries reported within this data package are acceptable.

PCB Initial Calibration A Form: This form lists the retention times and calibration factors of Aroclor 1016/1260 (Aroclor 1660) calibration peaks for the 5-point calibration curve. The %RSD of all the calibration peaks was within the specified Method 8081 QC limits.

PCB Initial Calibration B Form: This form lists the retention times and calibration factors of Aroclors 1221, 1232, 1242, 1248, and 1254.

PCB Initial Calibration C Form: This form lists the retention times and calibration factors of the surrogates, TCMX and DCBP, from the initial calibration. The %RSD for TCMX and DCBP was within the specified Method 8081 QC limits.

PCB Continuing Calibration Check: This form lists the retention times and calibration factors of the Aroclor 1016/1260 continuing calibration. The % Difference of the calibration peaks was within the specified Method 8081 QC limit

PCB Florisil Cartridge Check: This form indicates the recovery of analytes from a specified Florisil lot number. All compounds tested had acceptable recovery from Florisil Lot #1589FL.

PCB Analytical Sequence Form: This form lists the analytical sequence, date and time of analysis for the samples presented in this data package. Surrogate retention time QC information is also provided for the analytical sequence. For sample C-ST, the surrogate DCBP was outside of the retention time window.

4. DATA PACKAGE CLARIFICATIONS

EPA Method 8081 specifies a matrix spike solution that contains various pesticides. However, since only PCB analysis was requested, the matrix spike solution used for spiking samples contained in this data package consisted of Aroclors 1016 and 1260.

In order to accommodate changes in retention time during analysis, Method 8081 recommends obtaining data on standards over the course of 72 hours. The method states that shorter times could lead to tighter retention time windows. The retention time windows reported in this data package were established by running standards over the course of 51 hours. All samples and blanks reported were within the retention time windows

Every lot of Florisil cartridges to be used in sample cleanup is required to be tested for acceptable analyte recovery. Florisil lot number 1589FL was previously tested June 14, 1995 for recovery of Aroclor 1260 and the surrogates, TCMX and DCBP. Recovery of all three analytes was found to be acceptable. Florisil lot number 1589FL was also used for samples included in this data package. To ensure that no change in the quality and integrity of the Florisil cartridge had occurred, lot number 1589FL was again tested on February 2, 1996 for recovery of surrogates, Aroclors 1016 and 1260. Recovery of analytes was acceptable and is presented in this data package.

Pamela D. Postlethwait Date 20 Feb. 96
Pam Postlethwait, Analyst
PCB/Pesticide Analysis

Amrit S. Boparai Date 2/29/96
Amrit S. Boparai, Group Leader
Organic Analysis Group

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

C-ST

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: C-ST

Matrix: (soil/water) Water

Lab Sample ID: 96-8078-01

Sample wt/vol: 1000 (g/mL) mL

Lab File ID: 017F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/23/96

Extraction: (SepF/Cont/Sonc) SepF

Date Extracted: 1/29/96

Concentrated Extract Volume: 10,000 µL

Date Analyzed: 2/2/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) N

Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	Concentration Units (µg/L or µg/Kg) <u>µg/L</u>	Q
12674-11-2	Aroclor 1016	1.0	U
11104-28-2	Aroclor 1221	2.0	U
11141-16-5	Aroclor 1232	1.0	U
53469-21-9	Aroclor 1242	1.0	U
12672-29-6	Aroclor 1248	1.0	U
11097-69-1	Aroclor 1254	1.0	U
11096-82-5	Aroclor 1260	1.0	U

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

151-C

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: C-ST

Matrix: (soil/water) Water

Lab Sample ID: 96-8078-02

Sample wt/vol: 1000 (g/mL) mL

Lab File ID: 018F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/23/96

Extraction: (SepF/Cont/Sonc) SepF

Date Extracted: 1/29/96

Concentrated Extract Volume: 10,000 µL

Date Analyzed: 2/2/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) N

Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	Concentration Units (µg/L or µg/Kg) <u>µg/L</u>	Q
12674-11-2	Aroclor 1016	1.0	U
11104-28-2	Aroclor 1221	2.0	U
11141-16-5	Aroclor 1232	1.0	U
53469-21-9	Aroclor 1242	1.0	U
12672-29-6	Aroclor 1248	1.0	U
11097-69-1	Aroclor 1254	1.0	U
11096-82-5	Aroclor 1260	1.0	U

PCB ANALYSIS DATA SHEET

EPA Sample No

Lab Name: Argonne National Laboratory

Contract: _____

152-C

Lab Code: ANL

Case No.: _____

SAS No.: _____

SDG No.: C-ST

Matrix: (soil/water) Water

Lab Sample ID: 96-8078-03

Sample wt/vol: 1000 (g/mL) mL

Lab File ID: 019F0401.D

%Moisture: _____ decanted: (Y/N) _____

Date Received: 1/23/96

Extraction: (SepF/Cont/Sonc) SepF

Date Extracted: 1/29/96

Concentrated Extract Volume: 10,000 µL

Date Analyzed: 2/2/96

Injection Volume: 1µL

Dilution Factor: 1

GPC Cleanup: (Y/N) N

Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	Concentration Units (µg/L or µg/Kg) <u>µg/L</u>	Q
12674-11-2	Aroclor 1016	1.0	U
11104-28-2	Aroclor 1221	2.0	U
11141-16-5	Aroclor 1232	1.0	U
53469-21-9	Aroclor 1242	1.0	U
12672-29-6	Aroclor 1248	1.0	U
11097-69-1	Aroclor 1254	1.0	U
11096-82-5	Aroclor 1260	1.0	U

February 12, 1996

CASE NARRATIVE - Cyanide and Sulfide in Water

1. INORGANIC ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: D-ST (ACL 96-8079)

Number of Pages: 2

2. INTRODUCTION

Three water samples from the JANUS Reactor facility were analyzed to determine cyanide and sulfide as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Each water sample was analyzed to determine cyanide by Method 9010A (Total and Amenable Cyanide) and acid-soluble sulfide by Method 9030A (Acid-Soluble and Acid-Insoluble Sulfides) as described in the U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, Update I, July 1992. These methods represent the current promulgated methods for determinations of cyanide and sulfide in water samples and were applied in place of Methods 9010 and 9030, which are specified in the characterization plan. This report contains results and raw data from the cyanide and sulfide determinations on these waters.

3. METHODS

The methods applied to the analyses described in this package are as listed in the following table:

Methods for Determinations of Cyanide and Sulfide in JANUS Facility Characterization Water Samples		
Samples	Parameter Determined	Method (SW-846)
Waters, JANUS Facility	Cyanide (Total)	9010A (Total and Amenable Cyanide)
	Sulfide (Total)	9030A (Acid-Soluble and Acid-Insoluble Sulfide)

4. CLARIFICATIONS AND COMMENTS

A. Cyanide Determinations

Equipment: Spectrophotometric analysis of sample distillates was performed with a Cary 16 Spectrophotometer.

Cyanide Holding Time: Samples in this SDG were collected on January 23, 1996 and were analyzed on February 2, 1996. Hence, the holding time requirement for cyanide (14 days) was met.

B. Sulfide Determinations

Equipment: Titrimetric analysis of the sample distillates was conducted using a Metrohm 665 Dosimat.

Sulfide Holding Time: Samples in this SDG were collected on January 23, 1996 and were analyzed on either January 24 or 25. Hence, the holding time requirement for sulfide (7 days) was met.

5. QUALITY CONTROL

Quality control measurements appropriate to both Methods 9010A and 9030A were performed when samples were analyzed. These included blanks, spikes and spike duplicates and laboratory control samples. Results of the QC measurements are presented on the Report of Analytical Results form together with results for each sample. Data generated during the analyses (copies of logbook pages) are included in this package. Chain-of-Custody forms for the samples are collected at the back of this report.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to evaluate the concentrations of cyanide and sulfides in the water samples showed no values above the method detection limits for either analyte. Results for the duplicate determinations, e.g. spike and spike duplicate, agreed within the combined uncertainties for the two measurements for both cyanide and sulfide.

Date 2-15-96
Donald G. Graczyk,
Laboratory Supervisor

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Waters from JANUS Characterization
Submitted by: D. Geraghty

Date Received: 1/23/96
Date Reported: 2/5/96

Submitter's Sample No.	ACL Sample No.	Cyanide ^a
D-ST	96-8079-01	<0.2 µg/L
151-D	-02	<0.2 µg/L
Spike	-02S	78.4 µg/L (Spike Added: 80.6 µg/L - 97.3% Recovery)
Spike Duplicate	-02SD	75.8 µg/L (Spike Added: 80.6 µg/L - 94.0% Recovery)
152-D	-03	<0.2 µg/L
	Preparation Blank	<0.2 µg/L
	LCS	90.4 µg/L (Expected Value: 92.8 µg/L - 97.4% Recovery)
	ICV	78.4 µg/L (Expected Value: 80.6 µg/L - 97.3% Recovery)
	CCV	77.2 µg/L (Expected Value: 80.6 µg/L - 95.8% Recovery)
^a Samples were analyzed by spectrophotometry according to U.S. EPA Method 9010A as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Final Update I, July 1992. Quality control measurements were made consistent with protocol described in U.S. EPA Contract Laboratory Program Statement of work for Inorganic Analysis (SOW ILM03.0). QC measurements included spike sample (96-8079-02S), spike duplicate sample (96-8079-02SD), Laboratory Control Sample (LCS), Initial Calibration Verification sample (ICV), and Continuing Calibration Verification sample (CCV). The method detection limit for cyanide is 0.2 µg/L.		

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call J. Marr at 2- 9638 .

Reference(s): Notebook No. 814, pp. 72-74.

Copies To: D. Geraghty D. Graczyk Analyst(s): J. Marr
M. O'Connor F. Martino
M. Robinet J. Marr
D. Green ACL Results File
P. Lindahl ACL 200 File

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Waters from JANUS Characterization
Submitted by: D. Geraghty

Date Received: 1/23/96
Date Reported: 2/7/96

Submitter's Sample No.	ACL Sample No.	Date Collected	Date Analyzed	Acid-Soluble Sulfides ^a mg/L
D-ST	96-8079-01	1/23/96	1/24/96	<1.0
151-D	-02	1/23/96	1/24/96	<1.0
152-D	-03	1/23/96	1/25/96	<1.0
	Blank	--	--	<1.0
	Laboratory Control Sample		98 mg/L sulfide added (as sodium sulfide) 81.6 mg/L sulfide found (83.3% Recovery)	
	96-8079-03S Spike		98 mg/L sulfide added (as sodium sulfide) 94.4 mg/L sulfide found (96.3% Recovery)	
	96-8079-03SD Spike Duplicate		98 mg/L sulfide added (as sodium sulfide) 81.4 mg/L sulfide found (83.1% Recovery)	
^a Samples were analyzed to determine acid-soluble sulfides by U.S. EPA Method 9030A, Acid-Soluble and Acid-Insoluble Sulfides, as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, Update I, July 1992. Method detection limit is 1.0 mg/L.				

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. TenKate at 2- 7398 .

Reference(s): CMT Notebook No. 651, pp. 142-146.

Copies To: D. Geraghty D. Graczyk Analyst(s): L. TenKate
M. O'Connor F. Martino
M. Robinet L. TenKate
D. Green ACL Results File
P. Lindahl ACL 200 File

February 12, 1996

CASE NARRATIVE - Phenols in Water

1. INORGANIC ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: E-ST (ACL 96-8080)

Number of Pages: 2

2. INTRODUCTION

Three water samples from the JANUS Reactor facility were analyzed to determine phenols, i.e. phenolic materials, as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Each water sample was analyzed to determine phenols by Method 9065 (Phenolics) as described in the U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, September 1986. This method represents the current promulgated method for determination of phenols in water samples and was specified in the characterization plan. This report contains results and raw data from the phenols determinations on these waters.

3. METHODS

The method applied to the analyses described in this package is as listed in the following table:

Method for Determination of Phenols in JANUS Facility Characterization Water Samples		
Samples	Parameter Determined	Method (SW-846)
Waters, JANUS Facility	Phenols (Total)	9065 (Phenolics)

4. CLARIFICATIONS AND COMMENTS

A. Phenol Determinations

Procedure: No deviations from the specified procedure were noted during the analysis of the samples or review of the data.

Equipment: Spectrophotometric analysis of sample distillates was performed with a Cary 16 Spectrophotometer.

Holding Time: Samples in this SDG were collected on January 23, 1996, distilled on either January 29 or February 5, 1996, and analyzed on February 12, 1996. Hence, the holding time requirement for phenols (28 days) was met.

5. QUALITY CONTROL

Quality control measurements appropriate to Method 9065 were performed when samples were analyzed. These included a blank, spikes, and a laboratory control sample. Results of the QC measurements are presented on the Report of Analytical Results form together with results for each sample. Data generated during the analyses (copies of logbook pages) are included in this package. Chain-of-Custody forms for the samples are collected at the back of this report.

6. SUMMARY OF ANALYTICAL RESULTS

Results of the measurements to evaluate the concentration of phenols in the water samples showed no values above the method detection limits. Recovery results for the spiked samples were well within the typically acceptable percent recovery range ($\pm 20\%$) for spiked samples.

Date 2-20-96
Donald G. Graczyk,
Laboratory Supervisor

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Waters from JANUS Characterization
Submitted by: D. Geraghty

Date Received: 1/23/96
Date Reported: 2/12/96

Submitter's Sample No.	ACL Sample No.	Date Collected	Date Distilled	Date Analyzed	Phenols µg/L ^a
E-ST	96-8080-01	1/23/96	1/29/96	2/12/96	<20.0
151-E	-02	1/23/96	1/29/96	2/12/96	<20.0
152-E	-03	1/23/96	2/5/96	2/12/96	<20.0
	Blank	--	--	--	<20.0
	Laboratory Control Sample			1000 µg/L phenol added 988 µg/L phenol found: 98.8% Recovery	
	96-8080-02S Spike			1000 µg/L phenol added 1080 µg/L phenol found: 108% Recovery	
	96-8080-03S Spike			1000 µg/L phenol added 985 µg/L phenol found: 98.5% Recovery	

^a Samples were analyzed to determine total steam distillable phenols by U.S. EPA method 9065, Phenolics (Spectrophotometric, Manual 4-AAP with Distillation), as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, September 1986. Method detection limit is 20 µg/L.

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. TenKate at 2- 7398 .

Reference(s): CMT Notebook No. 653, pp. 22-27.

Copies To: D. Geraghty
M. O'Connor
M. Robinet
D. Green
P. Lindahl
D. Graczyk
F. Martino
L. TenKate
ACL Results File
ACL 200 File

Analyst(s): L. TenKate

L. TenKate

CASE NARRATIVE - Total Organic Carbon (TOC)**1. INORGANIC ANALYSIS DATA PACKAGE**

Laboratory Name: Argonne National Laboratory-East

Project Name: JANUS Facility Characterization

SDG Number: E-ST (ACL 96-8080)

Number of Pages: 2

2. INTRODUCTION

Three water samples from the JANUS Reactor facility were analyzed to determine Total Organic Carbon (TOC) as described in the "Characterization Plan for the Biological Irradiation Facility (JANUS Reactor)," November 1995 (prepared by the Technology Development Division, Decontamination & Decommissioning Projects, Argonne National Laboratory). Each water sample was analyzed to determine TOC by Method 9060 (Total Organic Carbon) as described in the U.S. EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition, September 1986. This report contains results and raw data from the TOC determinations on these waters.

3. METHOD

The method applied to the analysis described in this package is as listed in the following table:

Method for TOC in JANUS Facility Characterization Water Samples		
Samples	Parameter Determined	Method (SW-846)
Waters, JANUS Facility	Total Organic Carbon	9060 (Total Organic Carbon)

4. CLARIFICATIONS AND COMMENTS**A. Total Organic Carbon Determination**

Procedure: No deviations from the specified procedure were noted during the analysis of the samples on the review of the data.

Equipment: The TOC measurements were made using a Dohrmann DC-80 Total Organic Carbon System.

Holding Time: Samples in this SDG were collected on January 23, 1996 and analyzed on either February 2 or February 5, 1996; within the recommended holding time (28 days).

Sample Preservation: For the JANUS Reactor Characterization Project, aqueous samples were preserved at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ at collection and maintained in refrigerated storage at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ until analysis. Preservation by refrigeration at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ is believed to be the best practical approach when the sample types collected for this project and the associated safety issues are considered. Chemical preservatives were omitted in all cases because the samples to be collected were not clean waters but were actually aqueous waste of unknown composition. Because the potential existed for incompatibility between the chemical preservative and the waste samples, the use of chemical preservatives was judged imprudent. Chemical reagents were not added to the samples for safety's sake, for both the sample collector(s) and the laboratory analyst(s). Since the major consideration in maintaining the sample integrity for the determination of the total organic carbon is retardation of biological action, using refrigerated storage at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ without the addition of chemical preservatives as the means of sample preservation should be adequate to maintain the samples integrity from collection to the times of analysis indicated above.

5. QUALITY CONTROL

Quality control measurements appropriate to Method 9060 were performed as samples were analyzed. These included calibration of the Dohrmann DC-80 system with calibration standards containing oxidizable organic carbon and prepared from Primary Standard Grade Potassium Acid Phthalate (KHP); a spiked sample (E-ST S) and a duplicate spiked sample (E-STSD); deionized water blanks (DIW) for the determination of Total Carbon and deionized water blanks treated with acid for the determination of TOC; and a Continuing Calibration Verification (CCV) Sample (400 ppm Primary Standard Grade KHP).

Results of the QC measurements are presented on the Report of Analytical Results together with results for each sample. Data generated during the analyses are included in this package. Chain of Custody forms for the samples are collected at the back of this report.

6. SUMMARY OF ANALYTICAL RESULTS

Values of the TOC ranged from 1.72 to 2.36 mg/L. Results for the duplicate determinations agreed within the combined uncertainties for the two measurements.

Date 2-22-96
Donald G. Graczyk,
Laboratory Supervisor

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Water from JANUS Characterization
Submitted by: D. Geraghty

Date Received: 1/23/96
Date Reported: 2/12/96

Submitter's Sample No.	ACL Sample No.	Aliquot						Average	Range
		1	2	3	4	5	6		
		Total Carbon (mg/L)							
E-ST	96-8080-01	94.7	96.9	94.1	93.9			94.9	93.9-96.9
E-ST S	-01S	217	208	210	203			210	203-217
E-ST SD	-01SD	215	221	210	211			214	210-221
		Spike Recovery:* 81.2%							
151-E	-02	96.6	97.1	96.6	95.4			96.4	95.4-97.1
151-E S	-02S	214	215	207	205			210	205-215
		Spike Recovery:* 81.3%							
152-E	-03	93.2	91.5	94.5	94.4			93.4	91.4-94.5
	DIW Blank	0.209	0.206	0.400	0.477	0.284		0.315	0.206-0.477
	400 ppm CCV	396	402	408	419	404	395	404	395-419
		Total Organic Carbon (mg/L)							
E-ST	96-8080-01	2.19	3.73	1.87	1.66			2.36	1.66-3.73
E-ST S	-01S	188	175	184	185			183	175-188
E-ST SD	-01SD	183	188	179	182			183	179-188
		Spike Recovery:* 90.9%							
151-E	-02	2.15	1.38	1.67	1.66			1.72	1.38-2.15
151-E S	-02S	157	186	196	125			166	125-196
		Spike Recovery:* 82.6%							
152-E	-03	2.47	1.85	1.72	1.74			1.95	1.72-2.47
	DIW w/Acid Blk	0.404	0.605	0.307	0.244	0.412		0.394	0.244-0.605
		*Spiked samples prepared by mixing equal volumes of sample and 400 ppm KHP standard.							

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call E. Streets at 2- 4460

Reference(s): ANL-SOP NNWS1-RNL-05-018.

Copies To:	D. Geraghty	D. Graczyk	Analyst(s):	E. Streets
	M. Robinet	P. Lindahl		L. Hafenrichter
	M. O'Connor	F. Martino		
	C. Sholeen	ACL Results File		
	D. Green	ACL 200 File		

APPENDIX K

Analytical Results from Reactor Core Samples
ANL Analytical Chemistry Laboratory Data Package Summaries

Locations of Core Samples

JANUS Sample Number	ACL Number	Description	Sample Location
007F03, 08L1	96-8069-01	Solid Lead	High Dose Room Floor
007S5.5, 3.5L	96-8069-02	Solid Lead	High Dose Room South Wall
007W7.5, 3.5L	96-8069-03	Solid Lead	High Dose Room West Wall
#1	96-8120-01	Lead Shavings	High Dose Room Reactor Face 7, 3
#2	96-8120-02	Lead Shavings	High Dose Room 2,2 Lead Planks
007F03, 08B1	96-8074-01	Hard Board	High Dose Room Floor
007S5.5, 3.5B1	96-8074-02	Hard Board	High Dose Room South Wall
007W7.5, 3.5B1	96-8074-03	Hard Board	High Dose Room West Wall
007F03, 08C1	96-8067-01	Solid Concrete	High Dose Room Floor - 0" to 3"
007F03, 08C2	96-8067-02	Solid Concrete	High Dose Room Floor - 3" to 6"
007N02, 3.5C1	96-8067-03	Solid Concrete	High Dose Room Door - 0" to 3"
007N02, 3.5C2	96-8067-04	Solid Concrete	High Dose Room Door - 3" to 6"
Door #1A	96-8124-05	Solid Concrete	High Dose Room Door - 6" to 7½"
Door #2A	96-8124-06	Solid Concrete	High Dose Room Door - 7½" to 11½"
Door #3A	96-8124-07	Solid Concrete	High Dose Room Door - 11½" to 15¼"
Door #4A	96-8124-08	Solid Concrete	High Dose Room Door - 15¼" to 18¾"
007S5.5, 3.5C1	96-8067-05	Solid Concrete	High Dose Room South Wall - 0" to 3"
007S5.5, 3.5C2	96-8067-06	Solid Concrete	High Dose Room South Wall - 3" to 6"
007W7.5, 3.5C1	96-8067-07	Solid Concrete	High Dose Room West Wall - 0" to 3"
007W7.5, 3.5C2	96-8067-08	Solid Concrete	High Dose Room West Wall - 3" to 6"
Westwall #1	96-8124-01	Solid Concrete	High Dose Room West Wall - 6" to 8½"
Westwall #2	96-8124-02	Solid Concrete	High Dose Room West Wall - 8½" to 10½"
Westwall #3	96-8124-03	Solid Concrete	High Dose Room West Wall - 10½" to 14½"
Westwall #4	96-8124-04	Solid Concrete	High Dose Room West Wall - 14½" to 15½"

Locations of Core Samples

JANUS Sample Number	ACL Number	Description	Sample Location
015N04, 04L	96-8070-01	Lead Shavings	Low Dose Room North Wall
015W12.5, 04L	96-8070-02	Lead Shavings	Low Dose Room West Wall
015E12, 04C	96-8068-01	Concrete Powder	Low Dose Room East Wall
015S17.5, 04C	96-8068-02	Concrete Powder	Low Dose Room South Wall
015W12.5, 06C	96-8068-03	Concrete Powder	Low Dose Room West Wall
J015 -0.9	96-8067-14	Solid Concrete	Low Dose Room Horizontal Core 0.9 ft from Reactor Center
J015 0	96-8067-13	Solid Concrete	Low Dose Room Horizontal Core at Reactor Center
J015 +1.8	96-8067-15	Solid Concrete	Low Dose Room Horizontal Core 1.8 ft from Reactor Center
J015 +5.1	96-8067-16	Solid Concrete	Low Dose Room Horizontal Core 5.1 ft from Reactor Center
J015 +7.5	96-8067-17	Solid Concrete	Low Dose Room Horizontal Core 7½ ft from Reactor Center
J015 TB	96-8083-01	Water	Trip Blank to Accompany J015 +5.7 for Volatile Organic Analysis
J015 +5.7	96-8084-01	Soil	Low Dose Room Horizontal Core 5.7 ft from Reactor Center - Volatile Organics
200-1	96-8087-01	Aluminum Clip	Reactor Core - α and γ Spec
200-2	96-8087-02	Bolts, Washers	Reactor Core - α and γ Spec
200T +4.5	96-8087-12	Solid Concrete	Vertical Core 4 ft above Reactor Center
200T +1.5	96-8087-10	Solid Concrete	Vertical Core 1½ ft above Reactor Center
200T 0	96-8087-09	Solid Concrete	Vertical Core at Reactor Center
200T -2.5	96-8087-11	Solid Concrete	Vertical Core 2½ ft Below Reactor Center
200T -4.0	96-8072-01	Solid Steel	Vertical Core Rebar 4 ft Below Reactor Center
#1	96-8088-01	Graphite	Thimbol Hole #1; 2 ft from Top - γ Spec
#2	96-8088-02	Graphite	Thimbol Hole #1; 4 ft from Top - γ Spec
#3	96-8089-01	Graphite	Thimbol Hole #1; 6 ft from Top - α and γ Spec
#4	96-8090-01	Solid Lead	Thimbol Hole #1; ½ ft from Top - γ Spec

ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

February 29, 1996

To: Charlotte Sholeen ESH-HP
From: Edward Semones ESH-HP
Subject: **Portable γ Spectroscopy Results**

During the week of 1/15/96, a qualitative measurement of an "ionization detector" from the Janus Reactor was made with a portable HPGe detector (S/N: 20-P610B). The following two radionuclides were identified:

1. ^{60}Co ($T_{1/2} = 5.27 \text{ a}$)
2. ^{65}Zn ($T_{1/2} = 244 \text{ d}$)

A crude estimate of the activity ratio ($^{60}\text{Co}/^{65}\text{Zn}$) is 5/1. The exposure rate was also measured using an energy compensated G-M detector at 1.22 m from the middle of the "ionization detector" and was found to be 160 $\mu\text{R/h}$ (Background = 16 $\mu\text{R/h}$).

CASE NARRATIVE - GAMMA SPECTROSCOPY

1. RADIOLOGICAL ANALYSIS DATA PACKAGE

Laboratory Name: Argonne National Laboratory
Lab Code: ANL-E
Project Name: JANUS Reactor Characterization Project
SDG Number: 007F03,08L1
Number of Pages: 2

2. INTRODUCTION

Gamma spectroscopy analyses were performed on the following samples:

<u>Janus Sample Number:</u>	<u>ACL Number:</u>	<u>Description:</u>
007F03,08L1	96-8069-01	Solid Lead
007S5.5,3.5L	96-8069-02	Solid Lead
007W7.5,3.5L	96-8069-03	Solid Lead
015N04,04L	96-8070-01	Lead Shavings
015W12.5,04L	96-8070-02	Lead Shavings
200T-4.0	96-8072-01	Solid Steel
200-1	96-8087-01	Solid Metal
200-2	96-8087-02	Solid Metal
#4	96-8090-01	Solid Lead

Standard operating procedure ACL-072 was followed for the preparation of the lead shavings samples for gamma spec analysis.

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detector 9 is also an intrinsic Ge detector and is interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described

above for detector 3. For detector 9, SOP:ACL-127 was followed.

Most samples were counted for a minimum of 1000 minutes to allow for adequate counting statistics.

3. DEVIATIONS FROM PROTOCOL

The solid lead, steel, and metal samples were slightly larger than the 4 oz. poly bottles, which is the normal geometry for gamma counting. Therefore, they were analyzed as received.

4. QUALITY CONTROL SUMMARY

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cs-137 standard, following SOP:ACL-075 for detector 3 and SOP:ACL-128 for detector 9. The performance of the lab control standard was always within 2.5 percent of the expected value, as indicated in the Associated Documentation section.

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Date 2/26/96
Tony Tenkate, Analyst
Radiological Analysis

Date 2/26/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Lead - Solid; JANUS Reactor Characterization Project Date Received: 1/23/96
Submitted by: C. Sholeen Date Reported: 2/21/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/Kg)				
		<u>Wt. (Kg)</u>	<u>²¹⁴Bi</u>	<u>²²⁶Ra</u>	<u>²³²Th</u>	<u>²²⁸Th</u>
007F03, 08L1	96-8069-01	5.16	<200	<200	<200	<200
007S5.5, 3.5L	-02	5.43	<200	<200	<200	<200
007W7.5, 3.5L	-03	5.07	<200	<200	<200	<200

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1111, Pg. 92; CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115.

Copies To: C. Sholeen M. Robinet M. O'Connor D. Geraghty D. Green Jht 2/22/96 CMT-24 (1.94)	D. Bowers P. Lindahl D. Graczyk F. Martino T. TenKate	Analyst(s): T. TenKate J. Yaeger 72	Addnl. Copies: J. Yaeger ACL Results File 200 Results File
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ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Lead - Shavings; JANUS Reactor Characterization Project Date Received: 1/23/96
Submitted by: C. Sholeen Date Reported: 2/21/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)				
		<u>Wt. (g)</u>	<u>²¹⁴Bi</u>	<u>²²⁶Ra</u>	<u>²³²Th</u>	<u>²²⁸Th</u>
015N04, 04L	96-8070-01	176.64	<0.2	<0.2	<0.2	<0.2
15W12.5, 04L	-02	243.19	<0.2	<0.2	<0.2	<0.2

OTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call TenKate _____ at 2- 4291 _____.

Reference(s): CMT Logbook No. 1111, Pg. 90; CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115;

WT Logbook No. 1112, Det. 1, 9, and 10, Pg. 73.

Copies To: C. Sholeen M. Robinet M. O'Connor D. Geraghty D. Green	D. Bowers P. Lindahl D. Graczyk F. Martino T. TenKate	Analyst(s): T. TenKate J. Yaeger	Addnl. Copies: J. Yaeger ACL Results File 200 Results File
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t
23/96
14 (4-94)

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Steel, JANUS Reactor Characterization Project
Submitted by: C. Sholeen

Date Received: 1/23/96
Date Reported: 2/20/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)		
		<u>Wt. (g)</u>	<u>⁶⁰Co</u>	<u>⁵⁴Mn</u>
200T-4.0	96-8072-01	152.1805	10.6 ± 1.0	0.7 ± 0.1

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1111, Pg. 90; CMT Logbook No. 1112, Det. 1,9, and 10, Pg. 73.

Copies To: C. Sholeen
M. Robinet
D. Geraghty
M. O'Connor
D. Green
D. Bowers
P. Lindahl
D. Graczyk
F. Martino
T. TenKate

Analyst(s): T. TenKate
J. Yaeger *T²*

Addnl. Copies:
J. Yaeger
ACL Results File
200 Results File

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Metal, JANUS Reactor Characterization Project

Date Received: 1/29/96

Submitted by: C. Sholeen

Date Reported: 2/21/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)	
		<u>Wt. (g)</u>	<u>⁶⁰Co</u>
200-1	96-8087-01	86	$1.65 \times 10^2 \pm 1.7 \times 10^1$
200-2	-02	620	$9.74 \times 10^4 \pm 9.7 \times 10^3$

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291.

Reference(s): CMT Logbook No. 1111, Pg. 94; CMT Logbook No. 938, Det. 2, 3, and 6, Pgs. 115 and 117.

Copies To: C. Sholeen
M. Robinet
M. O'Connor
D. Geraghty
D. Green
D. Bowers
P. Lindahl
D. Graczyk
F. Martino
T. TenKate

Analyst(s): T. TenKate
J. Yaeger

Addnl. Copies:
J. Yaeger
ACL Results File
200 Results File

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Lead, JANUS Reactor Characterization Project

Date Received: 1/30/96

Submitted by: D. Geraghty

Date Reported: 2/21/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)				
		<u>Wt. (g)</u>	<u>²¹⁴Bi</u>	<u>²²⁶Ra</u>	<u>²³²Th</u>	<u>²²⁸Th</u>
#4	96-8090-01	330	0.34 ± 0.03	0.26 ± 0.03	<0.2	<0.2

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291.

Reference(s): CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 117; CMT Logbook No. 1111, Pg. 92.

Copies To: D. Geraghty
M. Robinet
M. O'Connor
C. Sholeen
D. Green
D. Bowers
P. Lindahl
D. Graczyk
F. Martino
T. TenKate

Analyst(s): T. TenKate
J. Yaeger

Addnl. Copies:
J. Yaeger
ACL Results File
200 Results File

/hlt
2/22/96

March 4, 1996

CASE NARRATIVE

1. GAMMA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: 007F03.08B1

2. INTRODUCTION

Gamma spectroscopy analyses were performed on the following samples:

<u>Janus Sample Number:</u>	<u>ACL Number:</u>	<u>Description:</u>
007F03.08B1	96-8074-01	Hard Board
007S5.5,3.5B1	96-8074-02	Hard Board
007W7.5,3.5B1	96-8074-03	Hard Board

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detector 9 is also an intrinsic Ge detector and is interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described above for detector 3. For detector 9, SOP: ACL-127 was followed.

Most samples were counted for a minimum of 300 minutes to allow for adequate counting statistics.

3. DEVIATIONS FROM PROTOCOL

The hard board samples were slightly larger than the 4 oz. poly bottles, which is the normal geometry for gamma counting. Therefore, they were analyzed as received.

4. QUALITY CONTROL

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cs-137 standard, following SOP: ACL-075 for detector 3 and SOP: ACL-128 for

detector 9. The performance of the lab control standard was always within 2.5 percent of the expected value, as indicated in the Associated Documentation section.

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Tony TenKate Date 3/5/96
Tony TenKate, Analyst
Radiological Analysis

Delbert L. Bowers Date 3/5/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Hard Board, JANUS Reactor Characterization Project
Submitted by: C. Sholeen

Date Received: 1/23/96
Date Reported: 2/20/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec. (pCi/g)				
		<u>⁶⁰Co</u>	<u>²²⁶Ra</u>	<u>²¹⁴Bi</u>	<u>²³²Th</u>	<u>²²⁸Th</u>
007F03.08B1	96-8074-01	<0.2	<0.2	<0.2	<0.2	<0.2
007S5.5,3.5B1	-02	<0.2	<0.2	<0.2	<0.2	<0.2
007W7.5,3.5B1	-03	<0.2	<0.2	<0.2	<0.2	<0.2

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2-4291.

Reference(s): CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115; CMT Logbook No. 1112, Det. 1, 9, and 10, Pgs. 73 and 75; and CMT Logbook No. 1111, Pg. 93.

Copies To: C. Sholeen
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D. Green
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P. Lindahl
D. Graczyk
F. Martino
T. TenKate

Analyst(s): T. TenKate
J. Yaeger *72*

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ACL Results File
200 Results File

CASE NARRATIVE

1. GAMMA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: 007F03, 08C1

2. INTRODUCTION

Gamma spectroscopy analyses were performed on seventeen concrete core samples: Janus Sample No. 007F03,08C1 through J015+7.5, and three concrete powder samples: No. 015E12,04C, 015S17.5,04C, and 015W12.5,06C. Standard operating procedure (SOP): ACL-072 was followed for the preparation of each concrete powder sample for gamma spec analysis.

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detector 9 is also an intrinsic Ge detector and is interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described above for detector 3. For detector 9, SOP: ACL-127 was followed.

Most samples were counted for a minimum of 500 minutes to allow for adequate counting statistics.

3. DEVIATIONS FROM PROTOCOL

Since the concrete core samples were slightly larger than the 4 oz. poly bottles, the normal geometry for gamma counting, they were analyzed as received.

4. QUALITY CONTROL SUMMARY

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cesium-137 standard, following SOP: ACL-075 for detector 3 and SOP: ACL-128 for

February 19, 1996

detector 9. The performance of the lab control standard was always within 2.5 percent of the expected value, as indicated in the Associated Documentation section.

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Date 2/20/96
Tony TenKate, Analyst
Radiological Analysis

Date 2/21/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

REPORT OF ANALYTICAL RESULTS **Revised 2/20/96**

Sample Material: JANUS Characterization, Concrete - Solid Cores
Submitted by: C. Sholeen

Date Received: 1/23/96
Date Reported: 2/9/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/Kg)					
		<u>Wt. (Kg)</u>	<u>⁶⁰Co</u>	<u>¹³⁴Cs</u>	<u>¹⁵²Eu</u>	<u>¹⁵⁴Eu</u>	<u>²²⁶Ra</u>
007F03, 08C1	96-8067-01	0.605	$4.31 \times 10^2 \pm 4.3 \times 10^1$	<200	$3.48 \times 10^3 \pm 3.5 \times 10^2$	<200	<200
007F03, 08C2	-02	0.514	$3.71 \times 10^2 \pm 3.7 \times 10^1$	<200	$3.14 \times 10^3 \pm 3.1 \times 10^2$	<200	<200
007N02, 3.5C1	-03	0.601	$2.24 \times 10^3 \pm 2.2 \times 10^2$	<200	$5.51 \times 10^3 \pm 5.5 \times 10^2$	<200	<200
007N02, 3.5C2*	-04	0.647	$2.67 \times 10^3 \pm 2.7 \times 10^2$	<200	$6.53 \times 10^3 \pm 6.5 \times 10^2$	$4.23 \times 10^2 \pm 4.2 \times 10^1$	$2.06 \times 10^4 \pm 2.1 \times 10^3$
007S5.5, 3.5C1	-05	0.724	$1.94 \times 10^3 \pm 1.9 \times 10^2$	<200	$3.19 \times 10^3 \pm 3.2 \times 10^2$	<200	$3.21 \times 10^4 \pm 3.2 \times 10^3$
007S5.5, 3.5C2	-06	0.768	$5.58 \times 10^2 \pm 5.6 \times 10^1$	<200	$3.81 \times 10^3 \pm 3.8 \times 10^2$	$2.77 \times 10^2 \pm 2.8 \times 10^1$	<200
007W7.5, 3.5C1	-07	0.526	$3.24 \times 10^2 \pm 3.2 \times 10^1$	<200	$2.10 \times 10^3 \pm 2.1 \times 10^2$	<200	<200
007W7.5, 3.5C2	-08	0.705	$5.10 \times 10^2 \pm 5.1 \times 10^1$	<200	$3.43 \times 10^3 \pm 3.4 \times 10^2$	<200	<200
200T0	-09	0.831	$4.42 \times 10^4 \pm 4.4 \times 10^3$	$8.48 \times 10^2 \pm 8.5 \times 10^1$	$1.22 \times 10^4 \pm 1.2 \times 10^3$	$8.35 \times 10^3 \pm 8.4 \times 10^2$	$4.03 \times 10^5 \pm 4.0 \times 10^4$
200T + 1.5	-10	0.839	$1.44 \times 10^4 \pm 1.4 \times 10^3$	$2.54 \times 10^2 \pm 2.5 \times 10^1$	$4.03 \times 10^4 \pm 4.0 \times 10^3$	$2.90 \times 10^3 \pm 2.9 \times 10^2$	$1.34 \times 10^5 \pm 1.3 \times 10^4$

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1111, Pg. 89; CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115; CMT Logbook No. 111; Det. 1, 9, and 10, Pg. 73.

Copies To: C. Sholeen
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D. Geraghty
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T. TenKate

Analyst(s): T. TenKate
J. Yaeger

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J. Yaeger
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REPORT OF ANALYTICAL RESULTS Revised 2/20/96

Sample Material: JANUS Characterization, Concrete - Solid Cores

Date Received: 1/23/96

Submitted by: C. Sholeen

Date Reported: 2/9/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/Kg)					
		<u>Wt., (Kg)</u>	<u>⁶⁰Co</u>	<u>¹³⁴Cs</u>	<u>¹⁵²Eu</u>	<u>¹⁵⁴Eu</u>	<u>²²⁶Ra</u>
200T - 2.5	96-8067-11	0.842	$6.09 \times 10^3 \pm 6.1 \times 10^2$	<200	$1.64 \times 10^4 \pm 1.6 \times 10^3$	$1.03 \times 10^3 \pm 1.0^* \times 10^2$	$2.59 \times 10^2 \pm 2.6 \times 10^1$
200T + 4.5	-12	0.829	$1.55 \times 10^2 \pm 1.6 \times 10^1$	<200	$4.97 \times 10^2 \pm 5.0 \times 10^1$	<200	<200
J0150	-13	0.837	$9.49 \times 10^3 \pm 9.5 \times 10^2$	$2.89 \times 10^2 \pm 2.9 \times 10^1$	$4.29 \times 10^4 \pm 4.3 \times 10^3$	$2.08 \times 10^3 \pm 2.1 \times 10^2$	<200
J015 - 0.9*	-14	0.829	$1.65 \times 10^4 \pm 1.7 \times 10^3$	$2.60 \times 10^2 \pm 2.6 \times 10^1$	$4.29 \times 10^4 \pm 4.3 \times 10^3$	$2.95 \times 10^3 \pm 3.0 \times 10^2$	$2.30 \times 10^3 \pm 2.3 \times 10^2$
J015 + 1.8	-15	0.902	$1.26 \times 10^3 \pm 1.3 \times 10^2$	<200	$4.58 \times 10^3 \pm 4.9 \times 10^2$	$2.99 \times 10^2 \pm 3.0 \times 10^1$	<200
J015 + 5.1	-16	0.927	<200	<200	<200	<200	<200
J015 + 7.5	-17	1.747	<200	<200	<200	<200	$5.37 \times 10^2 \pm 5.4 \times 10^1$
<p>*Reason for revision: Typographical errors. ACL Sample No. 96-8067-04 should read 007N02, 3.5C2 for the Submitter's Sample No. Sample No. 96-8067-11 the uncertainty for ¹⁵⁴Eu should be 1.0×10^2. ACL Sample No. 96-8067-14 should read J015 - 0.9 for the Submitter's Sample No.</p>							

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1111, Pg. 89; CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115; CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 73.

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D. Green

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T. TenKate

Analyst(s): T. TenKate
J. Yaeger

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ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Concrete-powder, JANUS Reactor Characterization Project Date Received: 1/23/96
Submitted by: C. Sholeen Date Reported: 2/14/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)			
		<u>^{214}Bi</u>	<u>^{226}Ra</u>	<u>^{232}Th</u>	<u>^{228}Th</u>
015E12, 04C	96-8068-01	<0.2	0.38 $\pm$ 0.04	<0.2	<0.25 $\pm$ 0.03
01S17.5, 04C	-02	0.46 $\pm$ 0.05	0.45 $\pm$ 0.05	<0.2	<0.2
015W12.5, 06C	-03	0.28 $\pm$ 0.03	0.25 $\pm$ 0.03	<0.2	0.32 $\pm$ 0.03

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291 .

Reference(s): CMT Logbook No. 1111, Pg. 89; CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 73; CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 115.

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Analyst(s): T. TenKate
J. Yaeger *72*

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March 4, 1996

CASE NARRATIVE

1. GAMMA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: #1

2. INTRODUCTION

Gamma spectroscopy analyses were performed on three graphite samples: Janus sample no. #1, #2, and #3 (received 1/31/96). Standard operating procedure ACL-072 was followed for the preparation of each sample for gamma spec analysis.

Gamma spectra were obtained by following SOP: ACL-127 for detector 9, which is an intrinsic Ge detector, interfaced with an APTEC multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

3. DEVIATIONS FROM PROTOCOL

None.

4. QUALITY CONTROL

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cs-137 standard, following SOP: ACL-128 for detector 9. The performance of the lab control standard was always within 2.5 percent of the expected values, as indicated in the Associated Documentation section.

Backgrounds for the detector were done weekly and subtracted from the counting data of each sample counted during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Date 3/5/96
Tony Tefikate, Analyst
Radiological Analysis

Date 3/5/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Graphite; JANUS Reactor Characterization Project Date Received: 1/31/96
Submitted by: D. Geraghty Date Reported: 2/23/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)			
		<u>Wt. (g)</u>	<u>⁶⁰Co</u>	<u>¹⁵²Eu</u>	<u>¹⁵⁴Eu</u>
#1	96-8088-01	64.206	35.5 ± 3.5	97.7 ± 9.8	6.2 ± 0.6
#2	-02	71.979	7.6 ± 0.8	165.4 ± 16.5	10.2 ± 1.0
#3	96-8089-01	79.965	295 ± 30	3.11 × 10 ³ ± 3.1 × 10 ²	2.66 × 10 ² ± 2.7 × 10 ¹

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1111, Pg. 92; CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 75.

Copies To: D. Geraghty M. Robinet M. O'Connor /hlt C. Sholeen 2/23/96 D. Green CMT-84 (4-94)	D. Bowers P. Lindahl D. Graczyk F. Martino T. TenKate	Analyst(s): T. TenKate <i>TV</i> J. Yaeger	Addnl. Copies: J. Yaeger ACL Results File 200 Results File
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February 22, 1996

CASE NARRATIVE

1. ALPHA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: 200-1

2. INTRODUCTION

Thorium, uranium, and plutonium analyses were performed using isotope-dilution alpha spectroscopy. These metal and graphite samples were digested with acid, spiked with appropriate radiotracers, and subsequently separated into elemental components through extraction chromatography and anion exchange chromatography as described in SOP:ACL-165. Planchets were prepared by electrodeposition and counted on the Kicksort Alpha Spectrometer with associated Ortec ADCAM and AST personal computer with Ortec software according to SOP:ACL-181.

3. DEVIATIONS FROM PROTOCOL

There were no deviations from the standard analytical protocols.

4. QUALITY CONTROL SUMMARY

Blank sample 96-8087-blk consists of all reagents used in the sample preparation, and was taken through the same chemical procedure as the samples. The activity levels associated with this blank sample were very low, and normal. The uranium and plutonium results for the alpha laboratory control sample, 96-8087-spk, were within 20% and 2 sigma of the expected results. The thorium results for 96-8087-spk were high and exceeded 20%; however, the determined value was within 2 sigma. No duplicate samples were analyzed due to the nature of the samples.

Date 2/23/96
Lesa L. Smith, Analyst
Radiological Analysis

Date 2/26/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

SAMPLE CROSS-REFERENCE LIST - ALPHA SPECTROSCOPY

JANUS REACTOR CHARACTERIZATION PROJECT

SDG: 200-1

ACL Sample Number	Customer Sample Number
96-8087-01	200-1
96-8087-02	200-2
96-8089-01	Graphite, #3

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Metal, JANUS Reactor Characterization

Date Received: 1/29/96

Submitted by: C. Sholeen

Date Reported: 2/22/96

Submitter's Sample No.	ACL Sample No.	pCi $\pm 2\sigma$ (Total Sample)						
		<u>^{232}Th</u>	<u>^{230}Th</u>	<u>^{238}U</u>	<u>$^{235/238}\text{U}$</u>	<u>$^{233/234}\text{U}$</u>	<u>$^{239/240}\text{Pu}$</u>	<u>^{238}Pu</u>
200-1	96-8087-01	<0.01	0.02 $\pm$ 0.01	<0.01	<0.01	0.07 $\pm$ 0.02	<0.03	<0.05
200-2	-02	<0.01	0.02 $\pm$ 0.02	0.02 $\pm$ 0.01	<0.01	0.07 $\pm$ 0.01	0.02 $\pm$ 0.01	<0.04
	96-8087-BLK	<0.01	0.03 $\pm$ 0.01	<0.01	<0.01	<0.01	<0.02	<0.04

NOTE: Uncertainties (σ) based upon propagation of counting statistical error. Less than (<) values are 3.29σ .

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. Smith at 2- 1890.

Reference(s): CMT Notebook No. 1044, Pgs. 100, 105, 107, and 111.

Copies To: C. Sholeen
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D. Geraghty
D. Green
D. Bowers
P. Lindahl
D. Graczyk
F. Martino
L. Smith

Analyst(s): L. Smith

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ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Graphite, JANUS Reactor Characterization Project

Date Received: 1/31/96

Submitted by: D. Geraghty

Date Reported: 2/22/96

Submitter's Sample No.	ACL Sample No.	pCi/g $\pm 2\sigma$						
		<u>^{232}Th</u>	<u>^{230}Th</u>	<u>^{238}U</u>	<u>$^{235/236}\text{U}$</u>	<u>$^{233/234}\text{U}$</u>	<u>$^{239/240}\text{Pu}$</u>	<u>^{238}Pu</u>
Graphite, #3	96-8089-01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02 $\pm$ 0.01	<0.02
NOTE: Uncertainties (σ) based upon propagation of counting statistical error. Less than ($<$) values are 3.29σ .								

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. Smith at 2- 1890

Reference(s): CMT Notebook No. 1044, Pgs. 100, 105, 107, and 111.

Copies To: C. Sholeen
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D. Geraghty
D. Green

D. Bowers
P. Lindahl
D. Graczyk
F. Martino
L. Smith

Analyst(s): L. Smith *JS*

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February 13, 1996

CASE NARRATIVE

1. VOLATILE ORGANICS DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG Number: S1-B

Instrument: HP5970 GC/MSD-1; HP UNIX System Software; Tekmar Purge and Trap Model 4000 Dynamic Headspace Concentrator with Automatic Laboratory Sampler

2. INTRODUCTION

Analyses of samples for volatile organic compounds, which are reported in this data package, were performed using Method 8260A in the EPA Document SW-846 (Final Update II, Revision 1, September 1994).

The enclosed data package contains data for seven soil samples, one matrix spike (MS) sample, one matrix spike duplicate (MSD) sample, and two method blanks. The samples were collected from the Janus Reactor site and were received on January 11 and 29, 1996.

The samples were stored at 4°C until the analyses were performed on the dates given on the attached bench sheets.

3. SUMMARY COMMENTS

Holding Time: Holding time was met for all samples included in this data package.

GC/MS Tuning: All samples were analyzed within 12 hours of a BFB tune which met tuning criteria.

Instrument Calibrations: All instrumental calibrations met SW-846 criteria.

Laboratory Blanks: The laboratory blanks were found to be within SW-846 criteria.

Surrogate Recoveries: All of the surrogate recoveries reported in this data package were within SW-846 QC limits.

Matrix Spike Recoveries: SW-846 provides no QC limits for recoveries of matrix spike compounds for volatile organic analysis. Matrix spike and MSD recoveries were within the CLP (Contract Laboratory Program) QC limits for ten out of ten values reported; relative percent difference between MS and MSD were within the CLP QC limits for five out of five values reported. .

4. DATA PACKAGE CLARIFICATIONS

Copies of pages from the VOA Sample Preparation Book V are included at the end of the data package.

Date 2/13/96
Laura L. Chromizky, Analyst
Volatile Organic Analysis

Date 2/13/96
Amrit S. Boparai, Group Leader
Organic Analysis Group

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: J015+5.7

Sample Date: 01/29/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8084-01

Date Received: 01/29/96

Sample Type: SOIL

Date Reported: 02/02/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
74-87-3-----	CHLOROMETHANE	10.00	U
75-01-4-----	VINYL CHLORIDE	10.00	U
74-83-9-----	BROMOMETHANE	10.00	U
75-00-3-----	CHLOROETHANE	10.00	U
75-35-4-----	1 1-DICHLOROETHENE	10.00	U
75-09-2-----	METHYLENE CHLORIDE	10.00	U
156-60-5-----	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3-----	1 1-DICHLOROETHANE	10.00	U
74-97-5-----	BROMOCHLOROMETHANE	10.00	U
67-66-3-----	CHLOROFORM	10.00	U
71-55-6-----	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5-----	CARBON TETRACHLORIDE	10.00	U
71-43-2-----	BENZENE	10.00	U
107-06-2-----	1 2-DICHLOROETHANE	10.00	U
79-01-6-----	TRICHLOROETHENE	10.00	U
78-87-5-----	1 2-DICHLOROPROPANE	10.00	U
75-27-4-----	BROMODICHLOROMETHANE	10.00	U
10061-02-0-----	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3-----	TOLUENE	10.00	U
10061-01-0-----	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5-----	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4-----	TETRACHLOROETHENE	10.00	U
124-48-1-----	DIBROMOCHLOROMETHANE	10.00	U
108-90-7-----	CHLOROBENZENE	10.00	U
100-41-4-----	ETHYL BENZENE	10.00	U
-----	m&p-XYLENE	10.00	U
95-47-6-----	o-XYLENE	10.00	U
100-42-5-----	STYRENE	10.00	U
75-25-2-----	BROMOFORM	10.00	U
79-34-5-----	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8-----	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4-----	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7-----	2 2-DICHLOROPROPANE	10.00	U
156-59-2-----	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6-----	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: J015+5.7

Sample Date: 01/29/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8084-01

Date Received: 01/29/96

Sample Type: SOIL

Date Reported: 02/02/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
106-43-4-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: S1-B

Client Sample ID: J015+5.7

Sample Date: 01/29/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8084-01

Date Received: 01/29/96

Sample Type: SOIL

Date Reported: 02/02/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 5

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====
1. 67-64-1	2-Propanone	7.250	21.79	NJ
2. 928-68-7	2-Heptanone, 6-methyl-	23.556	6.34	NJ
3. 104-76-7	1-Hexanol, 2-ethyl-	25.741	9.52	NJ
4.	Unknown	27.516	7.06	J
5.	Unknown	28.397	5.39	J

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: J015TB

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8083-01

Date Received: 01/23/96

Sample Type: WATER

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/L
			Q
74-87-3	CHLOROMETHANE	10.00	U
75-01-4	VINYL CHLORIDE	10.00	U
74-83-9	BROMOMETHANE	10.00	U
75-00-3	CHLOROETHANE	10.00	U
75-35-4	1 1-DICHLOROETHENE	10.00	U
75-09-2	METHYLENE CHLORIDE	10.00	U
156-60-5	TRANS-1 2-DICHLOROETHENE	10.00	U
75-34-3	1 1-DICHLOROETHANE	10.00	U
74-97-5	BROMOCHLOROMETHANE	10.00	U
67-66-3	CHLOROFORM	10.00	U
71-55-6	1 1 1-TRICHLOROETHANE	10.00	U
56-23-5	CARBON TETRACHLORIDE	10.00	U
71-43-2	BENZENE	10.00	U
107-06-2	1 2-DICHLOROETHANE	10.00	U
79-01-6	TRICHLOROETHENE	10.00	U
78-87-5	1 2-DICHLOROPROPANE	10.00	U
75-27-4	BROMODICHLOROMETHANE	10.00	U
10061-02-0	CIS-1 3-DICHLOROPROPENE	10.00	U
108-88-3	TOLUENE	10.00	U
10061-01-0	TRANS-1 3-DICHLOROPROPENE	10.00	U
79-00-5	1 1 2-TRICHLOROETHANE	10.00	U
127-18-4	TETRACHLOROETHENE	10.00	U
124-48-1	DIBROMOCHLOROMETHANE	10.00	U
108-90-7	CHLOROBENZENE	10.00	U
100-41-4	ETHYL BENZENE	10.00	U
	m&p-XYLENE	10.00	U
95-47-6	o-XYLENE	10.00	U
100-42-5	STYRENE	10.00	U
75-25-2	BROMOFORM	10.00	U
79-34-5	1 1 2 2-TETRACHLOROETHANE	10.00	U
75-71-8	DICHLORODIFLUOROMETHANE	10.00	U
75-69-4	TRICHLOROFLUOROMETHANE	10.00	U
594-20-7	2 2-DICHLOROPROPANE	10.00	U
156-59-2	CIS-1,2-DICHLOROETHENE	10.00	U
563-58-6	1 1-DICHLOROPROPENE	10.00	U

TARGET COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: J015TB

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8083-01

Date Received: 01/23/96

Sample Type: WATER.

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L	Q
---------	----------	--	---

74-95-3-----	DIBROMOMETHANE	10.00	U
142-28-9-----	1 3-DICHLOROPROPANE	10.00	U
106-93-4-----	1 2-DIBROMOETHANE	10.00	U
630-20-6-----	1 1 1 2-TETRACHLOROETHANE	10.00	U
98-82-8-----	ISOPROPYLBENZENE	10.00	U
108-86-1-----	BROMOBENZENE	10.00	U
96-18-4-----	1 2 3-TRICHLOROPROPANE	10.00	U
103-65-1-----	n PROPYLBENZENE	10.00	U
95-49-8-----	2 CHLOROTOLUENE	10.00	U
108-67-8-----	1 3 5-TRIMETHYLBENZENE	10.00	U
95-49-8-----	4 CHLOROTOLUENE	10.00	U
98-06-6-----	TERT BUTYLBENZENE	10.00	U
95-63-6-----	1,2,4-TRIMETHYLBENZENE	10.00	U
135-98-8-----	SEC-BUTYLBENZENE	10.00	U
99-87-6-----	p ISOPROPYLTOLUENE	10.00	U
541-73-1-----	1 3 DICHLOROBENZENE	10.00	U
106-46-7-----	1 4 DICHLOROBENZENE	10.00	U
104-51-8-----	n BUTYLBENZENE	10.00	U
95-50-1-----	1 2-DICHLOROBENZENE	10.00	U
96-12-8-----	1 2-DIBROMO-3-CHLOROPROPANE	10.00	U
120-82-1-----	1 2 4-TRICHLOROBENZENE	10.00	U
87-68-3-----	HEXACHLOROBUTADIENE	10.00	U
91-20-3-----	NAPHTHALENE	10.00	U
87-61-6-----	1 2 3-TRICHLOROBENZENE	10.00	U

TENTATIVELY IDENTIFIED COMPOUNDS

Argonne National Lab

Client Name: M. Robinet

Client SDG: SN-T1

Client Sample ID: J015TB

Sample Date: 01/23/96

Sample Location: Janus reactor

Sample Point:

Lab Sample ID: 96-8083-01

Date Received: 01/23/96

Sample Type: WATER.

Date Reported: 02/01/96

Analysis Type: VOA

Level: LOW

Data Type: MS DATA

Column Number: 1

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
=====	=====	=====	=====	=====

April 1, 1996

CASE NARRATIVE

1. ALPHA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG Number: J-015-F-17

2. INTRODUCTION

Thorium, uranium, and plutonium analyses were performed using isotope-dilution alpha spectroscopy. This concrete dust sample was digested with acid, spiked with appropriate radiotracers, and subsequently separated into elemental components through extraction chromatography and anion exchange chromatography as described in SOP:ACL-165. Planchets were prepared by electrodeposition and counted on the Kicksort Alpha Spectrometer with associated Ortec ADCAM and AST personal computer with Ortec software according to SOP:ACL-181.

3. DEVIATIONS FROM PROTOCOL

There were no deviations from the standard analytical protocols.

4. QUALITY CONTROL SUMMARY

Blank sample 96-8111-blk consists of all reagents used in the sample preparation, and was taken through the same chemical procedure as the samples. The activity levels associated with this blank sample were very low, and normal. The uranium, plutonium, and thorium results for the alpha laboratory control sample, 96-8111-spk, were within 20% and 2 sigma of the expected results. No duplicate samples were analyzed due to the nature of the samples.

Date 01 Apr 96
Lesa L. Smith, Analyst
Radiological Analysis

Date 4/5/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

April 1, 1996

QC SUMMARY - ALPHA SPECTROSCOPY

JANUS REACTOR CHARACTERIZATION PROJECT

SDG: J-015-F-17

A quality control sample, 96-8111-sp, was prepared by spiking approximately 20 mL of 8 M HNO_3 with known quantities of Th-230, U-236, and Pu-239. This QC sample was subsequently spiked with appropriate radiotracers and processed through SOP:ACL-165 with the Janus sample. The uranium, plutonium, and thorium results were within 20% and 2 sigma of the expected results. The data is summarized below:

Isotope	Tracer ID	"Accepted" Value ^a	Analytical Result ^a	Units
Th-230	²³⁰ Th (02.24.88)B	3.13 ± 0.22	3.11 ± 0.21	pCi
U-236	²³⁶ U (09.14.94)	3.86 ± 0.20	3.61 ± 0.29	pCi
Pu-239	²³⁹ Pu (1.18.90)	1.20 ± 0.16	1.34 ± 0.14	pCi

^a Results are reported at 2 sigma uncertainty.

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS **Revised 4/2/96**

Sample Material: Concrete Dust, JANUS

Date Received: 3/14/96

Submitted by: J. Cooney

Date Reported: 3/22/96

Submitter's Sample No.	ACL Sample No.	Alpha Spec., (pCi/g $\pm$ 2 σ)*						
		<u>²³²Th</u>	<u>²³⁰Th</u>	<u>²³⁸U</u>	<u>^{235/238}U</u>	<u>^{233/234}U</u>	<u>^{239/240}Pu</u>	<u>²³⁴Pu</u>
J-015-F-17	96-8111-01	0.26 $\pm$ 0.05	0.48 $\pm$ 0.08	0.30 $\pm$ 0.06	<0.01	0.34 $\pm$ 0.07	<0.01	<0.03
		Sample Size = 0.575 g						
		NOTE: Uncertainties (σ) based upon propagation of counting statistical error. Less than (<) values are 3.29 σ .						
		*Reason for Revision: Title was not complete on the first result.						

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call L. Smith at 2- 1890

Reference(s): CMT Notebook No. 1044, Pgs. 115, and 119.

Copies To: D. Geraghty P. Lindahl
 J. Cooney J. Yaeger
 D. Green L. Smith
 D. Bowers ACL Results File
 F. Martino

Analyst(s): L. Smith
 J. Yaeger

July 10, 1996

CASE NARRATIVE

1. GAMMA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East

Project Name: JANUS Reactor Characterization Project

SDG No.: #1 (Lead)

2. INTRODUCTION

Gamma spectroscopy analyses were performed on two lead samples: Janus sample no. J007 Rt Face 7, 3(1) and J0072,2 Lead Planks(2). Standard operating procedure ACL-072 was followed for the preparation of each lead sample for gamma spec analysis.

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detector 9 is also an intrinsic Ge detector and is interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described above for detector 3. For detector 9, SOP: ACL-127 was followed.

Most samples were counted for a minimum of 500 minutes to allow for adequate counting statistics.

3. QUALITY CONTROL SUMMARY

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cesium-137 standard, following SOP: ACL-075 for detector 3 and SOP: ACL-128 for detector 9. The performance of the lab control standard was always within 2.5 percent of the expected value, as indicated in the Associated Documentation section.

July 10, 1996

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Tony TenKate Date 7/15/96
Tony TenKate, Analyst
Radiological Analysis

D.L. Bowers Date 7/16/96
Delbert L. Bowers, Group Leader
Instrumental Analysis Group

ANALYTICAL CHEMISTRY LABORATORY
Argonne National Laboratory
Argonne, IL 60439

REPORT OF ANALYTICAL RESULTS

Sample Material: Lead, JANUS Reactor Characterization Project
Submitted by: M. Robinet

Date Received: 4/12/96
Date Reported: 5/31/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/g)			
		<u>Wt. (g)</u>	<u>^{110m}Ag</u>	<u>¹³⁷Cs</u>	<u>⁶⁰Co</u>
#1	96-8120-01	191.0	0.97 ± 0.10	<0.2	<0.2
#2	-02	139.28	<0.2	<0.2	<0.2

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2- 4291

Reference(s): CMT Logbook No. 1111, Pg. 107; CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 121;
CMT Logbook No. 1112, Det. 1, 9, and 10, Pg. 79.

Copies To: M. Robinet
D. Geraghty
C. Sholeen
D. Green
D. Bowers
P. Lindahl
F. Martino
L. Smith
T. TenKate
ACL Results File

Analyst(s): T. TenKate

7²
Addnl. Copies:
200 Results File

/hlt

5/31/96

CMT-34 (4-94)

July 10, 1996

CASE NARRATIVE

1. GAMMA SPECTROSCOPY DATA PACKAGE

Laboratory Name: Argonne National Laboratory - East
Project Name: JANUS Reactor Characterization Project
SDG No.: Door #1A

2. INTRODUCTION

Gamma spectroscopy analyses were performed on eight concrete samples: Janus sample no. westwall #1, #2, #3, and #4, and door #1A, #2A, #3A, and #4A. Standard operating procedure ACL-072 was followed for the preparation of each sample for gamma spec analysis.

Gamma spectra were obtained by following SOP: ACL-080 for detector 3, which is an intrinsic Ge detector, interfaced with a Nuclear Data ND 66 multichannel analyzer. The gamma spectrum obtained was then transferred to a computer that processes the data using the computer code, GAMANAL. The GAMANAL program contains gamma ray libraries and detector efficiency curves that permit the identification and quantification of gamma-emitting radionuclides.

Detector 9 is also an intrinsic Ge detector and is interfaced with an APTEC multichannel analyzer. The gamma-emitting radionuclides are identified and quantified as described above for detector 3. For detector 9, SOP: ACL-127 was followed.

Most samples were counted for a minimum of 500 minutes to allow for adequate counting statistics.

3. DEVIATIONS FROM PROTOCOL

Since the concrete core samples were slightly larger than the 4 oz. poly bottles, the normal geometry for gamma counting, they were analyzed as received.

4. QUALITY CONTROL SUMMARY

The QA/QC performance was checked weekly by obtaining a gamma spectrum of the Cesium-137 standard, following SOP: ACL-075 for detector 3 and SOP: ACL-128 for detector 9. The performance of the lab control standard was always within 2.5 percent of the expected value, as indicated in the Associated Documentation section.

July 10, 1996

Backgrounds for each detector were done weekly and subtracted from the counting data of each sample counted on that detector during that week.

Raw data generated during the analyses are included in this package. Copies of logbook pages and Chain-of-Custody forms for the samples are collected at the back of this report.

Date 7/15/96
 Tony TenKate, Analyst
 Radiological Analysis

Date 7/16/96
 Delbert L. Bowers, Group Leader
 Instrumental Analysis Group

REPORT OF ANALYTICAL RESULTS **Revised 7/8/96**

Sample Material: JANUS Reactor Characterization Project; Concrete Date Received: 4/12/96
Submitted by: M. Robinet Date Reported: 5/24/96

Submitter's Sample No.	ACL Sample No.	Gamma Spec.; (pCi/kg)				
		<u>Wt. (kg)</u>	<u>⁶⁰Co</u>	<u>¹⁵²Eu</u>	<u>¹⁵⁴Eu</u>	<u>¹³⁴Cs</u>
Westwall #1	96-8124-01	0.622	$(2.93 \pm 0.29) \times 10^2$	$(1.90 \pm 0.19) \times 10^3$	<200	<200
Westwall #2	-02	0.309	$(3.94 \pm 0.39) \times 10^3$	$(1.18 \pm 0.12) \times 10^4$	$(1.07 \pm 0.11) \times 10^3$	$(1.60 \pm 0.16) \times 10^2$
Westwall #3	-03	0.473	$(1.66 \pm 0.17) \times 10^2$	$(1.57 \pm 0.16) \times 10^3$	<200	<200
Westwall #4	-04	0.855	$(5.83 \pm 0.58) \times 10^2$	$(1.01 \pm 0.10) \times 10^3$	$(2.02 \pm 0.20) \times 10^2$	<200
Door #1A	-05	0.778	$(7.97 \pm 0.80) \times 10^1$	$(7.21 \pm 0.72) \times 10^2$	<200	<200
Door #2A	-06	0.778	$(1.60 \pm 0.16) \times 10^3$	$(3.26 \pm 0.33) \times 10^3$	$(3.48 \pm 0.35) \times 10^2$	<200
Door #3A	-07	0.336	<200	$(1.64 \pm 0.16) \times 10^2$	<200	<200
Door #4A	-08	0.770	$(9.67 \pm 0.97) \times 10^2$	$(2.39 \pm 0.24) \times 10^3$	$(2.06 \pm 0.21) \times 10^2$	<200
Reason for Revision: Corrected data value for ¹³⁴ Cs for sample # 96-8124-02						

NOTE: Unused sample material will be returned to the Customer. Prepared samples will be discarded one (1) month after the date of this report unless other arrangements are made. When making future inquiries regarding this report, please reference the ACL sample number(s) above. For further information about the results reported here, please call T. TenKate at 2-4291

Reference(s): CMT Logbook No. 938, Det. 2, 3, and 6, Pg. 105.

Copies To: M. Robinet P. Lindahl Analyst(s): T. TenKate
D. Geraghty F. Martino
C. Sholeen T. TenKate
D. Green ACL Results File
D. Bowers

hlt
5/28/96
T-84 (4-94)

APPENDIX L

Photographic History

Reactor Shield Plugs Being Removed

Tech Covering Reactor Top in Preparation for Work

Removal of Instrument Package from Thimble #1

Removal of Thimble Tube

Preparing to Core Top of Reactor

Coring Top of Reactor in Progress

Core Sample from Top of Reactor

Coring Floor of J007, High Base Room

Coring of South Wall J007

Close-up Coring of West Wall J007

Taking of East Soil Sample

Survey Location of West Soil Sample

Reactor Core Plug Being Removed Showing Fuel Grid Plate

Plug Being Prepared for Survey

Survey of Core Plug

Removing Grid Plate from Reactor

Survey of Interior of Reactor Tank

Grid Plate Chip, Removed to be Sent for Analysis

Removing Cover to Rabbit Tube

Collecting Core Samples from Bussel in Low Dose Room

Graphite Sampling Tool Being Positioned for Work

Cover Assembly Being Removed

Sample Tool in Place

Showing Area From Well - Sample Was Taken After Done

Removal of Two Piece Low Dose Room Access Plug

Depleted Uranium Cask Being Removed from Low Dose Room to
Allow Accurate Survey of Low Dose Room

Plug Being Removed from High Dose Access

Entering High Dose Vent Pit

High Dose Vent Pit Showing Container of Borax

Measurements Being Taken for Survey Spot

Survey of Spot

Survey of Upper Part of High Bay

Manlift Used in Survey

Survey of J120

Survey of Vents in Low Dose Prep Room

Slicing of Core Samples

APPENDIX M

Instruments' Calibration Records

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1052 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator
Unit#: 5492 Mfr/Model: NE Technology Electra S/N:
Unit#: 6817 Mfr/Model: NE Technology DP6A S/N: 605

Pulse Generator, Eberline MP- 1, S/N 200
Electrostatic KiloVoltmeter: ESD, S/N 950556
Alpha Source: Am241, S/N DNV957, Activity 64,900 DPM
Beta Source: Sr90, S/N DN652, Activity 122,000 DPM

I) MAINTENANCE/PRECALIBRATION:

Window: OK Cabling: OK Mechanical/Cleanliness: OK
Battery Voltage (Parameter # 0): 4.6 (ref: > 4)
Threshold: 21 mV (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2.00 V (ref: near 2 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: OK
HV Calib.: 840 V (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than ~ 1 % of count rate in beta channel.
Beta cpm: 36.1 k Alpha cpm: 8 (e.g., 0.02 % of beta)
HV = , and INHIBIT:

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 uA, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 usec, then INHIBIT: ✓
Parameter #8 (Units): cpm ✓
Parameter #A (inhibit bkgd subt): set to OFF ✓
Parameter #b (inhibit integrate): set to OFF ✓
Parameter #C (rate mode): set to preset ✓
Parameter #d (preset response time): set to 3 sec ✓
Parameter #E (pulse mode): set to DUAL ✓
Parameter #F (ohms): set to S66 ✓

Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ✓

II) PRIMARY CALIBRATION:

Response to Alpha Std: 14.0 k cpm; 21.6 % efficiency (alpha)
Alpha Mode Bkgd: 1 cpm (ref.: < 7 cpm)
Response to Beta Std: 36.1 k cpm; 29.6 % efficiency (beta)
Beta Mode Bkgd: 358 cpm (ref.: < 400 cpm)
Integrate Function Check: OK
Audible and Alarm Functional Checks: OK

REMARKS: Mylar and scintillator damaged. Replaced both.

Robert Kern
Calibrator

1/4/95
Date

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1696 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator (dpm units)
Unit#: 6289 Mfr/Model: NE Technology Electra S/N: 901
Unit#: 6288 Mfr/Model: NE Technology DP6A S/N: 997

Pulse Generator, Eberline MP- (), S/N 200
Electrostatic KiloVoltmeter: ESD, S/N 950556
Alpha Source: Am241, S/N DV957, Activity 69,900 dpm
Beta Source: SrY90, S/N QW652, Activity 122,000 dpm

I) MAINTENANCE/PRECALIBRATION:

Window: OK Cabling: OK Mechanical/Cleanliness: OK
Battery Voltage (Parameter # 0): 4.4 (ref: > 4)
Threshold: 24 mV (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2.00 V (ref: 2.00 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: OK
HV Calib.: OK (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 36.3 K Alpha cpm: 37 (e.g., 0.10 % of beta)
HV = 870 V, and INHIBIT: ✓

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 μ A, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 μ sec, then INHIBIT: ✓
Parameter #8 (Units): cpm ✓
Parameter #A (inhibit bkgd subt): set to OFF ✓
Parameter #b (inhibit integrate): set to OFF ✓
Parameter #C (rate mode): set to preset ✓
Parameter #d (preset response time): set to 3 sec ✓
Parameter #E (pulse mode): set to DUAL ✓
Parameter #F (ohms): set to S66 ✓

II) PRIMARY CALIBRATION:

Response to Alpha Std: 11.4 k cpm; 17.6 % efficiency (alpha)
Alpha Mode Bkgd: 1 cpm (ref.: < 7 cpm)
Response to Beta Std: 36.3 k cpm; 29.7 % efficiency (beta)
Beta Mode Bkgd: 356 cpm (ref.: < 400 cpm)
Integrate Check: OK Audible Functional Check: OK

Parameter #8 (Units): change from cpm to dpm
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ✓

REMARKS:

Calibrated by: Robert Kean Date: 1/15/96

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1694 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator (dpm units)
Unit#: 6283 Mfr/Model: NE Technology Electra S/N: 899
Unit#: 6285 Mfr/Model: NE Technology DP6A S/N: 985

Pulse Generator, Eberline MP- 1, S/N 200
Electrostatic KiloVoltmeter: ESD, S/N 950556
Alpha Source: Am24, S/N DV957, Activity 64,900 dpm
Beta Source: Sr90, S/N DN652, Activity 122,000 dpm

I) MAINTENANCE/PRECALIBRATION:

Window: OK Cabling: OK Mechanical/Cleanliness: OK
Battery Voltage (Parameter # 0): 4.4 (ref: > 4)
Threshold: 25 mV (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2.00 V (ref: 2.00 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: OK
HV Calib.: OK (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 35.5 k Alpha cpm: 36 (e.g., 1.0 % of beta)
HV = 915V, and INHIBIT: ✓

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 μ A, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 μ sec, then INHIBIT: ✓
Parameter #8 (Units): cpm ✓
Parameter #A (inhibit bkgd subt): set to OFF ✓
Parameter #b (inhibit integrate): set to OFF ✓
Parameter #C (rate mode): set to preset ✓
Parameter #d (preset response time): set to 3 sec ✓
Parameter #E (pulse mode): set to DUAL ✓
Parameter #F (ohms): set to S66 ✓

II) PRIMARY CALIBRATION:

Response to Alpha Std: 11.5 cpm; 17.7 % efficiency (alpha)
Alpha Mode Bkgd: 1 cpm (ref.: < 7 cpm)
Response to Beta Std: 35.5 k cpm; 29.1 % efficiency (beta)
Beta Mode Bkgd: 367 cpm (ref.: < 400 cpm)
Integrate Check: OK Audible Functional Check: OK

Parameter #8 (Units): change from cpm to dpm ✓
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch
S1-3 set to ON (hide). ✓

REMARKS:

Calibrated by: Robert 7 Date: 1/15/96

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1054 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator (dpm units)
Unit#: 5444 Mfr/Model: NE Technology Electra S/N: 511
Unit#: 6819 Mfr/Model: NE Technology DP6A S/N: 590

Pulse Generator, Eberline MP- 1, S/N 200
Electrostatic KiloVoltmeter: ESD, S/N 950556
Alpha Source: Am 241, S/N DV957, Activity 64,900 dpm
Beta Source: Sr 90, S/N DA632, Activity 122,000 dpm

I) MAINTENANCE/PRECALIBRATION:

Window: OK Cabling: OK Mechanical/Cleanliness: OK
Battery Voltage (Parameter # 0): 4.5 (ref: > 4)
Threshold: 23 mV (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2.00 V (ref: 2.00 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: OK
HV Calib.: OK (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 36.0 k Alpha cpm: 32 (e.g., 0.09 % of beta)
HV = 835 V, and INHIBIT: ✓

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 μ A, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 μ sec, then INHIBIT: ✓
Parameter #8 (Units): cpm ✓
Parameter #A (inhibit bkgd subt): set to OFF ✓
Parameter #b (inhibit integrate): set to OFF ✓
Parameter #C (rate mode): set to preset ✓
Parameter #d (preset response time): set to 3 sec ✓
Parameter #E (pulse mode): set to DUAL ✓
Parameter #F (ohms): set to S66 ✓

II) PRIMARY CALIBRATION:

Response to Alpha Std: 13.8 k cpm; 21.2 % efficiency (alpha)
Alpha Mode Bkgd: 2 cpm (ref.: < 7 cpm)
Response to Beta Std: 36.0 k cpm; 29.5 % efficiency (beta)
Beta Mode Bkgd: 386 cpm (ref.: < 400 cpm)
Integrate Check: OK Audible Functional Check: OK

Parameter #8 (Units): change from cpm to dpm ✓
Parameter #9 (Efficiencies): enter efficiencies from above ✓
Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ✓

REMARKS:

Calibrated by: Robert Kline Date: 1/15/96

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1051 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator
Unit#: 5491 Mfr/Model: NE Technology Electra S/N: 574
Unit#: 6816 Mfr/Model: NE Technology DP6A S/N: 591

Pulse Generator, Eberline MP- 1, S/N 545
Electrostatic KiloVoltmeter: ESD-9, S/N ES-12104
Alpha Source: Am241, S/N 01965, Activity 60800
Beta Source: Sr90, S/N 01636, Activity 9800

I) MAINTENANCE/PRECALIBRATION:

Window: X Cabling: X Mechanical/Cleanliness: X
Battery Voltage (Parameter # 0): 46 (ref: > 4)
Threshold: 25 (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2 V (ref: near 2 V), then INHIBIT: X
Count Rate Check @ 10 k cpm: X
HV Calib.: X (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than ~ 1 % of count rate in beta channel.
Beta cpm: 30K Alpha cpm: 21 (e.g., < 1% of beta)
HV = 850, and INHIBIT: X

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 uA, then INHIBIT: X
Parameter #5 (Deadtime): 3 usec, then INHIBIT: X
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd subt): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to DUAL
Parameter #F (ohms): set to S66

Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). X

II) PRIMARY CALIBRATION:

Response to Alpha Std: 12.8K cpm; 21 % efficiency (alpha)
Alpha Mode Bkgd: 4 cpm (ref.: < 7 cpm)
Response to Beta Std: 30K cpm; 30 % efficiency (beta)
Beta Mode Bkgd: 383 cpm (ref.: < 400 cpm)
Integrate Function Check: X
Audible and Alarm Functional Checks: X

REMARKS: _____

Labell
Calibrator

1-22-96
Date

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1041 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator
Unit#: 5445 Mfr/Model: NE Technology Electra S/N: 546
Unit#: 6806 Mfr/Model: NE Technology DP6A S/N: 595

Pulse Generator, Eberline MP- 2, S/N 775
Electrostatic KiloVoltmeter: ESD 9, S/N 13443
Alpha Source: AM241, S/N AV961, Activity 63000 DPM
Beta Source: SPY 90, S/N DN21, Activity 106000 DPM

I) MAINTENANCE/PRECALIBRATION:

Window: ✓ Cabling: ✓ Mechanical/Cleanliness: ✓
Battery Voltage (Parameter # 0): 4.5 (ref: > 4)
Threshold: 25 (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2 V (ref: near 2 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: 10K
HV Calib.: 820V (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than ~ 1 % of count rate in beta channel.
Beta cpm: 31.6K Alpha cpm: 0 (e.g., < 1 % of beta)
HV = 820, and INHIBIT: ✓

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 uA, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 usec, then INHIBIT: ✓
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd sub): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to DUAL
Parameter #F (ohms): set to S66

Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ✓

II) PRIMARY CALIBRATION:

Response to Alpha Std: 13.4K cpm; 21 % efficiency (alpha)
Alpha Mode Bkgd: 3 cpm (ref.: < 7 cpm)
Response to Beta Std: 31.6K cpm; 30 % efficiency (beta)
Beta Mode Bkgd: 315 cpm (ref.: < 400 cpm)
Integrate Function Check: ✓
Audible and Alarm Functional Checks: ✓

REMARKS:

Jerry Letizia
Calibrator

1/30/96
Date

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 860 Procedure#: 016 Configuration: GM Field
Type: Energy Comp. Hi-Range Energy Comp.
 End Window Side Wall Other

Unit#: 5286 Mfr/Model: 10010M 77-3 S/N: 86789
Unit#: Mfr/Model: S/N:

Pulse Generator, Eberline MP- 2, S/N 665
Electrostatic KiloVoltmeter: S/N 2312048
Gamma Source S/N 7083

I) MAINTENANCE/PRECALIBRATION:

Batteries: ✓ Cabling: ✓ Mechanical/Handle: ✓
Meter Zero: ✓ Cleanliness: ✓

Threshold: 11 mV (typ.: > 15 mV)
High Voltage: 1 1/2 Vdc (see specifications table)
Audible Function Check: OK

1. J. J. J. 2-9-96
Pre-Calibrator Date

II) PRIMARY CALIBRATION (Linear Scales):

*****Mid-Field**** **Low-Field** **High-Field**
Range Field As As Field Response Field Response
Found Left

(0 to 1.0 MA / H)

	<u>400x</u>	<u>0.493</u>	<u>.5</u>	<u>.5</u>	<u>400x</u>	<u>0.202</u>	<u>.2</u>	<u>400x</u>	<u>0.989</u>	<u>9</u>
<u>11/11</u>	<u>X 1 320x20</u>	<u>4.83</u>	<u>5</u>	<u>5</u>	<u>320x40</u>	<u>2.4</u>	<u>2.5</u>	<u>320x20</u>	<u>9.39</u>	<u>9.5</u>
	<u>X 100 320x10</u>	<u>48.0</u>	<u>50</u>	<u>50</u>	<u>320x40</u>	<u>22.6</u>	<u>22</u>	<u>320x10</u>	<u>92.2</u>	<u>90</u>
	<u>X 1 220x4</u>	<u>4.07</u>	<u>.4</u>	<u>.4</u>	<u>220x10</u>	<u>0.195</u>	<u>.2</u>	<u>220x2</u>	<u>0.906</u>	<u>.9</u>
<u>12/11</u>	<u>X 10 100x2</u>	<u>4.39</u>	<u>4.1</u>	<u>4.1</u>	<u>100x4</u>	<u>1.97</u>	<u>2</u>	<u>100x0</u>	<u>9.34</u>	<u>9.5</u>
	<u>X 100 40x0</u>	<u>58.4</u>	<u>55</u>	<u>55</u>	<u>70x0</u>	<u>14.1</u>	<u>20</u>	<u>14x14</u>	<u> </u>	<u> </u>
	<u>✓ 1k</u>				<u>30x0</u>	<u>103.8</u>	<u>100</u>			

Off-Scale Response?: N/A (field should be 2x the top range)

REMARKS:

Jerry Letizia 2/9/96
Primary-Calibrator Date

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1054 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator (dpm units)
Unit#: 5394 Mfr/Model: NE Technology Electra S/N: 511
Unit#: 6819 Mfr/Model: NE Technology DP6A S/N: 590

Pulse Generator, Eberline MP- 1, S/N 575
Electrostatic KiloVoltmeter: ESD-9, S/N ES-12104
Alpha Source: Am 241, S/N OV 965, Activity 820800 dpm
Beta Source: Sr 90, S/N UN 636, Activity 97800 dpm

I) MAINTENANCE/PRECALIBRATION:

Window: X Cabling: X Mechanical/Cleanliness: X
Battery Voltage (Parameter # 0): 5.3 (ref: > 4).
Threshold: X (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2 V (ref: 2.00 V), then INHIBIT: X
Count Rate Check @ 10 k cpm: X
HV Calib.: 835 (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 29.2K Alpha cpm: 58 (e.g., <.1 % of beta)
HV = 835, and INHIBIT: X

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 μ A, then INHIBIT: X
Parameter #5 (Deadtime): 3 μ sec, then INHIBIT: X
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd subt): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to dUAL
Parameter #F (ohms): set to S66

II) PRIMARY CALIBRATION:

Response to Alpha Std: 42.9Kcpm; 21.2 % efficiency (alpha)
Alpha Mode Bkgd: 1 cpm (ref.: < 7 cpm)
Response to Beta Std: 29.2Kcpm; 29.8 % efficiency (beta)
Beta Mode Bkgd: 359 cpm (ref.: < 400 cpm)
Integrate Check: X Audible Functional Check: X

Parameter #8 (Units): change from cpm to **dpm**
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch
S1-3 set to ON (hide). X

REMARKS:

Calibrated by: [Signature] Date: 2-23-96

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 191 Procedure#: 029 Configuration: uR Field
Type: X 1x1 NaI scint.

Unit#: 4026 Mfr/Model: Eberline PRM-7 S/N: 428

Pulse Generator, Eberline MP- 2 S/N 775
Electrostatic KiloVoltmeter: ESD 9 S/N 13 443
Gamma Source CS 137 S/N

I) MAINTENANCE/PRECALIBRATION:

Mechanical: ✓ Cleanliness: ✓
Batteries: ✓ Cabling: ✓ Meter Zero: ✓

Threshold: 20 mV (fixed near 15 mV)
PMT Gain Adj.: — (only if new PMT, then maximize)
On Plateau?: ✓ (should respond to Am-241 gammas)
High Voltage: 1125 Vdc (typically near 1000 V)
Audible Function Check: ✓ (divides by 16)

Pre-Calibrated by: Jerry Letizia Date: 2/5/96

II) PRIMARY CALIBRATION:

*****Mid-Field****				**Low-Field**		**High-Field**	
Range	Field	As Found	As Left	Field Response		Field Response	
(uR/h)							
5000	<u>2.3</u>	<u>2.4</u>	<u>2.4</u>	<u>.9</u>	<u>.9</u>	<u>3.6</u>	<u>3.8</u>
500	<u>.23</u>	<u>.23</u>	<u>.23</u>	<u>.11</u>	<u>.1</u>	<u>.37</u>	<u>.39</u>

Electronic Calibration, referenced to the 500 uR/h range as follows: 40k cpm = 180 uR/h

50	<u>4k = 18</u>	<u>18</u>	<u>18</u>	<u>2k = 9</u>	<u>9</u>	<u>10k = 4.5</u>	<u>4.6</u>
25	<u>2k = 9</u>	<u>9</u>	<u>9</u>	<u>1k = 4.5</u>	<u>4.5</u>	<u>4k = 1.8</u>	<u>1.8</u>

Off-Scale Response?: OK (field should be 2x the top range)

Conditions: Pressure 1132 mB ; Temperature 68°F

REMARKS: _____

Primary-Calibrator: A. M. Date: 2-6-96
Re-Calibration Due Date: 6 mths

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1336 Procedure#: 029 Configuration: uR Field
Type: X Energy Compensated GM

Unit#: 5801 Mfr/Model: Eberline ASP-1 S/N: 3045
Unit#: 6625 Mfr/Model: TGM N378S/BNC S/N: 9407-137

Pulse Generator, Eberline MP- 1, S/N 545
Electrostatic KiloVoltmeter: ESD-9, S/N ES-12104
Gamma Source CL37, S/N 2083

I) MAINTENANCE/PRECALIBRATION:

Batteries: X Cabling: X Mechanical/Cleanliness: X

High Voltage: 450 Vdc (ref.: 450 V)

HV Cal: X

Threshold: 38 mV (ref.: 30 mV); Window: Gross

Range Switch Check: X Audible Function Check: X

Integrate Function Check: X

Dial: X1M to X10 Rate Unit: uR/h

Dip Switches: 136

Dead Time: 200 usec Test: Run

Min Sw: Open Hour Sw: Closed

Cal Sw 3: Closed Cal Sw 4: Open

Audio: Divide by 1

As Found Std. Current: 0.55.57

Adelle
Pre-Calibrator

1-24-96
Date

II) PRIMARY CALIBRATION:

Range	Field Intensity (uR/h)	Source to Detector Distance (cm)	As Found (uR/h)	As Left (uR/h)	% Diff. Field vs As Left
1K	.73	210 x 800	.73	.73	
10K	5.9	140 x 800	6.0	6.0	
100K	54.3	150 x 80	54.5	54.5	
1M	443.1	150 x 8	OVER RANGE		

As Left Std. Current: n/c

As Left Dead Time: n/c usec

REMARKS:

A. Dunn
Primary-Calibrator

2-7-96
Date

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 65 Procedure#: 018 Configuration: Scintillator
Type: X 2 mm. NaI

Unit#: 4479 Mfr/Model: Ludlum 18 S/N: 14489
Unit#: 6792 Mfr/Model: Ludlum 44-17 S/N:

Pulse Generator, Eberline MF- 1, S/N 300
Electrostatic KiloVoltmeter: Radiac, S/N 12048
Source(s): Pu-239, S/N 7552, Activity 4150000 dpm
Am-241, S/N 7551, Activity 6028000 dpm
U-235, S/N 22B6102, Activity 1.06 g foil

I) MAINTENANCE/PRECALIBRATION:

Batteries: OK Cabling: OK Mechanical/Cleanliness: OK

Threshold: 5 mV (typ.: 5 to 10 mV)
Window: 6 mV = 25 % (ref.: 25% of Threshold mV)
Audible Function Check: OK

(Signature)
Pre-Calibrator

2/96
Date

II) PRIMARY CALIBRATION:

Range (cpm)	Pulser Rate (cpm)	As Found (cpm)	As Left (cpm)	% Diff. Pulser vs As Left
<u>X1</u>	<u>400</u>	<u>400</u>	<u>400</u>	
<u>X10</u>	<u>4K</u>	<u>4K</u>	<u>4K</u>	
<u>X100</u>	<u>40K</u>	<u>40K</u>	<u>40K</u>	
<u>X1K</u>	<u>400K</u>	<u>400K</u>	<u>400K</u>	

With PHA in, adjust HV to maximize detector response to isotope of interest:

Mode	Isotope	Response		Efficiency (If Applicable) (%)
		As Found (cpm)	As Left (cpm)	
HV- 1	Pu-239	<u>18K</u>	<u>18K</u>	N/A
HV- 2	Am-241	<u>280K</u>	<u>280K</u>	N/A
HV- 3	U-235	<u>120K</u>	<u>120K</u>	N/A

Mode of Operation: HV- 1, Gross
Ambient Bkgd in chosen Oper. Mode: 2K cpm (ref.: > 300 cpm)

REMARKS: I- repair detector

(Signature)
Primary-Calibrator

2/8/96
Date

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 45 Procedure#: 018 Configuration: Scintillator
Type: X 2 mm NaI

Unit#: 4479 Mfr/Model: Ludlum 18 S/N: 14489
Unit#: 2922 Mfr/Model: Ludlum 44-17 S/N:

Pulse Generator, Eberline MP-1, S/N 300
Electrostatic KiloVoltmeter: Nauman, S/N 12048
Source(s): Pu-239, S/N 7552, Activity 4150000 dpm
Am-241, S/N 7551, Activity 6028000 dpm
U-235, S/N 22B6102, Activity 1.06 g foil

I) MAINTENANCE/PRECALIBRATION:

Batteries: ok Cabling: ok Mechanical/Cleanliness: ok

Threshold: 4.5 mV (typ.: 5 to 10 mV)
Window: 5 mV = ok % (ref.: 25% of Threshold mV)
Audible Function Check:

Pre-Calibrator

2/94
Date

II) PRIMARY CALIBRATION:

Range (cpm)	Pulser Rate (cpm)	As Found (cpm)	As Left (cpm)	% Diff. Pulser vs As Left
<u>SEL</u>	<u>400</u>	<u>390</u>	<u>400</u>	
<u>X/10</u>	<u>4K</u>	<u>4K</u>	<u>4K</u>	
<u>X/100</u>	<u>40K</u>	<u>40K</u>	<u>40K</u>	
<u>KK</u>	<u>400K</u>	<u>400K</u>	<u>400K</u>	

With PHA in, adjust HV to maximize detector response to isotope of interest:

Mode	Isotope	Response		Efficiency (If Applicable)
		As Found (cpm)	As Left (cpm)	(%)
HV- 1	Pu-239	<u>1K</u>	<u>12K</u>	N/A
HV- 2	Am-241	<u>200K</u>	<u>200K</u>	N/A
HV- 3	U-235	<u>140K</u>	<u>125K</u>	N/A

Mode of Operation: HV- 1, Gross
Ambient Bkgd in chosen Oper. Mode: 1200 cpm (ref.: > 300 cpm)

REMARKS: I - re-set window
II - re-cal

Primary-Calibrator

5/15/96
Date

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 1632 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator (dpm units)
Unit#: 6235 Mfr/Model: NE Technology Electra S/N: 1433
Unit#: 6236 Mfr/Model: NE Technology DP6A S/N: 1431

Pulse Generator, Eberline MP- 1, S/N 545
Electrostatic KiloVoltmeter: ESQ-9, S/N CS-12104
Alpha Source: Am-241, S/N NDV965, Activity 60800 dpm
Beta Source: Sr-90, S/N NDV436, Activity 97800 dpm

I) MAINTENANCE/PRECALIBRATION:

Window: X Cabling: X Mechanical/Cleanliness: X
Battery Voltage (Parameter # 0): 5.5 (ref: > 4)
Threshold: 25uV (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2 V (ref: 2.00 V), then INHIBIT: X
Count Rate Check @ 10 k cpm: X
HV Calib.: X (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than 0.1% of count rate in beta channel.
Beta cpm: 30.4K Alpha cpm: 24 (e.g., <.1% of beta)
HV = 905, and INHIBIT: X

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 μ A, then INHIBIT: X
Parameter #5 (Deadtime): 3 μ sec, then INHIBIT: X
Parameter #8 (Units): cpm
Parameter #A (inhibit bkgd subt): set to OFF
Parameter #b (inhibit integrate): set to OFF
Parameter #C (rate mode): set to preset
Parameter #d (preset response time): set to 3 sec
Parameter #E (pulse mode): set to dUAL
Parameter #F (ohms): set to S66

II) PRIMARY CALIBRATION:

Response to Alpha Std: 11K cpm; .180 % efficiency (alpha)
Alpha Mode Bkgd: 2 cpm (ref.: < 7 cpm)
Response to Beta Std: 30.4K cpm; .310 % efficiency (beta)
Beta Mode Bkgd: 452 cpm (ref.: < 400 cpm)
Integrate Check: X Audible Functional Check: X

Parameter #8 (Units): change from cpm to dpm
Parameter #9 (Efficiencies): enter efficiencies from above
Now set switch S1-2 back to OFF (user), and leave switch
S1-3 set to ON (hide). X

REMARKS:

Calibrated by: [Signature] Date: 2-26-96

INSTRUMENT MAINTENANCE/CALIBRATION CERTIFICATE

Set#: 505 Procedure#: 015 Configuration: Surface Contam
Type: X Dual Scintillator
Unit#: 4965 Mfr/Model: NE Technology Electra S/N: 292
Unit#: 7567 Mfr/Model: NE Technology DP6A S/N: 381

Pulse Generator, Eberline MP- 1, S/N 200
Electrostatic KiloVoltmeter: ESD, S/N 950556
Alpha Source: Am 241, S/N DV957, Activity 64,900
Beta Source: Sr 90, S/N DN652, Activity 122,000

I) MAINTENANCE/PRECALIBRATION:

Window: OK Cabling: OK Mechanical/Cleanliness: OK
Battery Voltage (Parameter # 0): 4.6 V (ref: > 4)
Threshold: 22 mV (verify 25 mV with the MiniPulser)
As the Electra "supervisor" set the Upper Level Discriminator
(Parameter #6): 2.00 V (ref: near 2 V), then INHIBIT: ✓
Count Rate Check @ 10 k cpm: OK
HV Calib.: OK (compare Parameter #3 w/ the Electrostatic)

High Voltage Adjustment:

Using Sr-90 beta source, observe count rates in both alpha and beta channels. Adjust HV so that count rate in alpha channel is less than ~ 1 % of count rate in beta channel.
Beta cpm: 36.3 k Alpha cpm: 7 (e.g., 0.02 % of beta)
HV = 800 V, and INHIBIT: ✓

Parameter Settings:

As the Electra "supervisor" (i.e., the internal switch S1-2 to ON), set the remaining parameters as follows:
Parameter #4 (Overload Current): 10 uA, then INHIBIT: ✓
Parameter #5 (Deadtime): 3 usec, then INHIBIT: ✓
Parameter #8 (Units): cpm ✓
Parameter #A (inhibit bkgd subt): set to OFF ✓
Parameter #b (inhibit integrate): set to OFF ✓
Parameter #C (rate mode): set to preset ✓
Parameter #d (preset response time): set to 3 sec ✓
Parameter #E (pulse mode): set to DUAL ✓
Parameter #F (ohms): set to S66 ✓

Now set switch S1-2 back to OFF (user), and leave switch S1-3 set to ON (hide). ✓

II) PRIMARY CALIBRATION:

Response to Alpha Std: 14.1 k cpm; 21.7 % efficiency (alpha)
Alpha Mode Bkgd: 3 cpm (ref.: < 7 cpm)
Response to Beta Std: 36.3 k cpm; 29.5 % efficiency (beta)
Beta Mode Bkgd: 387 cpm (ref.: < 400 cpm)
Integrate Function Check: OK
Audible and Alarm Functional Checks: OK

REMARKS:

Robert Keane
Calibrator

2/26/96
Date

CERTIFICATION OF CALIBRATION

Instrument H: Q Ser # 413
 Model No. CF-902 Bar Code 4756
 Serial No. 1012 Timer X
 Calibrator AFC 4001d Serial No. 464

The air flow calibrator is correlated and calibrated to within plus or minus 0.5% of flow standards which are traceable to NIST.

Temperature 21 °C Pressure 740 mmHg
 Relative Humidity 33 %

Flow Meter LPM

Calibration LPM

80	<u>95</u>
100	<u>115</u>
120	<u>140</u>
140	<u>160</u>
160	<u>180</u>
180	<u>200</u>
200	<u>220</u>
220	<u>250</u>
240	<u>270</u>
260	<u>300</u>
280	<u>320</u>

Comments 100 lpm = 90
250 lpm = 220

Certified by J. Lee Date 2-27-96

CERTIFICATION OF CALIBRATION

Instrument Hi Q Ser # 1327
 Model No. CF-902 L Bar Code 5426
 Serial No. 748 Timer X
 Calibrator AR 400-4D Serial No. .464

The air flow calibrator is correlated and calibrated to within plus or minus 0.5% of flow standards which are traceable to NIST.

Temperature 21 °C Pressure 740 mmHg
 Relative Humidity 33 %

Flow Meter LPM

Calibration LPM

80
100
120
140
160
180
200
220
240
260
280

70A
130
150
160
190
210
230
280
270
290

Comments 100 ± pm off scale
250 lpm = 240 on the gage

Certified by [Signature] Date 2-27-96

APPENDIX N

Diskette of AUTOCAD Drawings

Distribution for ANL/ESH-HP-96/03

Internal

N. L. Contos (ESH-HP)
D. C. Geraghty (ESH-HP)
M. R. O'Connor (ESH-HP)
D. W. Reilly (ESH-HP)
M. J. Robinet (ESH-HP)
C. M. Sholeen (ESH-HP)
R. Walker (ESH-HP)
HP Office - 6 copies (ESH)
C. Grandy (EWM)
M. A. Sodaro (EMW)
H. Gaines (CMB)
J. Hartig (CMB)
E. Huberman (CMB)
D. Grube (CMB)
D. LeBuis (CMB)
T. Yule (TD)
R. W. Rose (TD)
C. Fellhauer (TD)
TIS File (203)

External

DOE-OSTI (2)
ANL-E Library (Bldg 203)
ANL-W Library (J. Krieger IS/AW - 752)
DOE CH Operations Office