Appendix A

Maine Yankee Calculation EC-003-04 Rev. 1

"Use of Canberra In Situ Object Counting System (ISOCS) for FSS Surveys"

Dated November 24, 2004

COPY

ATTACHMENT A

MAINE YANKEE ENGINEERING	CALCULATION COVER SHEET	CALC NO. EC-003-04(MY) REV. NO. 1 PAGE 1 OF 207 TECH. FILE NO. 17.12

TITLE: Use of Canberra In Situ Object Counting System (ISOCS) for FSS Surveys

SOURCE DOCUMENT: LTP ID NO. N/A
(i.e. EDCR, TE, PROC, WO, SDCM, SPEC)

PLANT SYSTEM: N/A SYSTEM CODE: N/A

PLANT COMPONENT: N/A I.D. NO. N/A SAFETY CLASS N/A

TYPE OF CALC: ☐ Stress ☐ Thermal ☐ Hydraulic ☐ Capacity x Other FSS-Radiological

DISCIPLINE: ☐ Electrical ☐ I & C ☐ Mechanical ☐ Civil ☑ Other FSS-Rad Engineering

PURPOSE AND METHODOLOGY:
To describe the survey methods appropriate for use of ISOCS and the MDCs achieved for the various surveys. (Since the original NRC submittal covered the Forebay Survey Plan, that is also included).

SOURCES OF DATA: Canberra Tech Manuals
"Technical Basis Document for NRC Review: Forebay FSS Survey Measurement Methods (In situ Gamma Spectroscopy)-30 Day Notice per LTP Requirement", dated 9/3/04
"Maine Yankee Response to NRC and State of Maine Comments on the Technical Basis Document for NRC Review: Forebay FSS Survey Measurement Methods (In situ Gamma Spectroscopy)", dated 10/21/03.

SOURCES OF FORMULAE AND REFERENCES:
1.F. Bronson and L. Wang, "Validation of MCNP Monte Carlo Code for Germanium Detector Gamma Efficiency Calibrations", presented at the Waste Management Conference, February 28,1996.
2. F. Bronson and B. Young, "Mathematical Calibration of Ge detectors and the Instruments That Use Them, presented at the 5th Nondestructive Assay and Nondestructive Examination Waste Conference, January 14-16, 1997.
3. F. Bronson, et al, "Validation of In Situ Object Counting System (ISOCS) Mathematical Efficiency Calibration Software", Nuclear Instrumentation and Methods in Physics, 99:422, 450-452,1998.

Preliminary ☐ Final Calc ☑ Supersedes Calc No. 003-04 Rev. No. 0

Other Calculations Requiring Revision EC-041-01

Prepared by: G. Pillsbury Date: 11/11/04

Reviewed by: W S Cooper Date: 11/18/04

☒ Detailed Review ☐ Alternate Calculation

Senior Engineer (or above): W E Henries (W. HENRIES) Date: 11/24/04

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The attached calculation shall include (as a minimum): (1) appropriate design input values, (2) assumptions, with justifications, (3) computations with explanatory text, figures and tables, and (4) summary of results and conclusions.

ATTACHMENT B

MAINE YANKEE ENGINEERING	CALCULATION REVISION SUMMARY SHEET	CALC NO. 003-04(MY) REV. NO. 1

Reason for Change: LTP change to increase DCGLs for the Forebay. No CR required.

Page (s) affected	Section(s) Affected	Description/Justification for Change(s)
Pg 4	Application	Revised the DCGLs to 36,000 dpm/100 cm2 and 12.01 pCi/g.
Pg.8	Survey Methods	Revised the DCGLs and relative shift values. Revised ISOCS MDC values.
Pg. 9	"	Revised the ISOCS MDC and the DCGLEMC values. Added ref. for Soil/Area Factors. GP 11/23/04
Pg. 10	Scanning	Revised the EMC value.
	Area Factors	Corrected the surface areas to agree with the LTP dose model, the DCGLs and the annual dose rate. Corrected the Area Factors for an area of 435 m2 per the LTP.
Pg 11	Area Factors	Revised the DCGLs and maximum AF used. Added ref. for forebay area. GP 11/23/04
Pg 13	Table 3	Removed incorrect datum and added description of how table values were calculated.
pg 2.	Summary	Added reference for revised DCGLs. GP 11/23/04

All calculations affected by this revision have been reviewed and revisions initiated, if required.

Revision Originator: G. Pillsbury Date: 11/11/04

Revision Reviewer: WJ Cooper Date: 11/18/04

☒ Detailed Review ☐ Alternate Calculation

Senior Engineer (or above): WE Henries (W. HENRIES) Date: 11/24/04

**Use of Canberra In Situ Object Counting System (ISOCS)
For FSS Surveys**

Executive Summary

The Canberra ISOCS is being used at Maine Yankee for FSS surveys. This calculation discusses the various projected uses of ISOCS and establishes the Technical Bases under which it is used in order to meet the requirements of the MY License Termination Plan (LTP). Rev. 1 of this EC has been made to reflect the increases in DCGLs (18,000 to 36,000 dpm/100 cm2 and 7 pCi/g to 12.01 pCi/g) as described in EC-041-01(MY).

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Inputs

1. "Technical Basis Document for NRC Review: Forebay FSS Survey Measurement Methods (In situ Gamma Spectroscopy)- 30 Day Notice per LTP Requirement", dated 9/3/03.
(Heavily excerpted, with minor editing and incorporated to the discussion)

2. "Factory Integration and Test of the Canberra ISOCS System for Maine Yankee Detector S/N 7605", dated 2/3/03. (Attachment 1)

3. "Verification of the ISOCS Characterization of the Canberra LABSOCS System for Maine Yankee Detector S/N 7605", dated 2/4/03.(Attachment 1)

4. "Model S500VV S501 Genie 2000 Analysis Engines, V&V Manual, Version 2.1".
(Attachment 1)

5. "Model S573/S574 ISOCS/LabSOCS Validation & Verification Manual, Version 4.0".
(Attachment 1)

6. ISOCS verification runs to determine the whether the scan investigation level for soils are adequate. (Attachment 8)

Assumptions

1. Forebay media, soil, and activated concrete activities are uniformly distributed and the concentrations and nuclide fractions are as stated in Section 2 of the MY LTP.

2. Typical concentrations of K-40 in site-local surface soils is in the range of 12-20 pCi/g for sediment and soils, and ranges somewhat higher for rock ledge.

3. Submerged E-600 SSPA-3 (2" x 2" NaI(Tl) scintillation detector) scan setpoint

methodology is adequate to meet sensitivity requirements. I.e. The SSPA-3 setpoint method used in the forebay is capable of detecting the applicable $DCGL_{EMC}$.

4. For surface soil scans being performed with the ISOCS instrument, the posited 1 m^2 of uniformly contaminated material, located at the outer edge of the detector's field of view is adequately conservative to demonstrate that the instrument setpoint would be exceeded for any combination of contaminated areas that add up to exceed the $DCGL_{EMC}$ unity test (as defined in the LTP REV 3). This was tested on a 3m detector height geometry(28 m^2) field of view.

Note: This document is substantially produced from the "Forebay Technical Basis" document submitted to the NRC prior to performing the surveys. As such many of the now completed surveys and survey techniques are described here in the future tense.

Computation

ISOCS

The Canberra In Situ Object Counting System (ISOCS) system is proposed as the instrument for surveying portions of the Forebay and other survey locations. ISOCS is a flexible, well documented gamma spectroscopy system that does not rely on the use of standard calibration geometries for spectrum analysis (F. Bronson, 1996, 1997, 1998). Rather, detectors are rigorously characterized using a Monte Carlo modeling code and a three step process (Input Document 2, Att. 1). First the MCNP (Monte Carlo N Particle Transport Code) model is developed and validated for the particular detector to be characterized. Secondly, a large number of efficiency data sets are generated with the validated MCNP detector model in response to point-like sources at many locations about the detector. Finally, a detector characterization file is generated which contains the relationship of the detector to the point-efficiency data and the validation of the resulting characterization file. The end result is a detector parameter file that is used by the ISOCS to produce detailed geometry templates defined for each specific measurement situation.

GDP 4/12/05

Discrete ordinate attenuation computations are ~~The Monte Carlo code is~~ used to propagate photons through the various shielding media between the source and the detector. The geometry templates use methods similar to the well-documented Microshield software to detail the characteristics of the absorbers. The Monte Carlo software has been extensively validated and verified by Canberra (F. Bronson, 1996, 1997, 1998). The two Maine Yankee ISOCS detectors have been "characterized" using NIST standard source geometries described in the initial Canberra testing (Input Document 3, Att. 1). In addition, the ISOCS and Genie calibration and analysis software packages were validated and verified (Input Documents 4 and 5, Att. 1). As discussed in the "Confirmatory Measurements" section below, the Maine Yankee ISOCS were further tested using both wet and dry media to verify the adequacy of the geometries used for Forebay surveys.

The Canberra recommendations to ensure the detector characterization is maintained have been addressed, as appropriate, in the operating procedure for the ISOCS (DI 6-163). Rather than use a mixed gamma source, we chose a source composed of Am-241, Cs-137, and Co-60. This nuclide mix was felt to more closely mimic the primary nuclides in the site nuclide fraction and the Am-241 provides a low energy reference point as well as being an indicator of TRU contamination.

Application of In Situ Gamma Survey Techniques to Forebay Surveys

A 40% efficient HPGe detector and its liquid nitrogen Dewar will be inserted into a water-tight housing which will be lowered from a barge into the forebay or be suspended on a track over the rip-rap in order to conduct measurements on the floor and walls of the forebay. The design of the water-tight housing is provided (Att. 4). Collimation is used for under water measurements using ISOCS as described in Att.2 geometries. The source-to-detector distance is typically 20 to 50 cm, however, the distance used is adjusted based on sample K-40 activity which has been found to be the best indication of proper source-to-detector distance. Obviously the field of view is a function of source-to-detector distance but typically runs between 1 to 7 m2 for underwater measurements and can be as much as 10 to 70 m2 for measurements made in air. Geometries were created for the various physical configurations present in the forebay test area using the ISOCS templates.

The various geometries and applicable DCGLs for the forebay materials are described below. (The nuclide fraction was previously described in section 2 of the LTP.) The geometry name is given in parentheses and the dimensions and material densities are provided as Att. 2. Additional geometries may be created following the process outlined in Attachment 2, as the need arises (Potential geometries for possible use in forebay surveys are also listed below). Each specific geometry will be approved by the project radiological engineer trained in the operation and calibration of the ISOCS.

1. Gravel Floor-a layer of contaminated gravel interspersed with uncontaminated shot rock, both wet and dry (SR Wet.geo, SR Mud.geo). pp 4-5 of Attachment 2
   Template: Circular Plane
   Applicable Dose Model: Excavated Forebay Soil
   DCGL = 36,000 dpm/100 cm2 or 1.62E6 pCi/m2 pCi/g
   Estimated DCGL emc = DCGLxArea Factor = 360,000 dpm/100 cm2 or 1.62E7 pCi/m2

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2. Rip-Rap Dikes-a layer of contaminated gravel covered by large, uncontaminated granite boulders both dry and wet (Slope Sed20.geo). p. 6.of Attachment 2
   Template: Circular Plane
   Dose Model: Excavated Forebay Soil
   DCGL = 12.01 pCi/g
   Estimated DCGLemc = DCGLxArea Factor = 49.2, 27.6, 18.0 pCi/g (for scan areas of 4,

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Rev. 1 | 12, and 28 m2)

The dose model for the forebay considers both the surface activity contribution to dose as well as the volumetric contribution. Thus, it is felt that both DCGLs need to be addressed. Where the surface activity applies, the DCGL is measured in units of dpm/100 cm2 or pCi/m2 and where the volumetric DCGL applies, the DCGL is measured in units of pCi/g. The MDC values are also provided in the appropriate units. If necessary, the surface activity can be converted into volumetric units for comparison. These unit conversions changes are made within survey package designs as circumstances warrant.

Test Area Measurements

In order to assess the accuracy of the ISOCS geometries, test area measurements were performed. The seal pit was surveyed in the "as found" condition using ISOCS and volumetric sampling. The pit was remediated wet; resurveyed using ISOCS and volumetric surveys and the survey process was then repeated following draining of the pit. Count times for the ISOCS measurements were set to achieve an MDA less than the DCGL. Volumetric samples were standard 1 L, dried sediment counted to environmental LLDs. The objective of the test measurements was to gain field experience with the ISOCS and to refine the ISOCS geometries to the degree necessary to get good agreement between the wet and dry results and the ISOCS measurements and the volumetric sample results. Observation of the test area provided the actual surface features and material thicknesses needed to adjust the geometries.

As an additional quality check, selected initial ISOCS geometries were reviewed by Canberra before being used for FSS.and deemed appropriate.

Results of Test Measurements

Surveys of Forebay Walls and Floor

One test area was surveyed within the forebay. The seal pit area consisted of water covered ledge walls and a gravel and rock floor (SR Wet, SR Mud geometries) which could be surveyed underwater then drained and re-surveyed in a dry condition. Test measurements were taken using ISOCS in underwater locations which could then be compared with volumetric samples from the same locations and also compared with measurements taken in dry conditions. Fundamental differences that exist between laboratory and ISOCS gamma spectroscopy systems make a direct one-to-one comparison difficult. With an ISOCS system, the more information that is known about the area being analyzed, the more accurate the results will be, and therefore, the better the agreement between a volumetric sample and an associated ISOCS measurement. Ideal circumstances would provide knowledge of depth and surface area of potentially contaminated locations, a smooth surface, and a consistent distance from the surface to the detector face. Under such conditions, experience indicates an agreement of $\pm$ 10% could be achieved. As more unknowns infiltrate the parameters, the error margin widens. The test geometries presented here were developed and refined based upon acquired information to

provide the most accurate analyses possible.

The data in Table 1 show that there was greater variability between the wet and dry results. The ratios of wet to dry results were determined and then averaged. Comparing the average ratio of wet-to-dry results for Co-60 gave a value of 1.74 (The wet Co-60 values generally over estimated the actual Co-60 activity which is conservative.). Longer count times for the underwater measurements can improve the agreement and reduce the Cs-137 MDAs (The "less than" values were assumed to be present at the MDA value). The average agreement between the ISOCS dry readings and the volumetric results was 0.76 which is considered acceptable (the agreement improves to 0.99 to 1.04 when the NE corner sample, an additional sample from an unremediated area outside of the test area, is discounted).
Results:

Table 1
Post Remediation Data

Underwater Surveys				Dry Surveys					
Location	Sample #	ISOCS Co-60 pCi/g	ISOCS Cs-137 pCi/g	Sample #	ISOCS Co-60 pCi/g	ISOCS Cs-137 pCi/g	Vol Co-60 pCi/g	Vol Cs-137 pCi/g	SPA-3 k c/m
RandomSE	SUB014	13.22	6.70	CAN002	2.75	0.86	0.33	0.41	21.20
RandomSW	SUB013	2.75	<13.5	CAN003	2.34	0.71	0.45	0.29	19.30
SW Outer	SUB009	1.37	<13.1	CAN004	1.46	0.56	0.87	0.64	18.50
SW Inner	SUB010	<3.40	<15.2	CAN005	1.05	0.41	0.65	0.36	19.70
NW Outer	SUB011	<24.4	<108	CAN007	23.21	9.41	33.74	10.79	26.70
NW Inner	SUB012	<36.6	<166	CAN008	15.83	5.64	14.36	4.55	23.60
NE Outer	SUB007	<33.6	<141	CAN009	37.45	11.81	31.69	9.59	28.80
NE Inner	SUB008	<43.1	<188	CAN010	27.51	9.57	16.44	5.31	23.30
SE Outer	SUB005	2.17	<14.5	SUB018	3.32	0.86	2.89	0.77	21.40
SE Inner	SUB006	<3.06	<13.3	SUB019	4.02	0.99	4.42	1.49	22.00
Disch Ctr	N/A	N/A	N/A	CAN011	3.29	0.83	3.83	0.86	N/A
NE Corner	N/A	N/A	N/A	CAN012	8.25	3.54	44.80	17.80	N/A
				Average	9.76	3.34	12.87	4.40	
			Ave no NE Corner		9.87	3.33	9.97	3.19	

Note: SUBxxx represents the small ISOCS (#7605) unit, CANxxx represents the large ISOCS(#7607) unit.

There were a few locations with verified, elevated activity that were surveyed by SPA-3 detector. Of those that were, the data showed sensitivities in the range of 300 to 500 c/m per pCi/g. The estimated Co-60 sensitivity described in Attachment 3 was determined to be similar to that of Cs-137 in air. (Co-60 response in water is 1183 c/m per uR/h and Cs-137 response in air is 1200 c/m per uR/h.) A range of 300 to 500 c/m per pCi/g for Co-60 in water is similar to the value of 472 c/m per pCi/g for Cs-137 for a distributed source in air.

The test plan for the seal pit was based on the fact that it would be possible to obtain measurements underwater using the ISOCS then compare those measurements to measurements obtained with the seal pit drained. Volumetric samples could also be taken for comparison.

The test was designed to show that geometries could be designed that closely modeled the configuration of the seal pit and, by extension, the forebay as well. Test data were more limited than we anticipated due to instrument problems. The limited data not with standing, the test was successful in demonstrating the ability to model the seal pit using the geometry composer function of ISOCS. With the seal pit drained and remediated, there is not any reasonable way to get more data. These before and after surveys are considered sufficient to confirm the accuracy of the ISOCS and SPA-3 measurement techniques.

2" x 2" NaI Detectors

Individual two-inch NaI detectors (SPA-3) were placed in watertight housings and were deployed from a barge for use in scanning the forebay floor surfaces. Each detector was connected via a 30 foot cable to its' associated E-600. Each instrument/detector combination was calibrated with the 30 foot cable to ensure the effect of voltage loss over the cable was minimized.

The detector waterproof housing was moved along the forebay floor surface attached to the end of a pole. The bottom of the detector housing was set at 7.6 cm from the floor surface. This allowed vertical variations in the bottom of $\pm$ 7.6 cm. Each detector was set at a distance above the surface to be surveyed to provide a field of view of approximately 25 cm in diameter.

The scan MDC, though strongly influenced by the background count rate produced by the NORM in the granite floor of the forebay (Att. 3), is calculated to be a maximum of 180,000 dpm/100 cm2. No adjustments in model response at the non-detect distance was needed.

Forebay FSS Survey Plan

The Maine Yankee License Termination Plan, section 6.6.9, describes the dose assessment for residual radioactivity in the Forebay following remediation. The LTP concluded that ..."since the dose is so insignificant and the probability is so low that an individual would be able to successfully place a viable well within the forebay, survey measurements of the forebay surfaces, including rip-rap, will be limited".

During the summer of 2002, Maine Yankee performed an extensive core boring campaign to sample directly behind the rip-rap rock and in the center of the Forebay dike (Att. 7). This boring

campaign resulted in the collection of 274 samples of which only six had identified, detectable cobalt (Co-60) at very low levels ($\leq$ 0.53 pCi/g) and only 38 had identified cesium (Cs-137) at very low levels ($\leq$ 0.24 pCi/g). The cores sampled the dike walls to within a few inches of the surface. All of the sample results were below the Forebay Excavated Soil DCGL and the Surface Soil DCGL. Overall, the Forebay dike soil coring campaign showed that radiological contamination has not penetrated into the Forebay dikes beneath the rip-rap to any dose-significant extent. Therefore Maine Yankee's final status survey of the Forebay will be limited to measurements of the post-remediation surface of the Forebay floor and walls.

Accordingly, the actual FSS survey methods will be specific to the Survey Unit geometry. Proposed survey techniques for the Forebay Survey are described below.

1. Floor of the Forebay and Remediated Concrete Structures Underwater:
   a. Direct Measurements: approximately 50-60 ISOCS counts for each survey unit will be taken at systematic locations on the floor surfaces. These measurements will be capable of detecting uniform activity at a level less than the DCGL of 36,000 dpm/100 cm2 (1.62E6 pCi/m2) on the surface of the floor. Using the sediment data from Attachment 2-H of section 2 of the LTP, a sigma of 1.75 pCi/g or 740 dpm/100 cm2 is derived. The corresponding relative shift would be 0.5xDCGL or 18,000 dpm/100 cm2/740 dpm/100 cm2 or 24.4. A relative shift of 24 would require an n of 14 direct measurements which is far fewer than the 50 to 60 per survey unit proposed. This survey plan results in Type 1 and Type 2 errors of 0.05.

   b. Scan Measurements: 100% of the above water concrete surface will be scanned with a 43-68 gas-filled detector which has an MDC of 1832 dpm/100 cm2. Eight ISOCS combined scan/direct measurements were made to spot check underwater concrete surfaces.

Note: No remediation of concrete structures was required.

2. Rip-Rap Walls Underwater:
   a. Direct Measurements: a number ISOCS counts were taken on rip-rap surfaces underwater. These were combined with the samples taken above the water level, as described in 3.a and added to a combined total of approximately 20 measurements for each survey unit. These measurements were capable of detecting a uniform activity at a level less than the EC-041-01 DCGL of 12 pCi/g. The sediment sigma of 1.75 pCi/g produces a relative shift of 3 and a value of n equal to 14 for Type 1 and Type 2 errors of 0.05 which is fewer than the approximately 20 per survey unit proposed.

   b. Scan Measurements: approximately 100% of the rip-rap surface will be scanned using ISOCS measurements. These measurements will be capable of detecting uniform

Rev.1 | activity less than the DCGLemc of 33.6 pCi/g. (This $DCGL_{EMC}$ is detemined by multiplying to DCGL of 12.01 pCi/g by a soil area factor (LTP Table 6-12) of 2.8).

3. Dike Walls Above the Water Level:

a. Samples: a number of volumetric samples from the dike walls above the water level will be counted which when combined with the ISOCS counts on rip-rap surfaces underwater, as described in 2.a, will total approximately 20 measurements for each survey unit at systematic locations. These measurements will be capable of detecting a Rev.1 | uniform activity at a level less than the DCGL of 12 pCi/g. The sediment sigma of 1.75 pCi/g produces a relative shift of 3 and a value of n equal to 14 for Type 1 and Type 2 errors of 0.05 which is fewer than the approximately 20 per survey unit proposed.

b. Scan Measurements: approximately 100% of the dike surface will be scanned using ISOCS measurements. These measurements will be capable of detecting a uniform Rev.1 | activity at a level less than the DCGLemc of 33.6 pCi/g.

Scanning With 2" x 2" NaI Detectors

The basic procedure for performing a scan will be functionally identical to that used for soil scans with the SPA-3. All existing operational checks will be performed without a need for modification. Other scan performance requirements (e.g., programming of alarm setpoints, alarm verification, etc.) will be performed in accordance with FSS program procedures. The major difference in the scan procedure is the scan speed. Soil scans are typically done at a scan rate of 0.25 m per second. Underwater scan rates will be 0.08 m per second (Att. 3).

The scan process was conducted as follows:
1. Position the barge at the desired scan area and secure it from drifting.
2. Slowly lower the detector on the pole until it contacts the floor of the forebay.
3. Record the start location on the scan grid map.
4. Reset the E-600 and begin to advance the detector at a rate of 8 cm per second across the width of the barge (3 m). At the end of each scan pass, move the barge 25 cm and repeat.
5. Verify scan results as necessary by reversing the travel path of the detector array and scanning in the opposite direction.
6. At the end of the scan grid (approximately 9 m2), log the E-600 data and record the location on the scan grid map.
7. Repeat the above steps until the scan is complete.

Note: The highest net peak hold value of the E-600s for a scan grid will be utilized as the scan result for the grid.

The alarm setpoints for the detectors will be set using the data provided in Attachment 3.

Calculation of the alarm setpoint must attempt to account for variations in distance to a potential source. With this in mind, a value of 4000 c/m was added to the background value (see assumption #4.). Procedural controls and engineering judgement were utilized to prevent exceeding the true DCGL emc value of 360,000 dpm/100 cm2. The basic alarm setpoint process used is described below:

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1. Affix a 5 cm standoff to the bottom of a single SPA-3 detector housing.
2. Lower the detector until the standoff contacts the floor surface in the background area designated in the survey instruction.
3. Obtain a scaler background measurement of the floor and log the count result.
4. Add 4000 c/m to the background count rate. (The source response was 4 uR/h for 100,000 dpm/100 cm2 through 5 cm of water, as calculated using the Microshield code. At 1183 c/m per uR/h for Co-60, the source should give a response of 4732 c/m. A value of 4000 c/m was conservatively used.)
5. Use this resulting value as the alarm setpoint.

Forebay Area Factors

The LTP does not specifically address area factors for the Forebay. Two LTP models were considered for the Forebay: 1) basement fill and 2) deep soil. Applying the Basement Fill model to derive area factors would result in the following:

Engineering Calculation EC 041-01(MY) documents the basis for the dose model factors for the forebay floor contributions to drinking water and irrigation dose. From this calculation it can be seen that the surface area of the forebay that contributes to the dose is the granite floor, which is 7435 m2, and the volume of the forebay over the floor is 42,000 m3. For a survey unit size of 7435 m2, the surface area to volume ratio is 7435 m2/42,000 m3 or 0.177 m2/m3. Multiplying the ratio of 0.177 m2/m3 by 2460 m3, which is the volume of fill required to supply the annual drinking water volume of 738 m3, equals 435 m2. According to EC 041-01, the dose conversion factor is 1.53E-2 mrem/y at the DCGL of 36,000 dpm/100 cm2 or 1.62E6 pCi/m2. Decreasing the contaminated forebay surface area results in the following dose rate values which can then be converted into area factors.

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Table 2
Forebay Area Factors (based on 36,000 dpm/100 cm2)

Area m2	Total pCi	mrem/y	Area Factor
435	7.05E8	1.53E-2	1
400	6.48E8	1.41E-2	1.09
350	5.67E8	1.23E-2	1.24
300	4.86E8	1.05E-2	1.45

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200	3.24E8	7.03E-3	2.18
100	1.62E8	3.52E-3	4.35
50	8.10E7	1.76E-3	8.70
35	5.67E7	1.23E-3	12.40
25	4.05E7	8.79E-4	17.40
20	3.24E7	7.03E-4	21.80
10	1.62E7	3.52E-4	43.50
5	8.10E6	1.76E-4	87.0
1	1.62E6	3.52E-5	435

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If the floor is divided into survey units of approximately 2000 m2 each and 57 direct measurements are taken in each survey unit, the resulting elevated area would be 35 m2. The area factor for a 35 m2 elevated area would be approximately 10. Based on the LTP soil dose model, the contaminated soil elevated area is assumed to be 1 m2 to 2 m2 with area factors between 7 to 12. Area factors for the sediment excavation scenario produce similar values (5 to 12). Therefore, because sediment is treated like soil, using an average area factor for forebay surveys of 10 is reasonable.

A value of 10 is more consistent with the conservative values used in the LTP for area factors. Therefore, based on conservative engineering judgement, the forebay area factor in areas with a DCGL of 36,000 dpm/100 cm2 will be 10 for design purposes. This results in a DCGLemc of 360,000 dpm/100 cm2.

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The actual size of the forebay floor survey units was determined to be 1400 m2 (Forebay Release Record FR-0400 SU-4). Using the method described in the LTP for evaluating elevated areas, the actual area factor for an ISOCS field of view of 9 m2 would be 1400 m2/9m2 or 155. This is the area factor that could be used in the EMC unity calculation for elevated areas. (Note: Actual area factors used in the FSS of the Forebay did not exceed 43.5)

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Application of In Situ Gamma Survey Techniques to Other Final Status Surveys

In situ gamma spectroscopy using ISOCS can be used for soil scan surveys, for either surface soil or excavated soil; for determining appropriate use or disposal of stored soil in truck load lots; for pavement scans; for activated concrete measurements; and for structure pre-demolition surveys. For each use, one or more specific geometries need to be created, detector to source distance and use of collimation, if required, must be specified; and count times or MDC must be specified to

ensure remediation or FSS release criteria are met. When scanning, ISOCS must be shown to provide an MDC that is less than the DCGLemc value for the survey unit. Since ISOCS typically can achieve MDCs similar to laboratory spectrometers in reasonable count times, as long as the correct number of measurements are taken and any adjustment for EMC criteria has been made, use of in situ gamma spectroscopy should be able to achieve Type I and II errors of 0.05. In situ gamma spectroscopy survey results have shown good agreement with the volumetric samples collected from the survey units in which ISOCS has been used. A brief description of the uses and MDCs achieved are presented below.

Summary of Experience With Other FSS Surveys and MDCs Achieved

Site soils have been surveyed using ISOCS with a geometry that evaluates soil activity to a depth of 15 cm over the geometric field of view. The MDCs achieved have been on the order of 0.3 pCi/g for both Cs-137 and Co-60 which is sufficient for FSS. Investigation levels can be calculated, based upon the area of the geometric field of view, that allow for the detection of the DCGLemc activity for either Cs-137 (28.4 pCi/g) or Co-60 (10.9 pCi/g) in an area of 1 m2. (Investigation levels are typically less than 2.2 pCi/g for Cs-137 and 0.8 pCi/g Co-60 for an area of 12 m2.) As is evidenced in soil FSS Survey Design Packages e.g. FR0111.

Due to the non-homogeneous detection sensitivity within the ISOCS's field of view, a question arose as to whether a small area of elevated activity located at the outer edge of a scan measurement location might escape detection. It can be surmised that this problem is most consequential for the scan shots with the largest field of view. So, as a further step in validating the sufficiency of the ISOCS instrument for FSS soil scans, an analysis was performed to determine if the ISOCS as used for FSS scanning, would produce measurements exceeding the investigation level for this limiting combination of field of view and residual activity distribution.

To achieve this objective, it was conservatively posited that all of the activity in an ISOCS scan geometry of 3m height (the highest scan height used) is located in a 1-m^2 circular volume of 15cm depth located just inside the 3m radius of the detectors field of view. This posited distribution was then compared against the efficiency associated with a uniform activity distribution. The two geometries were then applied to actual spectral data, to determine whether the activity levels at $DCGL_{EMC}$ activity would be exceed the investigation level for Cesium-137 or Cobalt-60. These results are summarized in the table below. The ISOCS ouput data supporting these Tables is included as Attachment 8.

Table 3
Investigation Level Equivalent $DCGL_{EMC}$ Test

Rev.1

Att 8. Files	28-m^2 Area (3m height) Geometry Results		1-m^2 Edge Geometry Results		Investigation Level Eq DCGLemc / 28m^2 Result		Derived Activity in 1m^2 at the Investigation Level Eq DCGLemc	
	Co-60	Cs-137	Co-60	Cs-137	Co-60* (0.36 pCi/g)	Cs-137* (1.0 pCi/g)	Co-60** (pCi/g)	Cs-137** (pCi/g)
7607-EXC00135	0.25	0.11	5.26	2.49	1.46	9.10	7.67	22.64
7607-EXC00137	0.23	0.13	5.00	2.86	1.54	7.91	7.67	22.64
7607-EXC00138	0.21	0.20	4.51	4.63	1.69	4.89	7.64	22.64
7607-EXC00139	0.21	0.17	4.52	3.81	1.70	5.93	7.68	22.64
7607-EXC00141	0.14	0.35	3.01	7.99	2.54	2.83	7.65	22.64
7607-EXC00142	0.13	0.16	2.78	3.59	2.76	6.31	7.66	22.64
7607-EXC00147	0.12	0.15	2.62	3.33	2.95	6.80	7.74	22.64
7607-EXC00155	0.16	0.24	3.40	5.52	2.27	4.10	7.72	22.64
7607-EXC00159	0.14	0.14	2.96	3.11	2.57	7.29	7.61	22.64
7607-EXC00160	0.12	0.30	2.64	6.82	2.92	3.32	7.72	22.64
7607-EXC00177	0.12	0.34	2.44	7.72	3.13	2.93	7.64	22.64
7722-EXC00564	0.18	0.41	3.83	9.24	1.98	2.45	7.59	22.61
7722-EXC00567	0.15	0.18	3.19	4.06	2.39	5.57	7.61	22.61
7722-EXC00576	0.12	0.30	2.49	6.72	3.06	3.36	7.64	22.62
				Average	2.35	5.20	7.66	22.63
				Max	3.13	9.10	7.74	22.64
				Stdev	0.59	2.11	0.044	0.012

*Inv Level/28 m2 Result for Co-60 is (0.36 pCi/g Admin Value)/Col. 2 Results (0.36/0.25=1.46)

**Derived Act Inv Level for Co-60 is Col.4 value times Col.6 value (5.26x1.46=7.67)

Note that the Cs-137 values are calculated in a similar manner.

Rev.1

The $DCGL_{EMC}$ for a 1 m^2 area in soils are 10.9pCi/g and 28.4pCi/g for Cobalt and Cesium respectively. Thus it is demonstrated that the investigation levels being employed are adequate to attain scan sensitivity equivalent to a level below the $DCGL_{EMC}$. The scan MDC is also adequate since investigation levels are set such that they exceed the MDA associated with the 28m^2 geometry.

Truck load surveys of soil and rip-rap rocks have been surveyed by having the truck drive under the ISOCS detector mounted from a scaffold at a fixed distance above the truck body. The count times have been in the 40 to 60 minute range to provide an MDC of approximately 0.3 pCi/g for Cs-137 and Co-60 in soil (Similar to soil FSS MDCs and therefore acceptable). Similar count times resulted in an MDC of approximately 1 pCi/g for Co-60 on the surface of rip-rap. (EMC values for soil were given above. Although no EMC value was established, activity limits for rip-rap were set at 1 pCi/g Co-60 as described in EC 041-01(MY).)

Structure surfaces have been scanned prior to building demolition using ISOCS in standard geometries for flat surfaces. The MDC achieved has ranged between approximately 400 dpm/100 cm2 and 160,000 dpm/100 cm2 equivalent beta activity depending on the actual activity present in the area which is acceptable when compared to the demolition criteria. (Demolition limits have ranged between 50,000 and 500,000 dpm/100 cm2, as per TE013-01 Rev04-22-03)

ISOCS was also employed in performing measurements to confirm the inventory of activated concrete and steel in the ICI sump during FSS of the Containment Building. Typical MDC values ranged from a high of 5.6 pCi/g for Sb-125 to a low of 0.47 pCi/g for Co-60 with average values nearer 1 pCi/g for the other significant nuclides of Cs-137, Eu-152, Eu-154. (Activated concrete measurements were only used to confirm the inventory values used in the dose model and were not part of final status surveys of the Containment Building so the MDC values are acceptable.)

Conclusion

The use of ISOCS for FSS surveys is appropriate and the technical bases for its use have been established. MDCs have been shown to be acceptable.

b.

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Attachment 4	Submarine Drawing	2 pages
Attachment 5	Training Records	3 pages
Attachment 6	Operation and Calibration Procedure DI-6-163	17 pages
Attachment 7	Forebay Soil Boring Project	23 pages
Attachment 8	ISOCS $DCGL_{EMC}$ Test data	206 pages

References

1.F. Bronson and L. Wang, "Validation of MCNP Monte Carlo Code for Germanium Detector Gamma Efficiency Calibrations", presented at the Waste Management Conference, February 28,1996.

2. F. Bronson and B. Young, "Mathematical Calibration of Ge detectors and the Instruments That Use Them, presented at the 5th Nondestructive Assay and Nondestructive Examination Waste Conference, January 14-16, 1997.

3. F. Bronson, et al, "Validation of In Situ Object Counting System (ISOCS) Mathematical Efficiency Calibration Software", Nuclear Instrumentation and Methods in Physics, 99:422, 450-452,1998.

4. Maine Yankee License Termination Plan, Rev. 3, Approved February 28 2003.

Attachment 1

Canberra Technical Manuals

FACTORY INTEGRATION AND TEST OF THE CANBERRA ISOCS SYSTEM FOR MAINE YANKEE

ACK # 79813
DETECTOR S/N 7605
February 3, 2003

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ISOCS Characterization
&
Factory Integration and Test of Canberra ISOCS/LabSOCS System

Introduction

This document is a detailed report of ISOCS characterization of an HPGe detector response, performed at Canberra Industries. The ISOCS characterized HPGe detector is intended for use with Canberra's ISOCS/LabSOCS system. The report also presents details of factory integration and test of the ISOCS/LabSOCS system. Detector information and calibration results specific to your ISOCS/LabSOCS system are given in the appendices.

Monte Carlo Modeling

The MCNP Monte Carlo physics modeling code was used extensively in the development of the ISOCS characterization. The MCNP code is a direct descendant of the Monte Carlo simulation methods used at Los Alamos during the Manhattan Project for predicting criticality of various geometries [1]. The code simulates detector responses to gamma ray sources by mimicking the inherently random behavior of real physical events. The source/detector/universe geometry is specified via mathematical descriptions of the surfaces and volumes that make up the objects in the "universe." A source region, which can be point-like or distributed, is selected and the code simulates the emission of gamma rays with a specified energy distribution. Each emitted gamma ray is tracked as it undergoes collisions with the atoms in the materials it encounters, accurately taking into account the double-differential cross sections for photo-atomic reactions. Tallies (i.e. histograms as functions of energy) are maintained of the energy deposited in the model detector. The final tally distributions are then given as output from the program; these distributions represent the energy spectrum "seen" by the detector and can thus be used to obtain the full-energy efficiency for the source/detector/universe geometry. Canberra Industries has had a vast amount of experience and success using MCNP in modeling gamma-ray detection systems and in accurately reproducing measured efficiencies [2]. Typical model-to-measurement agreement is obtainable within 5% for simple point-like sources and within 10-15% for larger distributed sources and at low energies.

Overview of the ISOCS Characterization Process

Development of an ISOCS characterization involves three basic steps. The first is the development and validation of an MCNP model for the particular detector to be characterized. The second step is the generation of a large number of efficiency datasets with the validated MCNP detector model in response to point-like sources at many locations about the detector. The final step is the generation of the detector

characterization file, which contains the relationship of the detector to this point-efficiency data, and the validation of the resulting characterization file. The end result of this process is a detector parameter file that is used by the ISOCS user interface software. The three steps listed here are each discussed in detail below.

Development and Validation of an MCNP model

An MCNP model of the HPGe detector is developed based on the measured detector dimensions provided by Canberra's production facility. Dimensions such as the length and diameter of the Ge crystal, the thickness of the dead layer(s), detector well dimensions, holder and endcap dimensions etc. are used in developing the MCNP model. Much of the information physical features of the detector is proprietary and has been intentionally removed from this report, but remains on file at Canberra.

To validate the detector model, the MCNP efficiencies for five different source geometries are compared against the corresponding measured efficiency values. The source geometries used in the validation process are as follows.

1. Point source on-axis and 29.04 cm from the endcap (Figure 1)
2. Point source at 90 degrees, 2 cm below the endcap, 31.04 cm away from the axis of Ge crystal (Figure 2).
3. Point source at 135 degrees, at a radial distance of 31.04 cm from the axis of Ge crystal (Figure 3)
4. A glass fiber filter paper source mounted on a 1/8" inch thick Plexiglas disk, measured 4" away from the detector endcap (Figure 4)
5. The glass fiber filter paper source mounted on a 1/8" inch thick Plexiglas disk, measured right on top of the detector endcap (Figure 5)

A specially built source-positioning jig is used to locate the point source at a given angle. The jig consists of a radial arm with a source holder located at the end of the arm. The radial arm can be rotated about a pivotal point and can be fixed at a required angle.

Three point source measurements are performed at the 90° angular location, with the radial arm fixed at azimuthal angles of 120°, 240°, and 360°. These are performed to verify that the Ge crystal is mounted symmetrically inside the endcap. The efficiencies from the three measurements are averaged at each gamma ray energy of interest and the measured efficiency at the 90° position is obtained based on the average. Table 1 gives the efficiencies for the three 90° measurements, their average, and the % deviation from the average.

The point source used in the validation measurements is a NIST traceable source manufactured by North American Scientific Inc., consisting of he isotopes ^{241}Am and ^{152}Eu. The active portion of the source is a bead 2 mm in diameter deposited in a resin matrix formed into a rod. The diameter and length of the rod are 6.4 mm and 50 mm, respectively. The bead is located 6 mm into the length of the rod.

The glass fiber filter paper source is a mixed gamma standard source manufactured by Analytics Inc. The source certificates are included in Appendix 3.

The efficiencies calculated using the MCNP model of the HPGe detector are compared with the measured values. The parameters of the MCNP model are adjusted to provide optimum agreement between the model and measured efficiencies.

Tables 2a, 2b, and 2c give the results of comparison of MCNP efficiencies with measured efficiencies for the 0°, 90°, and 135° point source geometries, respectively. The MCNP and measured efficiencies for the close and far filter paper source geometries are given in Tables 2d and 2e, respectively. The MCNP efficiencies are shown graphically in Figure 6.

MCNP Efficiencies for Point Sources with Validated Model

Once the MCNP mode of the detector is validated against measured efficiencies, the mode is used to generate energy/efficiency/uncertainty triplets. The triplets are generated at a large number of point source locations, in vacuum, and at 15 energies between 45 keV and 7000 keV. The point source locations are chosen to fill a semicircular plane extending from 0 degrees (i.e. on the detector axis, in front of the detector) to 180 degrees (i.e. behind the detector), and extending from the center of the front face of the detector endcap out to a radius of 104 meters. The point locations are generated in Ln(R)-θ coordinates, R being the radius in meters, and θ being the angle in radians (Figure 7). The X axis represents the angle θ, and the Y-axis represents Ln(R). As seen from Fig.7, the points are in a grid pattern, spanning the entire semicircular plane. The number of point locations depends on the size of the crystal and the dimensions of the detector endcap. The density of points at the vicinity of the detector endcap is higher than in other regions.

Gridding Method to create Detector Calibration Generator

The MCNP calculations described above, yield efficiencies at each point source location in the Ln(R)-θ grid, at 15 different energies. The first step in producing a DCG (Detector Calibration Generator) grid is to sort the MCNP efficiencies at a given energy by the X coordinate (θ), and then by the Y coordinate [Ln(R)]. Next, using the cubic spline interpolation technique, the efficiencies at a large number of nodal points are generated by interpolating between the MCNP reference data. The DCG process thus creates a dense grid of efficiencies in the Ln(R)-θ coordinates, at each of the 15 photon energies. The efficiency grids at the 15 energies are then combined to produce the ISOCS detector characterization. Efficiency at any arbitrary spatial point between the grid nodes is obtained by linear interpolation along the Ln(R) and θ directions. At a given spatial location, efficiency at any arbitrary energy between 45 keV and 7000 keV is obtained by parabolic interpolation between the energy grids.

Since the detector has cylindrical symmetry about its axis, so does the efficiency response. Therefore, the response characterization that is valid within a semicircular plane of a given radius is also valid within a hemispherical region about the symmetry axis of the detector. In other words, the ISOCS characterization represents the detector's response to a point source in vacuum, anywhere within a *sphere* of 500 meter radius, centered about the detector, and at any energy between 45 keV and 7 MeV. Given the DCG grids, the ISOCS software can then calculate the efficiency for macroscopic sources by integrating the response over the active volume(s) of a given geometry, taking into account the attenuation through the materials in the geometry.

The detector response characteristics are presented in Appendix 4 as Surfer (©Golden Software Inc.) plots. Each of these plots displays the iso-efficiency contours at a given energy, as a function of Ln(R) and θ coordinates. In the Surfer plots, the X-axis represents θ, the Y-axis represents Ln(R), and the Z-axis represents [$-\text{Log}_{10}$(Efficiency)]. Also shown in the plots, is an outline of the detector endcap. One can observe that at regions close to the detector, the variation in efficiency is greater, especially at lower energies. At distances far away from the detector, the iso-efficiency contours become almost parallel to each other and with a constant separation, indicating that the efficiency varies according to inverse square of distance.

Statistical Tests to Validate the Quality of DCG Grids

Statistical Report:

A statistical test is performed to check the interpolation quality of the DCG grids. The test involves a bootstrapping method. First, a secondary set of point source locations is generated, intermediate to the primary set of points. The ISOCS efficiencies at the secondary points are determined by linear interpolation, using the primary DCG grids. Using the efficiencies at the intermediate points, a secondary set of DCG grids are created. From the secondary DCG, the efficiencies at the primary point locations are determined, and compared to the MCNP efficiencies at the primary points.

Within a specified spatial region, the relative deviation with respect to the MCNP efficiencies is given as follows:

$$\%RD = 100 \bullet \frac{(ISOCSeff - MCNPeff)}{MCNPeff}$$

The % Average Relative Deviation (%ARD) = Sum(%RD) / N, where N is the number of points in the specified region.

Standard Deviation of RD = sqrt{Sum [(RD – ARD)^2] / N}

For efficiency data points within a DCG region, and at the various photon energies at which the DCG grids have been created, the following statistics are reported.

1. The % Average Relative Deviation of the ISOCS efficiencies with respect to the MCNP efficiencies
2. The % Standard Deviation in these relative deviations
3. The % Standard Deviation of the MCNP data, averaged over the number of points in the DCG region.
4. The number of efficiency data points that are within 1σ , between 1σ and 2σ, and between 2σ and 3σ confidence intervals, at the various DCG energies
5. The number of data points that are above the 3σ limit

The above mentioned statistics are printed out for 6 different pre-defined spatial regions where the laboratory or the in situ users are most likely to locate their samples. The relative deviations and the standard deviations are calculated for those data points that are within these spatial regions only. This data is meant to provide the user, information regarding the quality of the response characterization within these regions. The pre-defined regions are as follows.

Region1: This region represents a laboratory source that is 2.5 cm in radius and 6 cm in height (e.g. a liquid scintillation vial), located right on top of the detector endcap.

Region 2: This region represents a disk source with a radius of 5 cm and a thickness of 0.5 cm (e.g. a filter paper or evaporated liquid, located right on top of the detector endcap. Often times, a laboratory user may choose to locate sources within this region.

Region 3: It represents a Marinelli Beaker, with a well diameter of 10 cm, a well depth of 10 cm (a volume of 1 liter approximately), and bottom thickness of 4 cm.

Region 4: This is a region in space de-limited by a minimum radius of 20 cm and a maximum radius of 1 meter. This region may be of interest to both laboratory and in situ users.

Region 5: This is a spatial region with a minimum radius of 1 meter and a maximum radius of 2 meters. This region may be of interest primarily to an in situ user.

Region 6: This region extends in space from a minimum radius of 2 meters to a maximum radius of 500 meters.

In the statistical report, the target values of average relative deviation and the percent standard deviation are indicated for each of the 6 regions, at all DCG energies. For the average relative deviation of ISOCS efficiencies, the target value is 1% at all DCG energies. For the standard deviation of the relative deviations, the target value is $\pm$ 2% at all DCG energies.

Three different statistical summaries are provided in the report. The 'Statistical Bias Summary' verifies whether the average relative deviations are within the % standard

deviation limits that have been obtained. Average relative deviation values that exceed 1σ standard deviation are indicated by an asterisk(*) at the appropriate energy, and ARDs that exceed 2σ are indicated by (**). Large ARD values that exceed the1σ limit may indicate of a bias in the data. The second summary titled 'Absolute Bias Summary' compares the average relative deviations of ISOCS efficiencies, with the target relative deviation (TRD) of 1%. Once again, if the average relative deviations exceed the TRD or 2•TRD, such an occurrence is indicated by an * or **, respectively, at the appropriate DCG energies. This would quantify the absolute bias in the group of efficiency data at a given DCG energy. The third and final summary titled 'Standard Deviation Summary' compares the standard deviation of the relative deviations of ISOCS efficiencies against the target standard deviations (TSD). If the observed standard deviation values exceed the TSD limits, the occurrence is indicated at the corresponding DCG energies. Large standard deviations are indicative of poor data quality.

See Appendix 5 for the statistical report.

Relative Deviation Contour plots:

For a given DCG energy, the deviation of the ISOCS efficiencies at the nodes of the secondary DCG grid are determined relative to the efficiencies at the same nodes of the primary DCG grid. The relative deviation values are plotted as contour maps using the Surfer software, in terms of the Ln(R) and θ coordinates. Relative deviation values equal to or above ± 2% are shown as closed contours in the spatial regions where they occur. A visual inspection of these plots helps the user to know the quality of the detector response characterization, in any spatial region where he/she may locate sources. In addition to the relative deviation values, these plots also consist of an outline of the detector endcap, as well as an outline representing the inner surface of Canberra's 747 lead shield. Canberra's 747 lead shield has an inner diameter of 27.9 cm and an inner height of 40.6 cm. For laboratory applications, sources are most likely to be located inside the 747 shield. An inspection of the plots below the shield outline will reveal information about the quality of the detector characterization in the region within the shield.

The relative deviation plots are included in Appendix 6.

Validation of DCG Efficiencies using measurements

Finally, to come full circle and to compare once again with measurements, the file containing DCG grid is loaded into LabSOCS/ISOCS user-interface software, and efficiencies are generated for the 0°, 90°, and 135° point source geometries, as well as the filter paper source geometry. Tables 3a-3e presents the results of comparison of LabSOCS/ISOCS efficiencies with measured efficiencies, for the five source geometries.

QA Recommendations

The ISOCS/LabSOCS characterization is based on the properties and dimensions of the HPGe detector at the time that it is characterized. Therefore, any changes in the Ge crystal properties could potentially induce a bias in the ISOCS efficiency calculations. For example, in coaxial HPGe detectors, the thickness of the lithium dead layer is known to increase over a period of several years. A thicker dead layer would mean a higher attenuation of gamma rays, especially at low energies. This would result in lower efficiencies to be recorded, and since the ISOCS efficiency calibration would stay the same, smaller than expected activity results will be reported. The Ge crystal properties could also be affected depending on (i) the environment in which the detector is used, and (ii) the manner in which the detector is handled.

Therefore, it is imperative that the users institute a QA procedure to verify that the ISOCS characterization continues to be valid. A general QA procedure is outlined below.

1. It is recommended that a NIST traceable $^{241}Am - ^{152}Eu$ gamma ray point source standard be used to perform the QA check. Such a source would provide coverage over a wide range of energies from 59.54 keV to 1408 keV.
2. A source holder that can reproducibly locate the source with respect to the detector must be used to perform the QA counts. It is recommended that the point source be located on-axis, at a distance of 10 cm from the front face of the detector endcap.
3. The activity of the $^{241}Am - ^{152}Eu$ source should be such that it does not cause high dead-time or pulse pile-up effects and that a good counting precision (1-2%) may be achieved within reasonably small counting times.
4. As soon as the HPGe detector is received from Canberra, set up the counting system using an appropriate set of parameters for the pulse processing electronics. Using the $^{241}Am - ^{152}Eu$ point source standard, and the designated source holder perform an initial count that would serve as the reference. Record the peak areas at the various gamma ray energies.
5. Perform a monthly (or a quarterly) count using the same set-up parameters for the electronics, and using the same source and source holder. Record the peak areas and decay correct them to the date when the initial (reference) count was performed. Compare the decay corrected peak areas to those that were obtained in the reference count. If the peak areas are within counting statistics, then one can conclude that the detector properties have not changed and that the ISOCS characterization is still valid. It is important that the same nuclear data be used in the subsequent monthly or quarterly QA counts.
6. If at some point in time, a given QA count indicates that the decay corrected peak areas results are significantly different from those that were obtained from the reference count, then it could indicate that the detector properties have deteriorated. It is the user's prerogative to impose limits of tolerance on the accuracy of the results. For example, some applications might demand tighter limits on the accuracy of efficiency calibration, whereas, some other applications may not place such a premium on the accuracy of efficiency calibrations. In the latter applications,

frequently, other sources of uncertainties may be far greater than any biases in efficiency calibrations attributable to changes in detector properties.

7. If the QA procedure indicates that the decay corrected peak areas from the QA source have deteriorated by an amount that exceeds the accuracy limits imposed by the user, then the ISOCS characterization is no longer valid and the detector has to be re-characterized.

List of References

[1] Breismeister, J.F. (ed.), MCNP-A general Monte Carlo N particle Transport Code Version 4B, Los Alamos National Laboratory Report LA-12625-M (March 1997).

[2] Bronson, F.L., and Wang, L., Validation of the MCNP Monte Carlo Code for Germanium Detector Gamma Efficiency Calibrations, Presented at Waste Management '96, February 26, 1996, Tucson, AZ.

Figure 1. Point source On-Axis

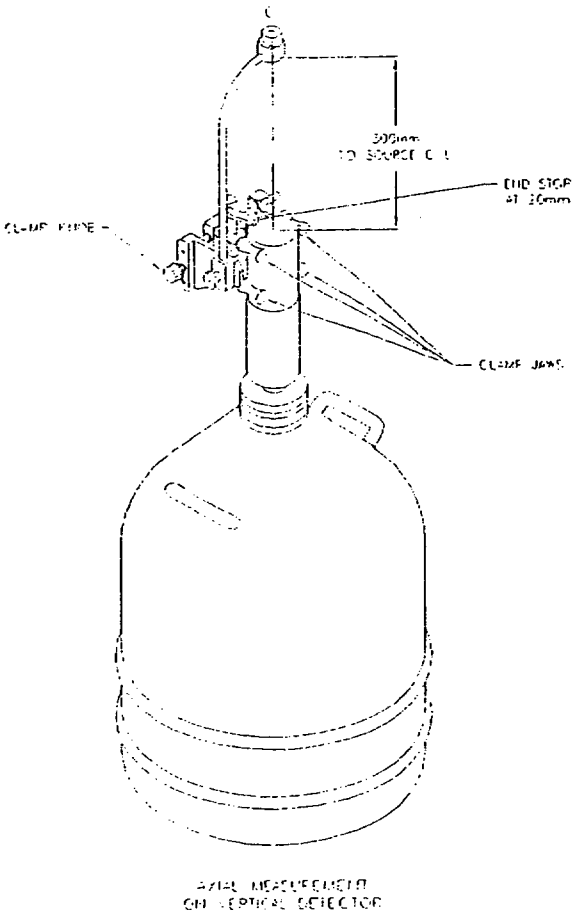


Figure 2. Point source at 90°

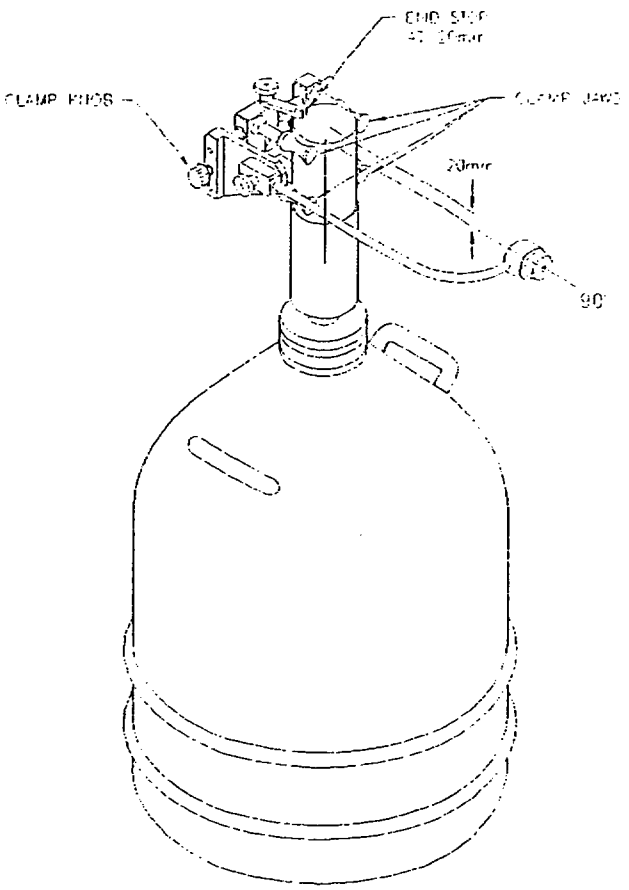


Figure 3. Point source at 135°

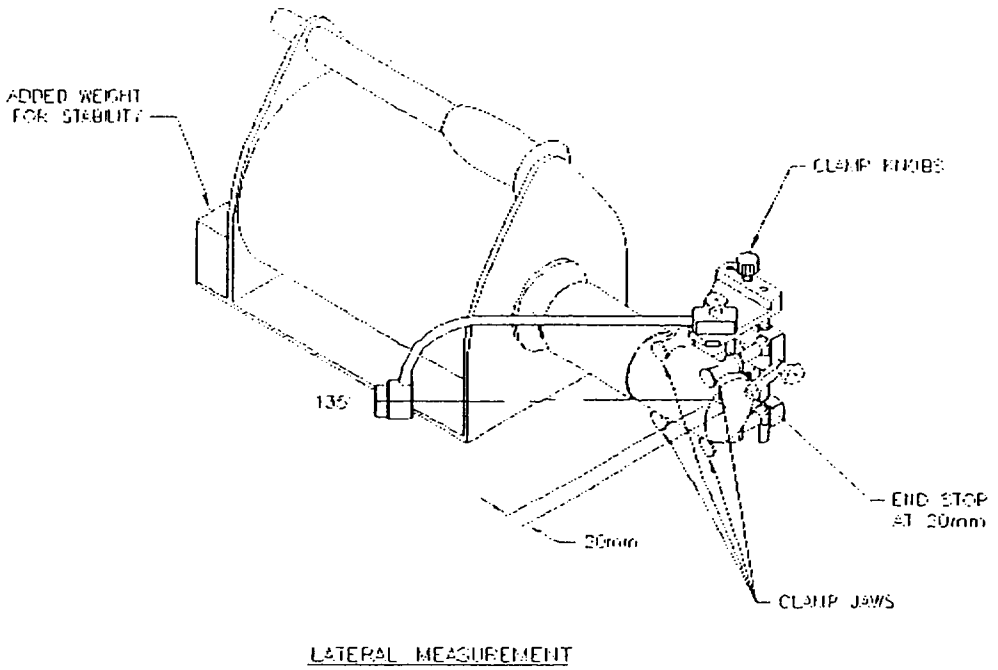


Figure 4. Glass Fiber Filter paper source 101.7 mm from endcap

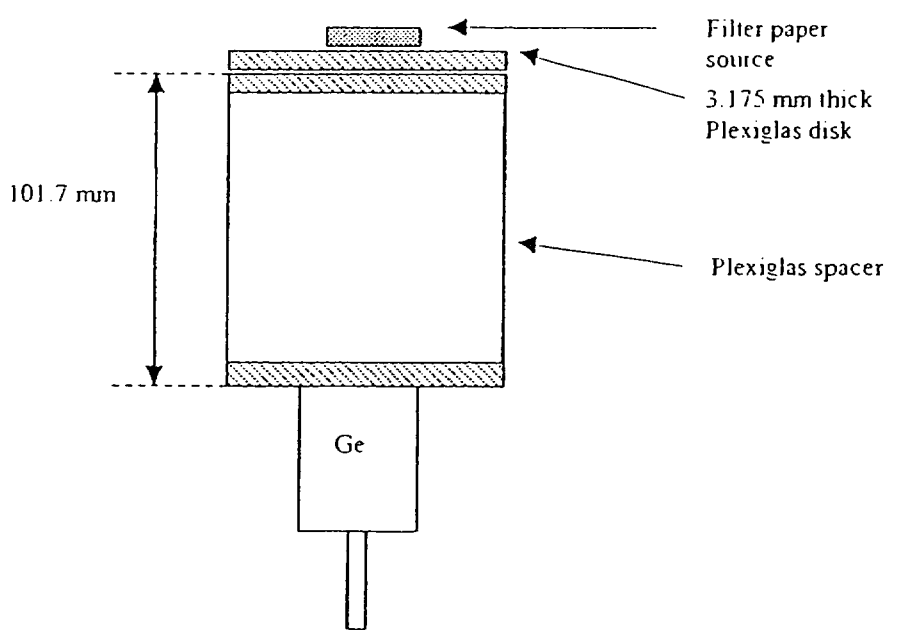


Figure 5. Glass Fiber Filter paper source on endcap

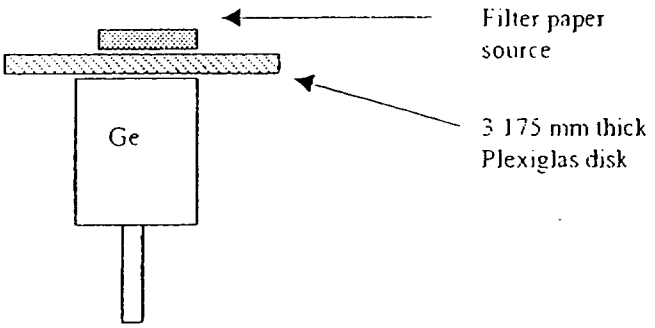


Figure 6. MCNP Efficiency for validation geometries.

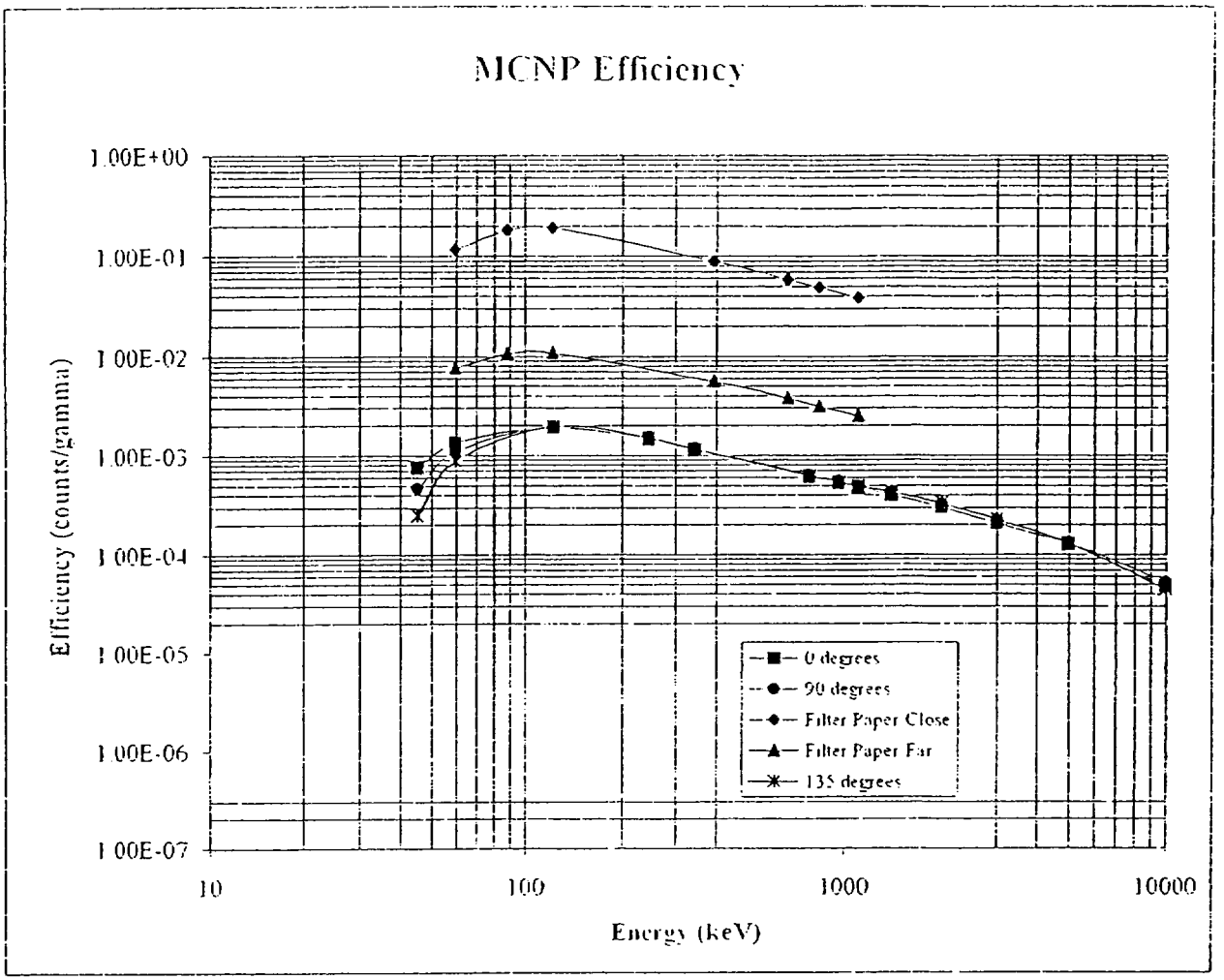


Figure 7: MCNP Point Locations

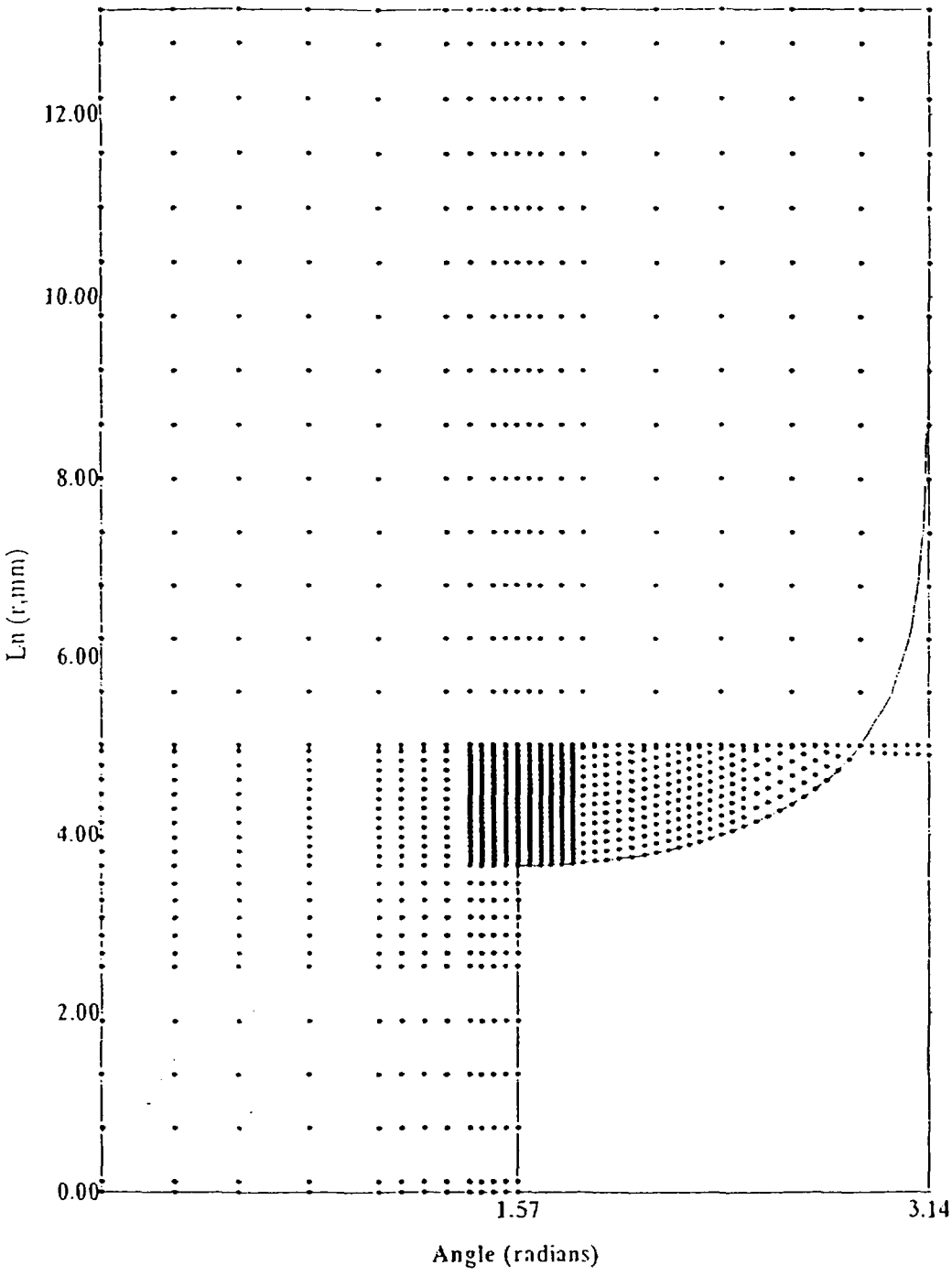


Table 1. Point source at 90 deg: Efficiency at different Azimuthal angles

Source located at 90 degrees		Efficiency at different Azimuthal angles							
		120 degrees		240 degrees		360 degrees		Average	
Nuclide	E (keV)	Efficiency	Uncertainty	Efficiency	Uncertainty	Efficiency	Uncertainty	Efficiency	Uncertainty
AM-241	59.54	1.10E-03	3.95E-05	1.10E-03	3.95E-05	1.12E-03	3.99E-05	1.11E-03	3.53%
EU-152	121.78	1.88E-03	6.21E-05	1.88E-03	6.22E-05	1.90E-03	6.29E-05	1.89E-03	3.44%
	244.6	1.46E-03	4.84E-05	1.45E-03	4.84E-05	1.47E-03	4.90E-05	1.46E-03	3.44%
	344.27	1.13E-03	3.74E-05	1.13E-03	3.74E-05	1.14E-03	3.78E-05	1.13E-03	3.44%
	778.89	6.20E-04	2.07E-05	6.10E-04	2.04E-05	6.23E-04	2.08E-05	6.18E-04	3.45%
	1112.02	4.90E-04	1.64E-05	4.89E-04	1.64E-05	4.95E-04	1.66E-05	4.91E-04	3.45%
	1407.95	4.20E-04	1.40E-05	4.19E-04	1.40E-05	4.25E-04	1.41E-05	4.21E-04	3.44%

Nuclide	E (keV)	Average	% deviation from Average		
		Efficiency	120 deg	240 deg	360 deg
AM-241	59.54	1.11E-03	-0.60%	-0.60%	1.20%
EU-152	121.78	1.89E-03	-0.35%	-0.35%	0.71%
	244.6	1.46E-03	0.00%	-0.68%	0.68%
	344.27	1.13E-03	-0.29%	-0.29%	0.59%
	778.89	6.18E-04	0.38%	-1.24%	0.86%
	1112.02	4.91E-04	-0.27%	-0.47%	0.75%
	1407.95	4.21E-04	-0.32%	-0.55%	0.87%

Table 2a. Point source On-Axis: Comparison of MCNP vs Measured Efficiencies

Source located at 0 degree		Measured Efficiency		MCNP Efficiency		Ratio of MCNP eff. over Measured eff	
Nuclide	E (keV)	Efficiency	1 sd %	Efficiency	1 sd %	MCNP/Meas	1 σ error
AM-241	59.54	1.33E-03	3.57%	1.35E-03	0.58%	1.016	0.037
Eu-152	121.78	1.88E-03	3.30%	1.91E-03	0.49%	1.016	0.034
	244.6	1.42E-03	3.32%	1.46E-03	0.56%	1.031	0.035
	344.27	1.10E-03	3.32%	1.13E-03	0.64%	1.025	0.035
	778.89	6.03E-04	3.35%	6.12E-04	0.86%	1.015	0.035
	1112.02	4.81E-04	3.35%	4.78E-04	0.98%	0.993	0.035
	1407.95	4.11E-04	3.33%	3.96E-04	1.07%	0.964	0.034
				Weighted Average		1.004	0.014

Table 2b. Point source at 90 deg: Comparison of MCNP vs Measured Efficiencies

Source located at 90 degrees		Measured Efficiency		MCNP Efficiency		Ratio of MCNP eff. over Measured eff	
Nuclide	E (keV)	Efficiency	1 sd %	Efficiency	1 sd %	MCNP/Meas	1 σ error
AM-241	59.54	1.11E-03	3.53%	1.11E-03	0.81%	1.001	0.036
EU-152	121.78	1.89E-03	3.44%	1.96E-03	0.60%	1.041	0.036
	244.6	1.46E-03	3.44%	1.53E-03	0.68%	1.050	0.037
	344.27	1.13E-03	3.44%	1.19E-03	0.78%	1.049	0.037
	778.89	6.18E-04	3.45%	6.41E-04	1.06%	1.037	0.037
	1112.02	4.91E-04	3.45%	4.94E-04	1.20%	1.006	0.037
	1407.95	4.21E-04	3.44%	4.17E-04	1.30%	0.991	0.036
				Weighted Average		1.020	0.015

Table 2c. Point source at 135 deg: Comparison of MCNP vs Measured Efficiencies

source located at 135 degrees		Measured Efficiency		MCNP Efficiency		Ratio of MCNP eff over Measured eff.	
Nuclide	E (keV)	Efficiency	1 sd %	Efficiency	1 sd %	MCNP/Meas	1 σ error
AM-241	59.54	8.80E-04	3.58%	8.90E-04	1.28%	1.011	0.038
EU-152	121.78	1.88E-03	3.31%	1.97E-03	0.85%	1.050	0.036
	244.6	1.46E-03	3.33%	1.53E-03	0.96%	1.047	0.036
	344.27	1.13E-03	3.32%	1.17E-03	1.10%	1.033	0.036
	778.89	6.25E-04	3.33%	6.34E-04	1.50%	1.015	0.037
	1112.02	4.97E-04	3.36%	4.94E-04	1.69%	0.993	0.037
	1407.95	4.31E-04	3.32%	4.38E-04	1.80%	1.015	0.038
				Weighted Average		1.020	0.015

Table 2d. Glass Fiber Filter Paper on Endcap: MCNP vs Measured Efficiencies

Energy	Measured Efficiency		MCNP Efficiency		MCNP Eff / Meas. Eff	
(keV)	Efficiency	1 sd%	Efficiency	1 sd%	Ratio	1 σ error
59.5	1.18E-01	4.51%	1.17E-01	0.76%	0.994	0.045
88	1.85E-01	4.92%	1.82E-01	0.60%	0.985	0.049
122	1.98E-01	4.22%	1.92E-01	0.58%	0.971	0.041
392	9.14E-02	3.92%	8.97E-02	0.85%	0.981	0.039
662	5.90E-02	4.41%	5.89E-02	1.06%	0.999	0.045
835	4.78E-02	4.02%	4.90E-02	1.16%	1.024	0.043
1115	3.83E-02	4.02%	3.86E-02	1.31%	1.009	0.043
			Weighted Average		0.995	0.016

Table 2e. Glass Fiber Filter Paper 10.17 cm from Endcap: MCNP vs Measured Efficiencies

Energy	Measured Efficiency		MCNP Efficiency		MCNP Eff / Meas. Eff	
(keV)	Efficiency	1 sd%	Efficiency	1 sd%	Ratio	1 σ error
59.5	8.13E-03	4.62%	7.80E-03	1.04%	0.960	0.045
88	1.15E-02	5.10%	1.07E-02	0.88%	0.934	0.048
122	1.16E-02	4.27%	1.10E-02	0.87%	0.946	0.041
392	6.00E-03	4.18%	5.60E-03	1.22%	0.934	0.041
662	3.95E-03	4.78%	3.78E-03	1.49%	0.957	0.048
835	3.27E-03	4.10%	3.14E-03	1.62%	0.961	0.042
1115	2.47E-03	4.03%	2.53E-03	1.81%	1.026	0.045
			Weighted Average		0.959	0.017

Table 3a. Point source On-Axis: Comparison of ISOCS vs Measured Efficiencies

Source located at 0 degree		Measured Efficiency		ISOCS Efficiency		Ratio of ISOCS eff over Measured eff	
Nuclide	E (keV)	Efficiency	1 sd %	Efficiency	1 sd %	MCNP/Meas	1 σ error
AM-241	59.54	1.33E-03	3.57%	1.36E-03	10.00%	1.025	0.109
Eu-152	121.78	1.88E-03	3.30%	1.92E-03	10.00%	1.019	0.107
	244.6	1.42E-03	3.32%	1.43E-03	8.00%	1.008	0.087
	344.27	1.10E-03	3.32%	1.13E-03	8.00%	1.028	0.089
	778.89	6.03E-04	3.35%	6.08E-04	6.00%	1.009	0.069
	1112.02	4.81E-04	3.35%	4.83E-04	4.00%	1.003	0.052
	1407.95	4.11E-04	3.33%	3.96E-04	4.00%	0.963	0.050
				Weighted Average		0.997	0.028

Table 3b. Point source at 90 deg: Comparison of ISOCS vs Measured Efficiencies

Source located at 90 degrees		Measured Efficiency		ISOCS Efficiency		Ratio of ISOCS eff over Measured eff	
Nuclide	E (keV)	Efficiency	1 sd %	Efficiency	1 sd %	MCNP/Meas	1 σ error
AM-241	59.54	1.11E-03	3.53%	1.11E-03	10.00%	1.001	0.106
EU-152	121.78	1.89E-03	3.44%	1.96E-03	10.00%	1.037	0.110
	244.6	1.46E-03	3.44%	1.51E-03	8.00%	1.036	0.090
	344.27	1.13E-03	3.44%	1.19E-03	8.00%	1.049	0.091
	778.89	6.18E-04	3.45%	6.50E-04	6.00%	1.052	0.073
	1112.02	4.91E-04	3.45%	4.98E-04	4.00%	1.015	0.054
	1407.95	4.21E-04	3.44%	4.29E-04	4.00%	1.017	0.054
				Weighted Average		1.025	0.029

Table 3c. Point source at 135 deg: Comparison of ISOCS vs Measured Efficiencies

Source located at 135 degrees		Measured Efficiency		ISOCS Efficiency		Ratio of ISOCS eff over Measured eff	
Nuclide	E (keV)	Efficiency	1 sd %	Efficiency	1 sd %	MCNP Meas	1 σ error
AM-241	59 54	8 80E-04	3 58%	8 63E-04	10.00%	0.981	0 104
EU-152	121 78	1 88E-03	3 31%	1 91E-03	10.00%	1 018	0 107
	244 6	1 46E-03	3 33%	1 45E-03	8 00%	0.995	0 086
	344 27	1 13E-03	3 32%	1 16E-03	8 00%	1 024	0.089
	778 89	6.25E-04	3.33%	6 36E-04	6.00%	1 017	0 070
	1112 02	4 97E-04	3 36%	5.00E-04	4 00%	1 007	0 053
	1407 95	4 31E-04	3 32%	4 07E-04	4 00%	0.943	0 049
				Weighted Average		0.989	0 028

Table 3d. Glass Fiber Filter Paper on Endcap: ISOCS vs Measured Efficiencies

Energy	Measured Efficiency		ISOCS Efficiency		ISOCS Eff. Meas Eff	
(keV)	Efficiency	1 sd%	Efficiency	1 sd%	Ratio	1 σ error
59 5	1 18E-01	4 51%	1 17E-01	10.00%	0 993	0 109
88	1 85E-01	4.92%	1 81E-01	10 00%	0 976	0 109
122	1 98E-01	4 22%	1 91E-01	10.00%	0 966	0 105
392	9 14E-02	3 92%	9 04E-02	8 00%	0 989	0.088
662	5 90E-02	4 41%	5.81E-02	6 00%	0 985	0 073
835	4 78E-02	4 02%	4 91E-02	6.00%	1 027	0 074
1115	3 83E-02	4 02%	3 56E-02	4 00%	1 034	0 059
			Weighted Average		1 005	0 031

Table 3e. Glass Fiber Filter Paper 10.17 cm from Endcap: MCNP vs Measured Efficiencies

Energy	Measured Efficiency		ISOCS Efficiency		ISOCS Eff. Meas. Eff	
(keV)	Efficiency	1 sd%	Efficiency	1 sd%	Ratio	1 σ error
59 5	8 13E-03	4 62%	7 67E-03	10 00%	0 943	0 104
88	1 15E-02	5 10%	1 04E-02	10 00%	0 900	0 101
122	1 16E-02	4 27%	1 08E-02	10 00%	0 930	0 101
392	6 00E-03	4 18%	5.51E-03	8 00%	0 919	0 083
662	3 95E-03	4 78%	3 67E-03	6 00%	0 929	0 071
835	3 27E-03	4 10%	3 11E-03	6.00%	0 951	0 069
1115	2 47E-03	4 03%	2 62E-03	4 00%	1 059	0 060
			Weighted Average		0 963	0 030

Appendix 1
Detector and System specific information

System Description

The In Situ Object Counting System (ISOCS) and is designed to count a wide variety of source geometries and to report activities of gamma ray emitting radioisotopes which may be present in the source. ISOCS is ideally suited for assaying large samples in an uncollimated or a collimated counting geometry.

The Laboratory Sourceless Calibration Software (LabSOCS) is ideal for performing efficiency calibration of laboratory counting geometries such as filter papers, vials, bottles, and Marinelli Beakers. Using LabSOCS, containers of any shape may be custom defined, as long as the shape is rotationally symmetric. Using LabSOCS with Canberra's Genie 2000 software, gamma ray spectra from a variety of source geometries may be analyzed and nuclide activities reported.

The acknowledgement number for this order is 79813. The system assembled for this order consists of one 40% relative efficiency P-type coaxial germanium detector (serial number 7605)

For the ISOCS system, gamma ray spectra from the detector are accumulated and processed using the Inspector. The data is stored on the IBM Notebook that runs the computer. The system is controlled and spectra analyzed by Procount2k v1.x and Genie2k v2.x software packages. Efficiencies may be generated using ISOCS v4.0 software package.

For a system using LabSOCS, users may employ their own set of electronics to acquire gamma ray spectra in their laboratory. Efficiencies may be generated using LabSOCS v4.0 software package, and used with Genie2k.

Data Distributed on Disk

The end result of the characterization process described in this report is a set of 15 efficiency grids, corresponding to the 15 energies between 45 keV – 7000 keV, all the energy grids having been compressed into a single binary file. The name of the binary file is the same as the last 4 digits of the detector serial number, with an extension of PAR (7605.PAR). The LabSOCS/ISOCS software generates efficiencies for sources of any shape or size, based on this detector characterization file. The file 7605.PAR is included in the disk. Once installed, the file 7605.PAR will reside in the directory \GENIE2K\ISOCS\DATA\DCG.

Also included in the diskette are the files DETECTOR.TXT and README.TXT. The file DETECTOR.TXT is must be copied to the directory \GENIE2K\ISOCS\DATA\PARAMETERS, and the detector will be referenced in the user-interface menu structure as 7605".

Appendix 2
Energy and Shape Calibration

Energy and Shape Calibration

Energy and Shape calibrations were performed by acquiring a gamma ray spectrum using a NIST traceable mixed gamma point source containing ^{241}Am and ^{152}Eu. The pole-zero setting was adjusted to yield an optimum pulse shape. The gain and the zero of the spectrum were adjusted to give, approximately, a slope of 0.36 keV/channel and an intercept of 0.0. The energy and Full Width Half Maximum calibrations were performed.

The calibration report and the plots for the system energy and FWHM calibrations are included in this appendix.

****

* ENERGY CALIBRATION REPORT *****

****

Detector Name: DET01
Sample Title: 7005_01

********** ENERGY CALIBRATION COEFFICIENTS **********

Energy Calibrate Performed on: 02/03/03 2:20:31 PM
by:
Energy Calibrate Type: POLY

Energy(keV) = 0.019 + 0.360*ch + -8.14E-008*ch^2 + 0.00E+000*ch^3

********** SHAPE CALIBRATION COEFFICIENTS **********

Shape Calibrate Performed on: 02/03/03 2:20:31 PM
by:

FWHM = 0.700 + 0.027*E^1/2

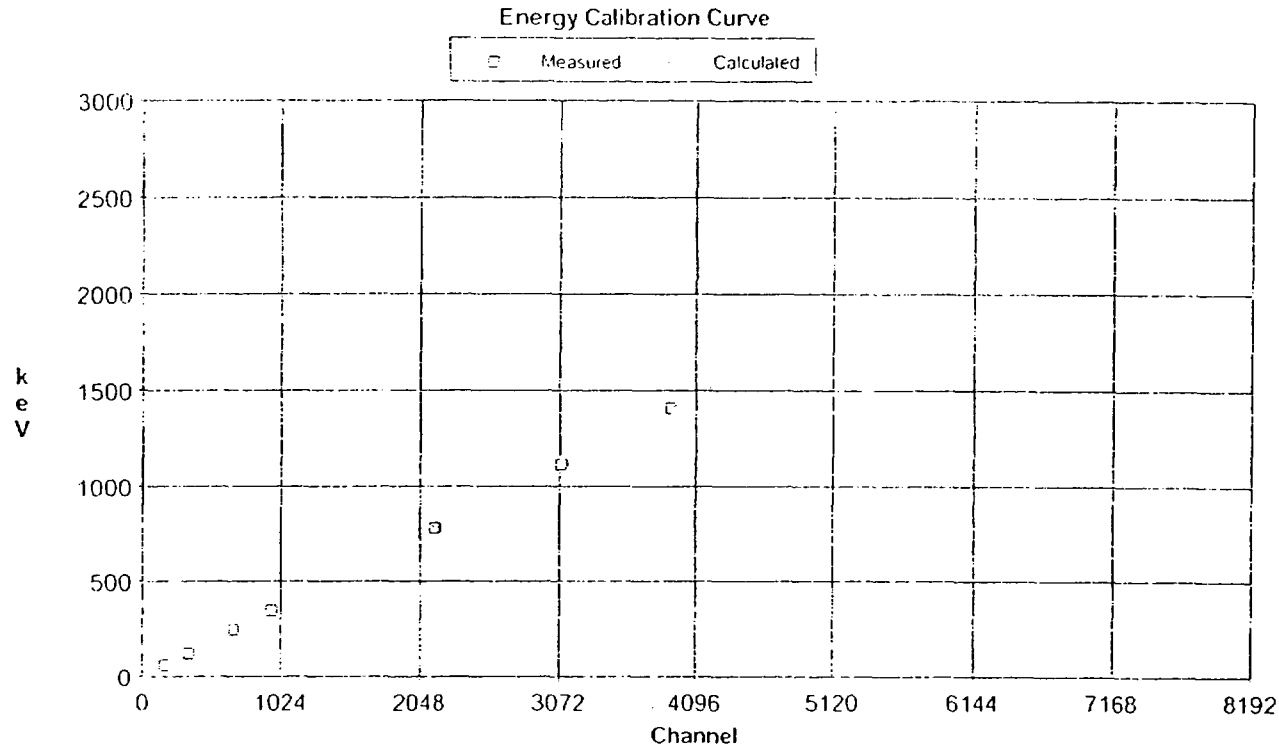
LOW TAIL = 4.4E-001 + 8.2E-004*E

********** ENERGY CALIBRATION RESULTS TABLE **********

Centroid Channel	Centroid error	Energy (keV)
165.15	0.00	59.54
337.83	0.00	121.78
678.81	0.01	244.70
955.28	0.00	344.28
2162.07	0.01	778.90
3087.23	0.01	1112.07
3909.61	0.01	1408.01

********** SHAPE CALIBRATION RESULTS TABLE **********

Energy (keV)	FWHM channels	FWHM error	TAIL channels	TAIL error
59.54	2.57	0.01	1.30	0.01
121.78	2.77	0.01	2.27	0.03
244.70	2.96	0.01	4.56	1.00
344.28	3.24	0.01	3.81	0.31
778.90	4.01	0.02	3.94	0.32
1112.07	4.53	0.02	3.20	0.09
1408.01	4.97	0.02	4.99	0.24



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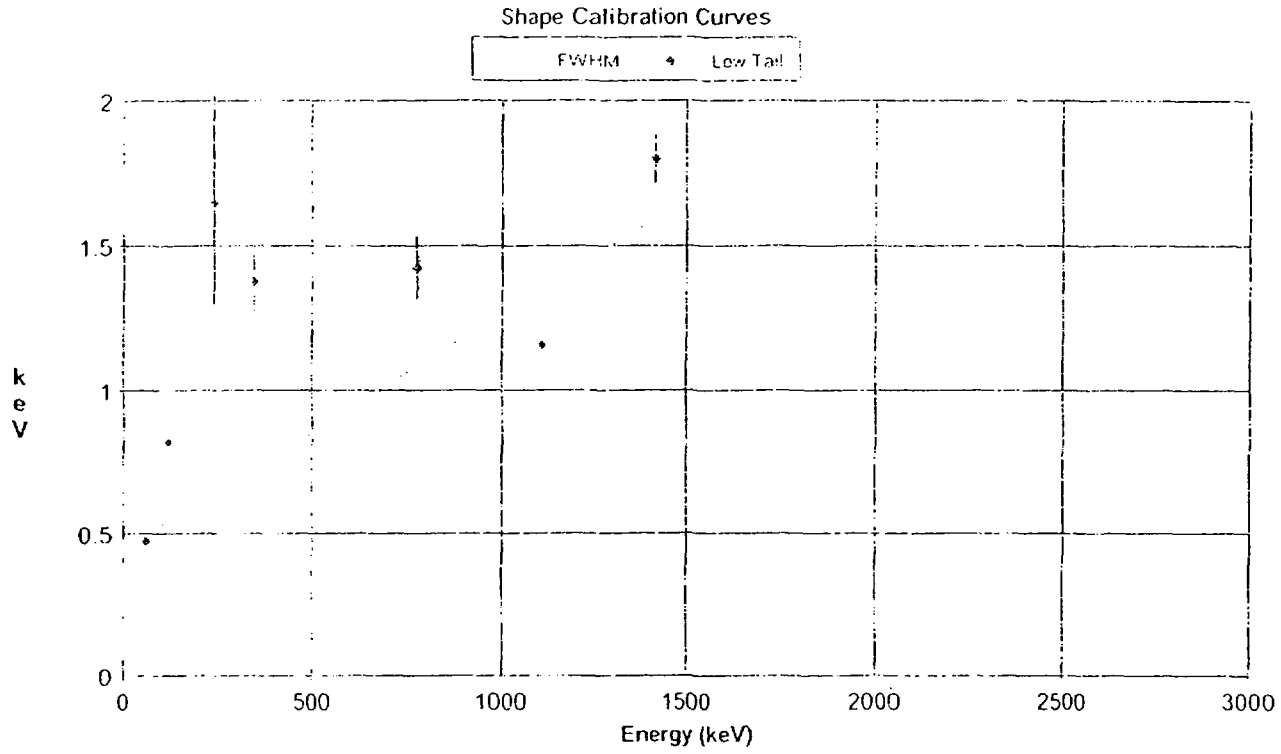
Energy = 1.929e-002 keV + 3.605e-001*Ch - 8.137e-008*Ch^2
FWHM = 6.996e-001 keV + 2.681e-002*E^1/2
Lo Tail = 4.440e-001 keV + 8.175e-004*E



Datasource F:\isox_ver_3\ACK_7K\7981\7605\7605_0d.CNF
Energy = 1.929e-002 keV + 3.605e-001*Ch - 8.137e-008*Ch^2
FWHM = 6.996e-001 keV + 2.681e-002*E^1/2
Lo Tail = 4.440e-001 keV + 8.175e-004*E

Appendix 3
Calibration Source Certificates

CERTIFICATE OF CALIBRATION

CUSTOM POINT SOURCE
SERIAL NUMBER A6248
Reference Date January 1, 1997

Radionuclide	Activity	Total Uncertainty (±)	Half Life[1]
Am-241	188.7 kBq (5.100 µCi)	3.57%	432.7 ± 0.5 years
Eu-152	219.0 kBq (5.918 µCi)	3.30%	13.33 ± 0.04 years

PRINCIPLE EMISSIONS[1]

	Type	Energy (keV)	Intensity (%)
Am-241	gamma	59.5364	35.7
Eu-152	gamma	121.7758	28.4
		244.6923	7.51
		344.286	26.6
		776.920	12.98
		964.110	14.5
		1112.075	13.6
		1408.002	20.8

SOURCE DESCRIPTION

Active Diameter:	2 mm	Nature of Active Deposit:	acitivity in ion exchange beads in resin matrix
Overall Diameter:	6.4 mm	Position of Active Bead:	6 mm from the end of rod
Overall Length:	50 mm		

METHOD OF CALIBRATION

The source was calibrated on a high purity Germanium detector against an NIST traceable standard in a similar geometry. The activity of the standard was determined using an energy vs. efficiency curve established through ongoing intercomparisons with the National Institute of Standards and Technology. This standard is indirectly (implicitly) traceable to the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the Nuclear Energy Institute.

Jay Fan, Ph.D.
Calibration Laboratory Manager

January 20, 1997
Date

REFERENCES

(1) Table of Radioactive Isotopes, 7th edition, 1986.

• LEAK TEST CERTIFICATION ON REVERSE •

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

Phone (404) 352-8677
Fax (404) 352-2837

03-04

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

65057-121

2 Inch Diameter Glass Fiber Filter in Tape

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide sources. The master Cr-51, Sr-85, Mn-54, and Zn-65 sources were calibrated in an ion chamber that was calibrated by the National Physical Laboratory Teddington, U.K. and is directly traceable to national standards. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using germanium gamma spectrometer systems. Calibration and purity of the final mixture were confirmed using germanium gamma spectrometer systems. At the calibration time no interfering gamma-ray emitting impurities were detected. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in US NRC Regulatory Guide 4.15, Revision 1, February, 1979. The certified emission rates in gamma rays per second (GPS) from this standard source are listed below.

Calibration Date: November 15, 2002 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432.2	y	1211	4.5
Cd-109	88	462.6	d	856.3	4.9
Co-57	122	271.79	d	443.4	4.2
Ce-139	166	137.6	d	545.9	4.1
Cr-51	320	27.70	d	2313	4.0
Sn-113	392	115.1	d	957.3	3.9
Sr-85	514	64.84	d	1834	4.1
Cs-137	662	30.07	y	659.4	4.4
Mn-54	835	312.1	d	2254	4.0
Y-88	898	106.6	d	1801	3.8
Zn-65	1116	244.3	d	2310	4.0
Co-60	1173	5.271	y	1152	4.0
Co-60	1332	5.271	y	1152	3.9
Y-88	1836	106.6	d	1907	3.9

Diameter of active area: 2 inch

P O NUMBER: C33347, Rev., Item 4

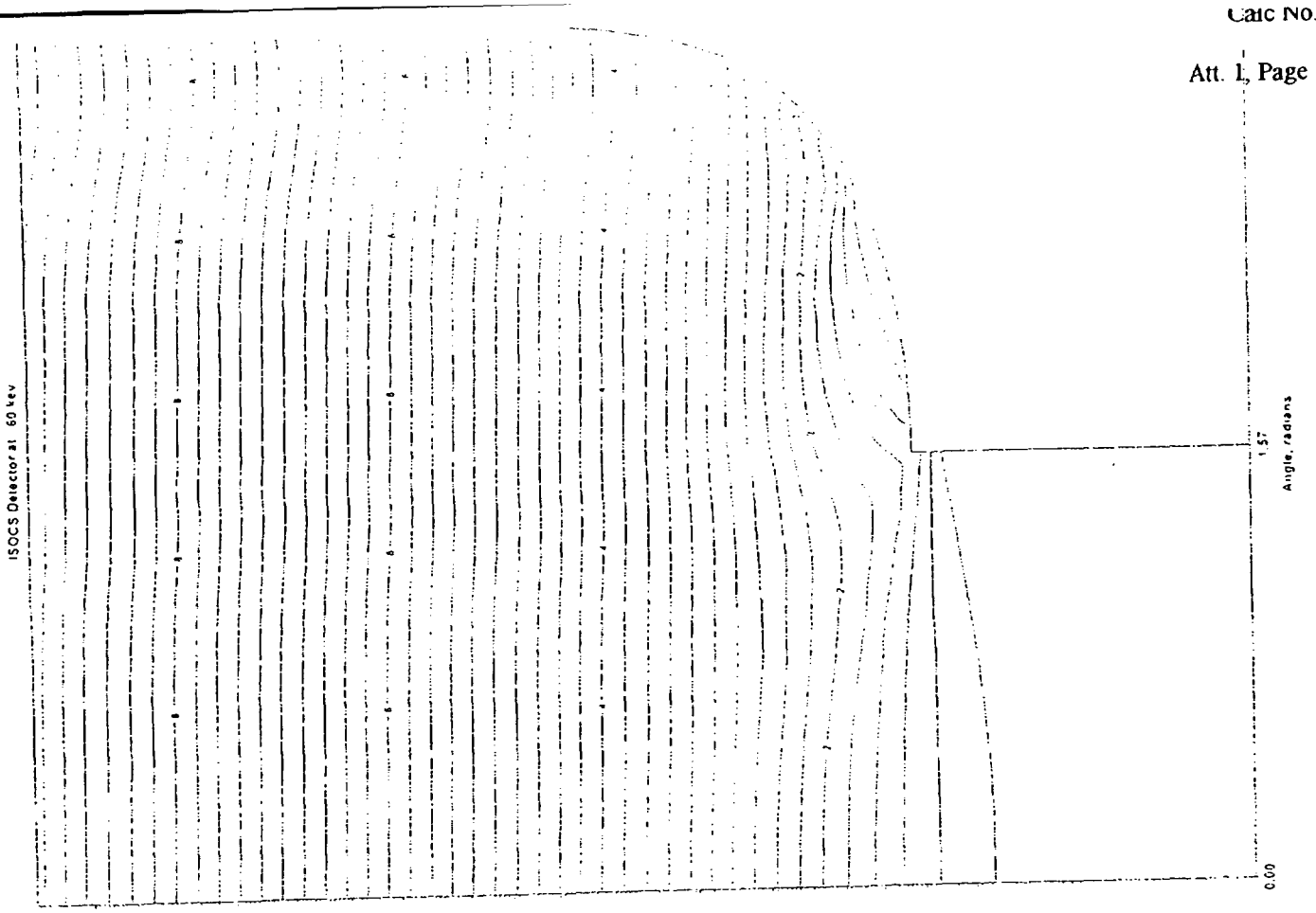
SOURCE PREPARED BY: M. D. Currie

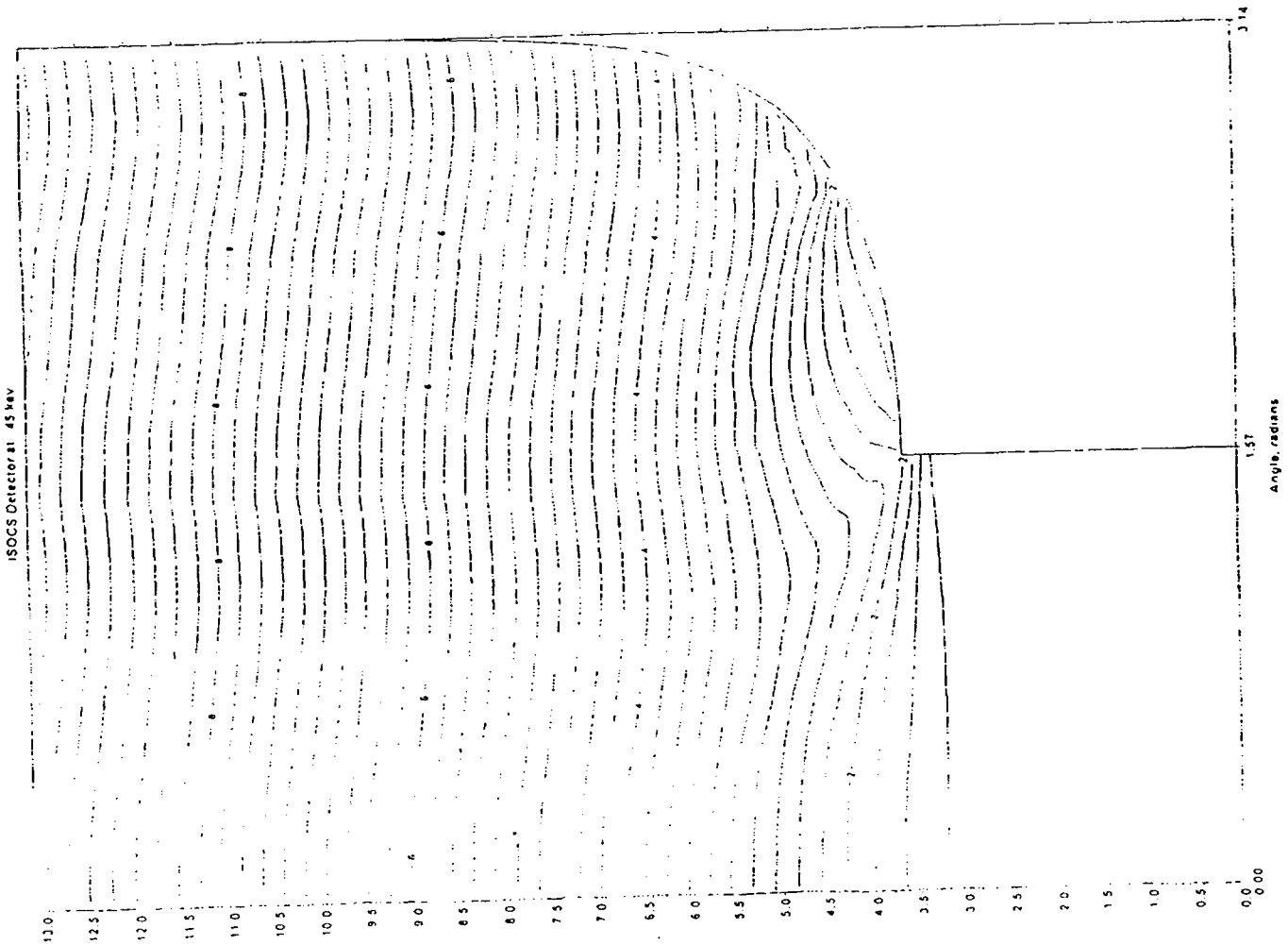
M. D. Currie, Radiochemist

Q A APPROVED: M. Mc 12-23-02

This standard will expire one year after the calibration date.

Appendix 4
Detector Response Characteristics


ISOCS Detector at 60 kev
3.14
1.57
0.00
Angle, radians


ISOCS Detector at 45 kev
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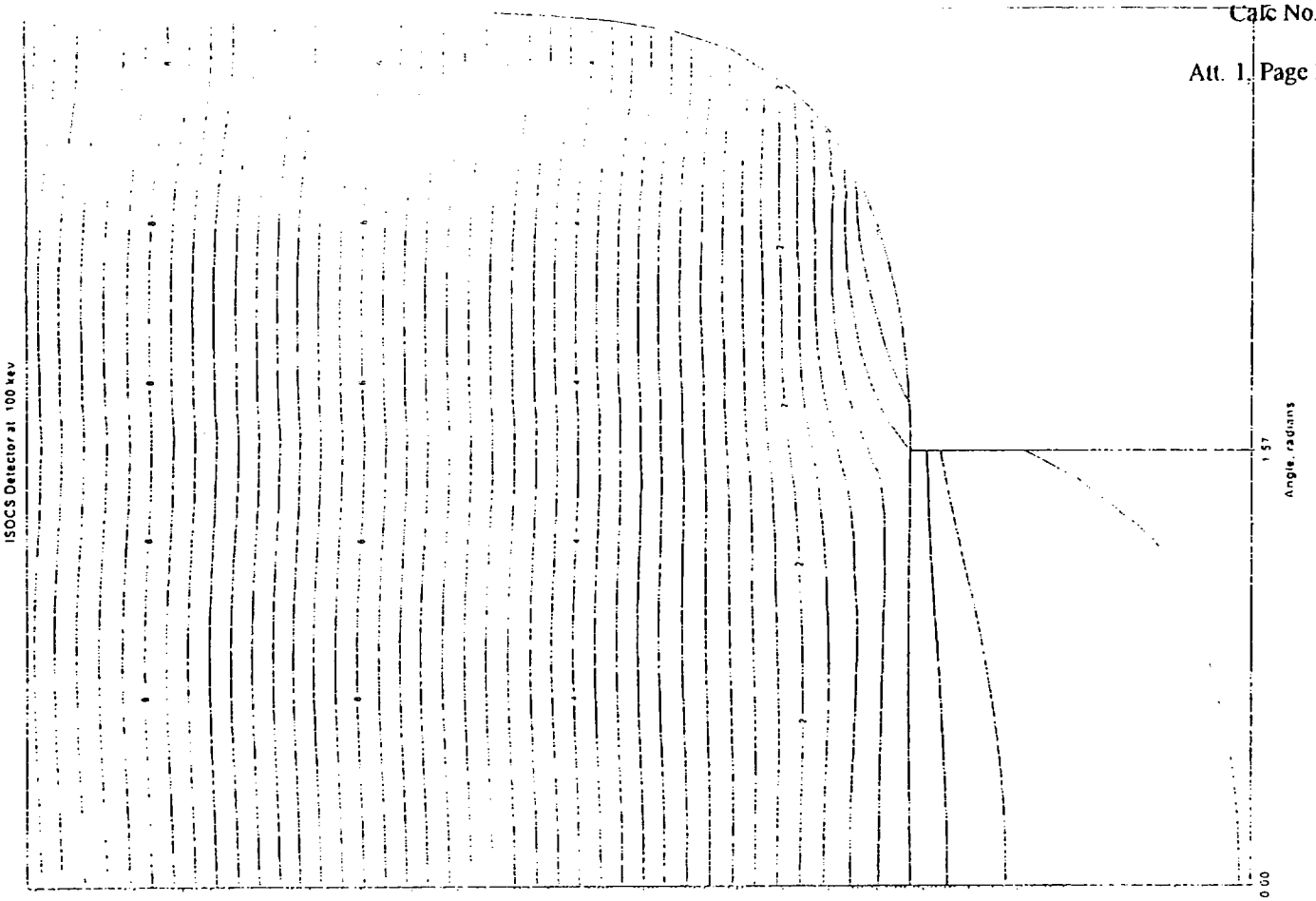
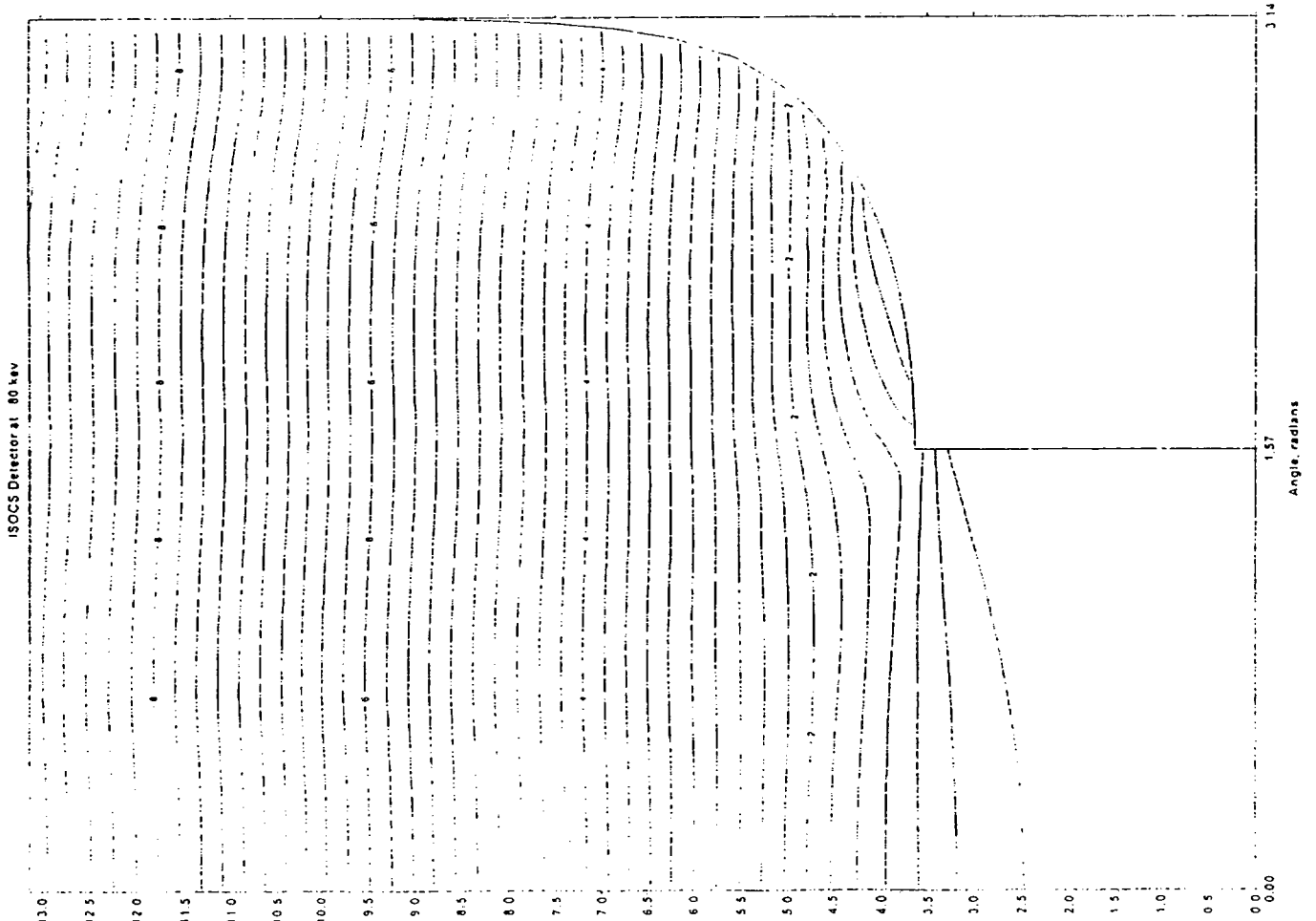
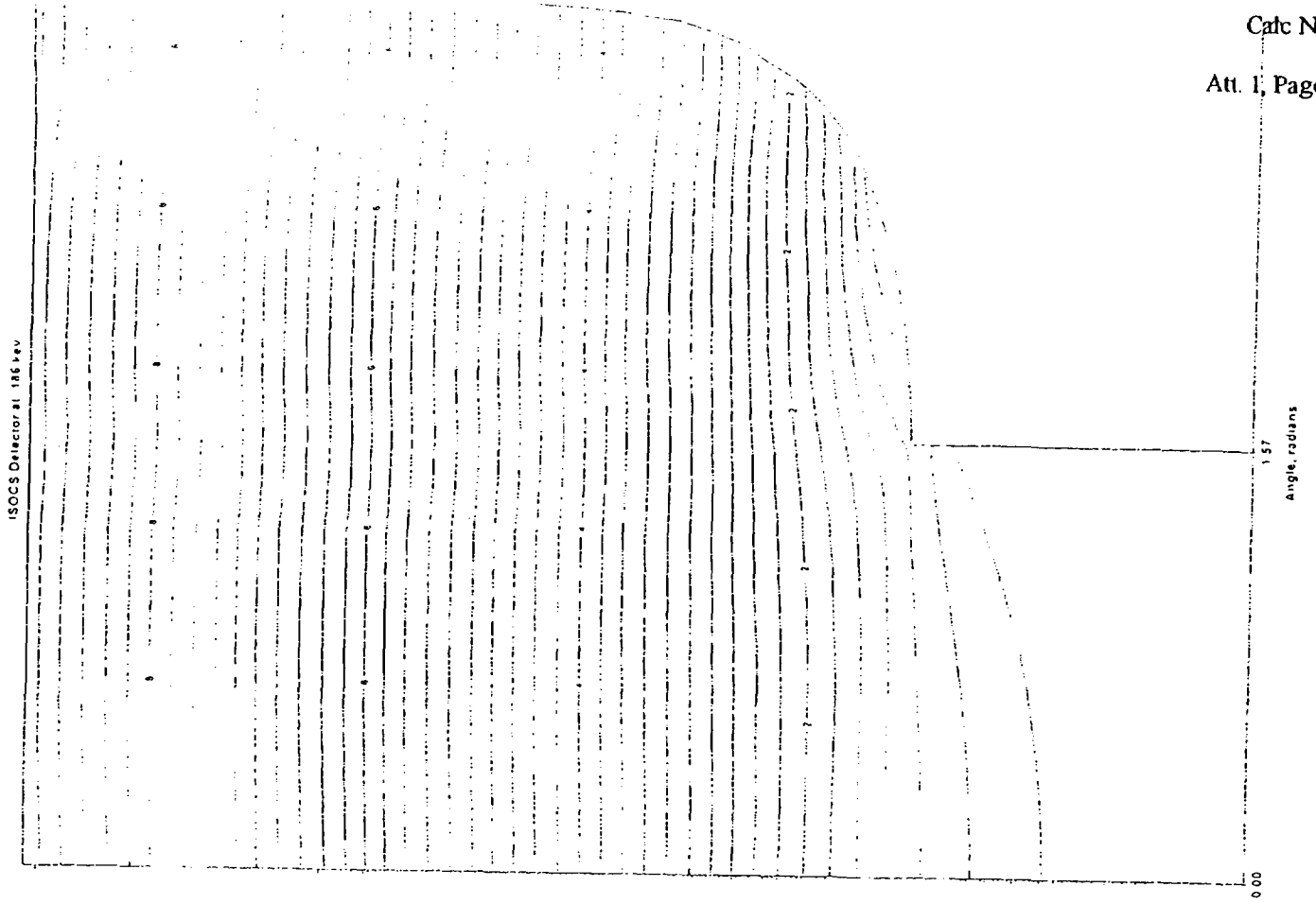
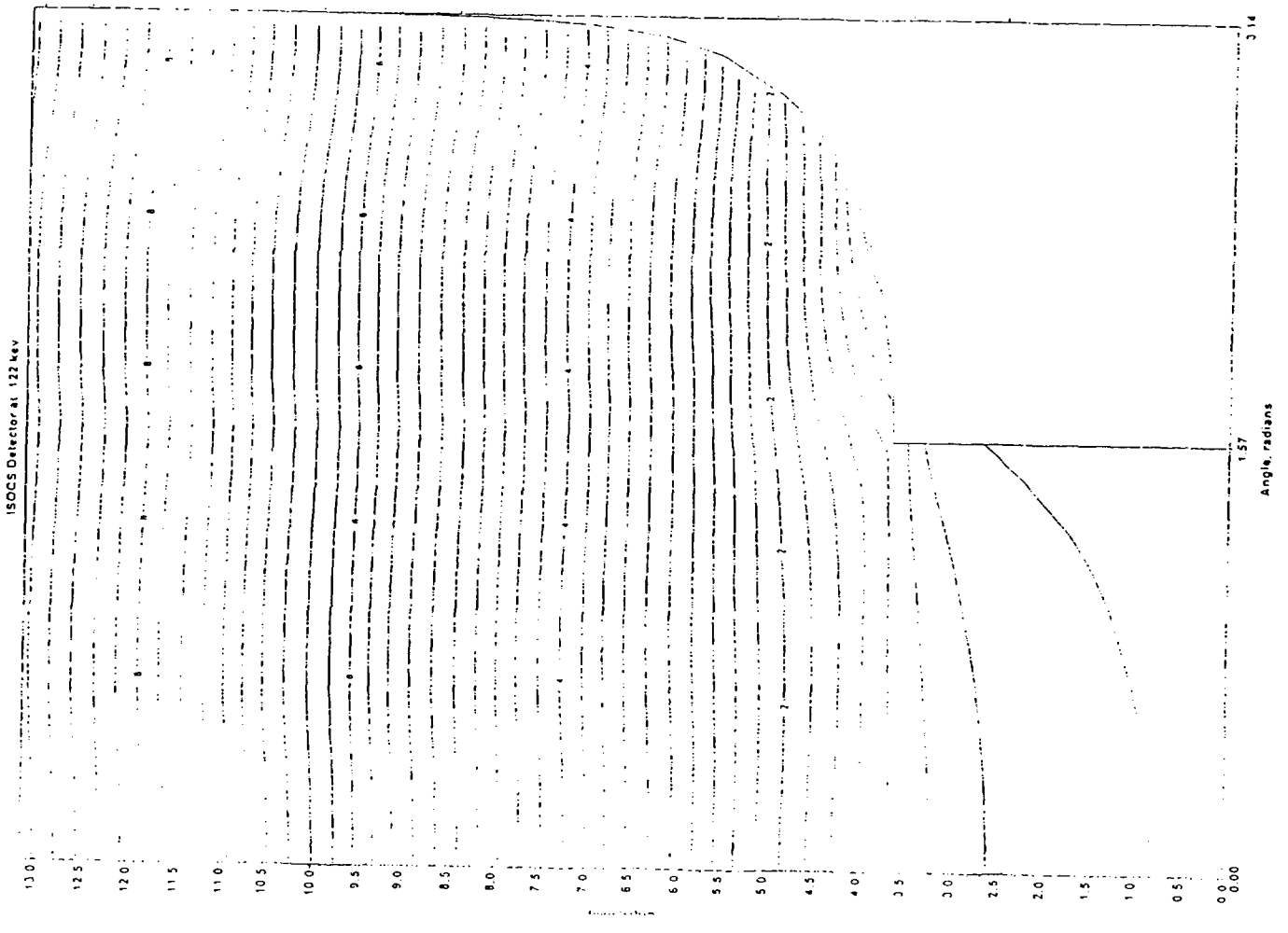
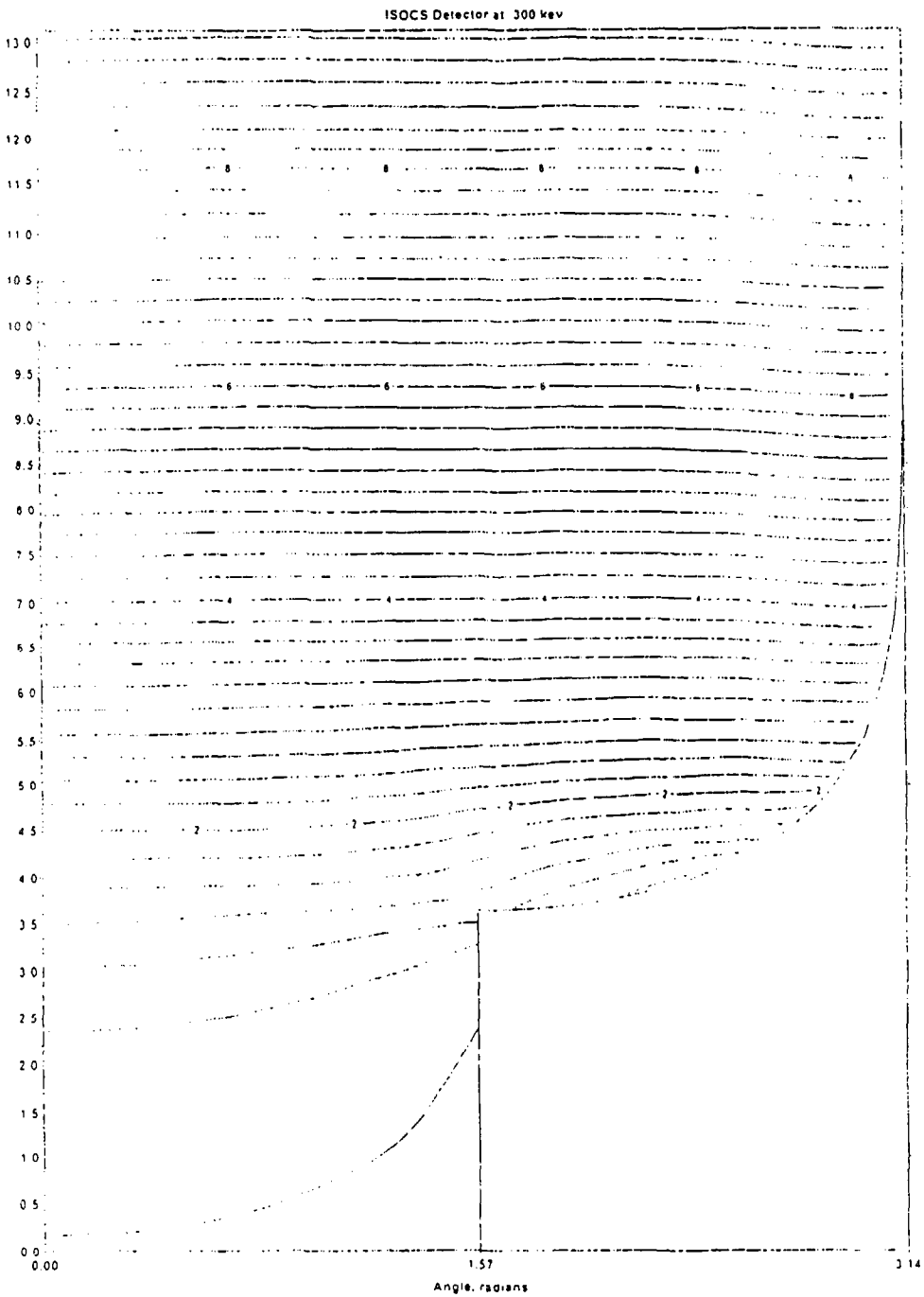
0.00
Angle, radians

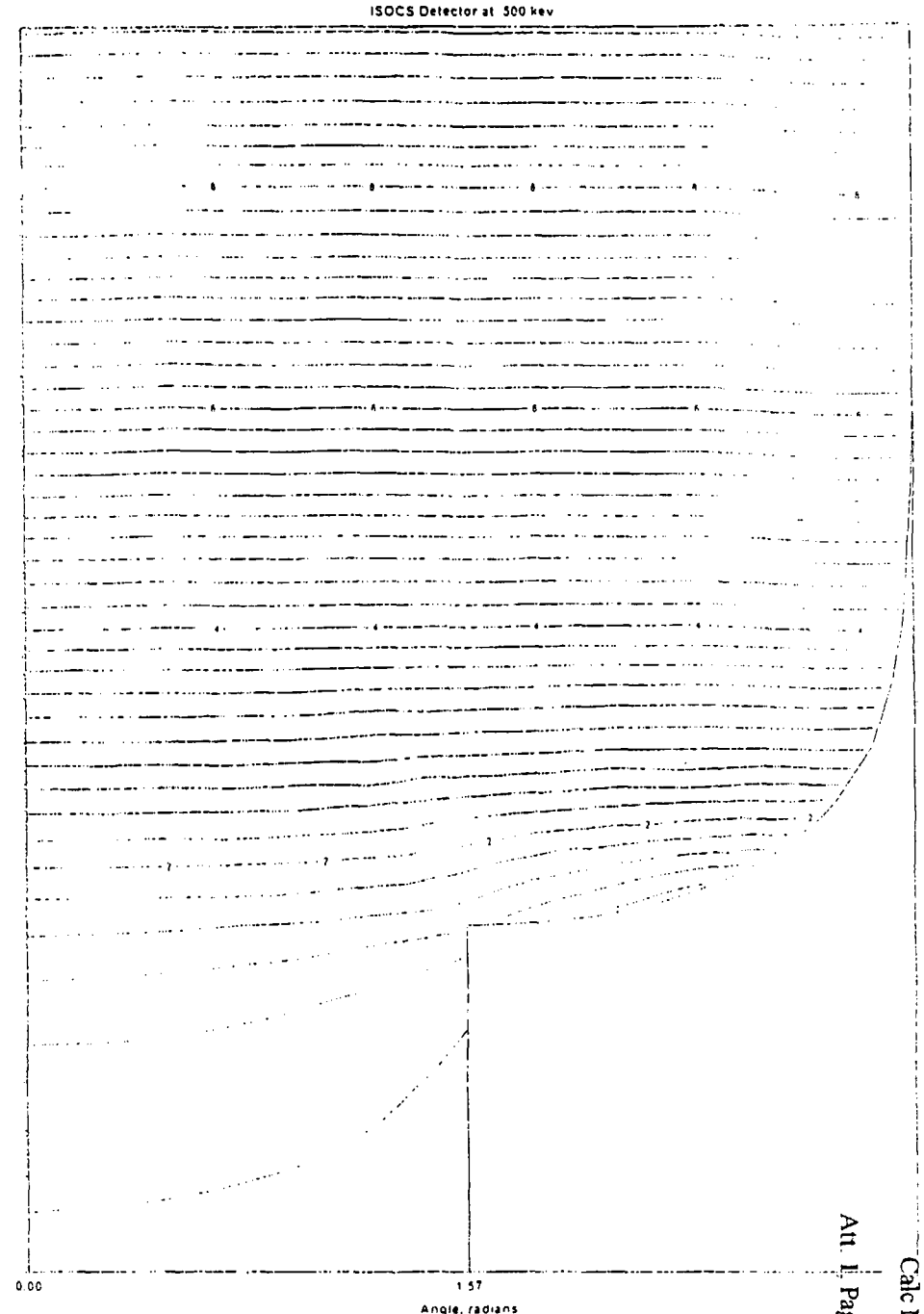

ISOCS Detector at 100 kev
Angle, radians
0.00
1.57

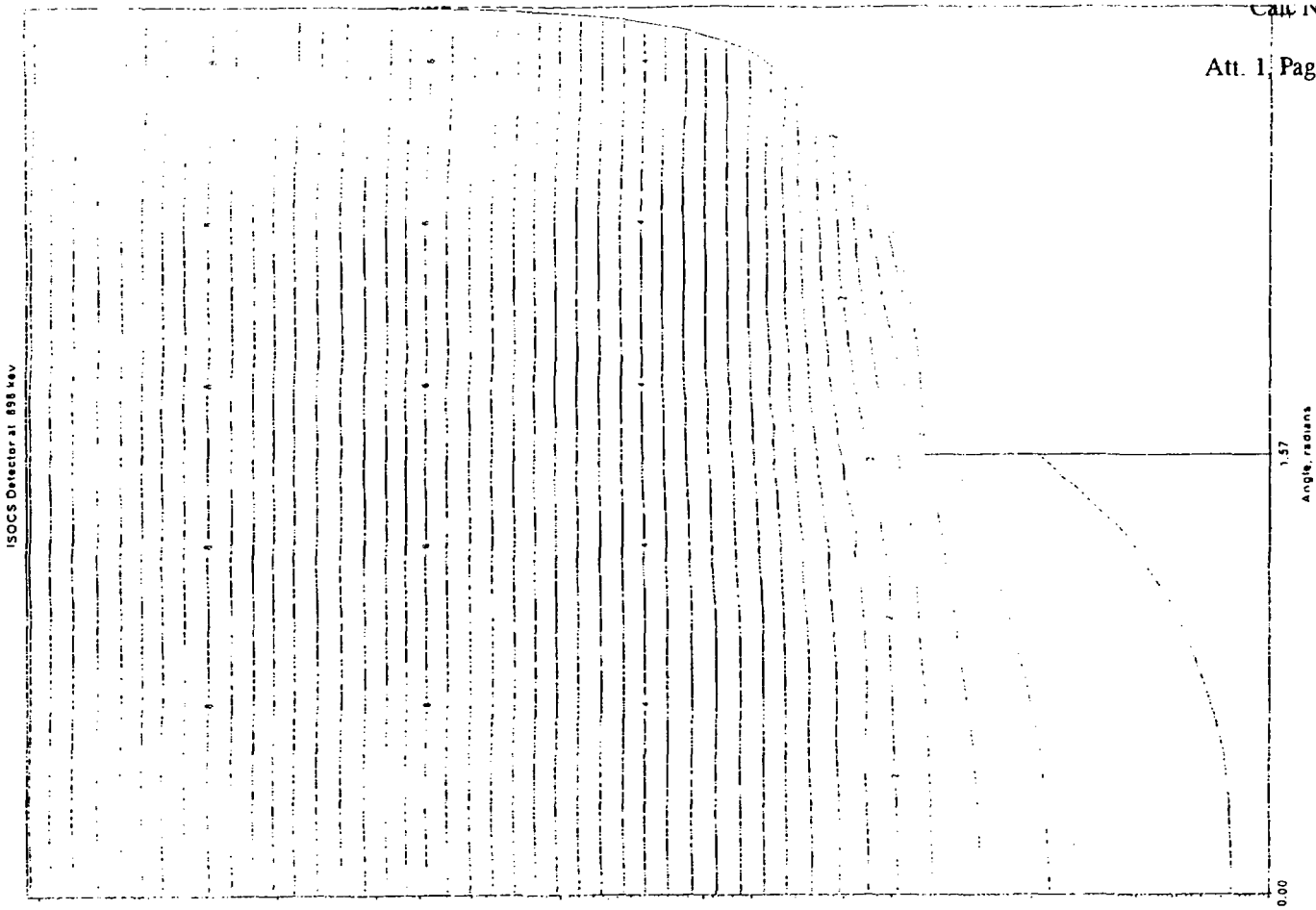

ISOCS Detector at 80 kev
Angle, radians
0.00
1.57
3.14

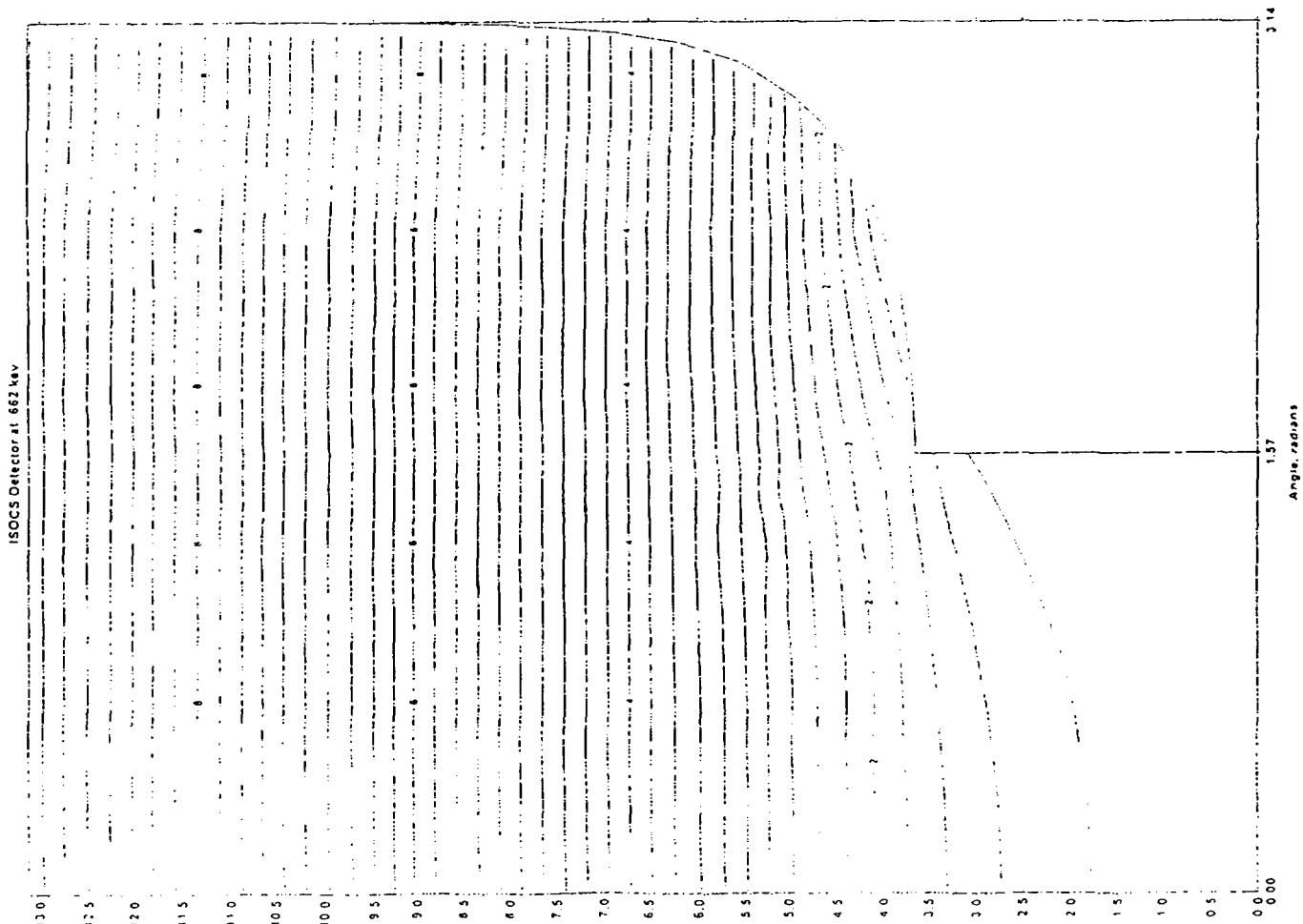

ISOCS Detector at 186 kev
Angle, radians
1.57
0.00

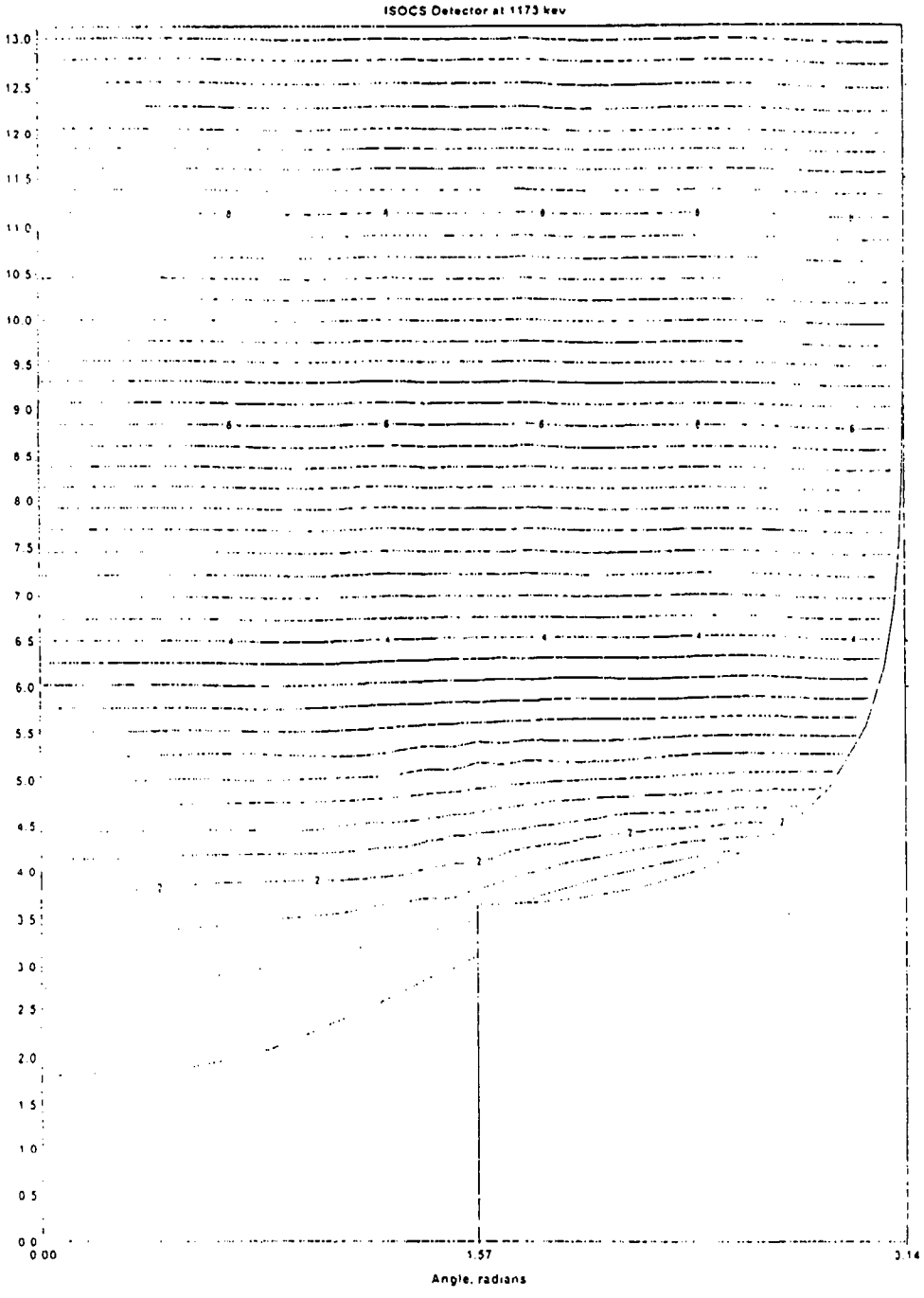

ISOCS Detector at 122 kev
Angle, radians
3.14
1.57
0.00

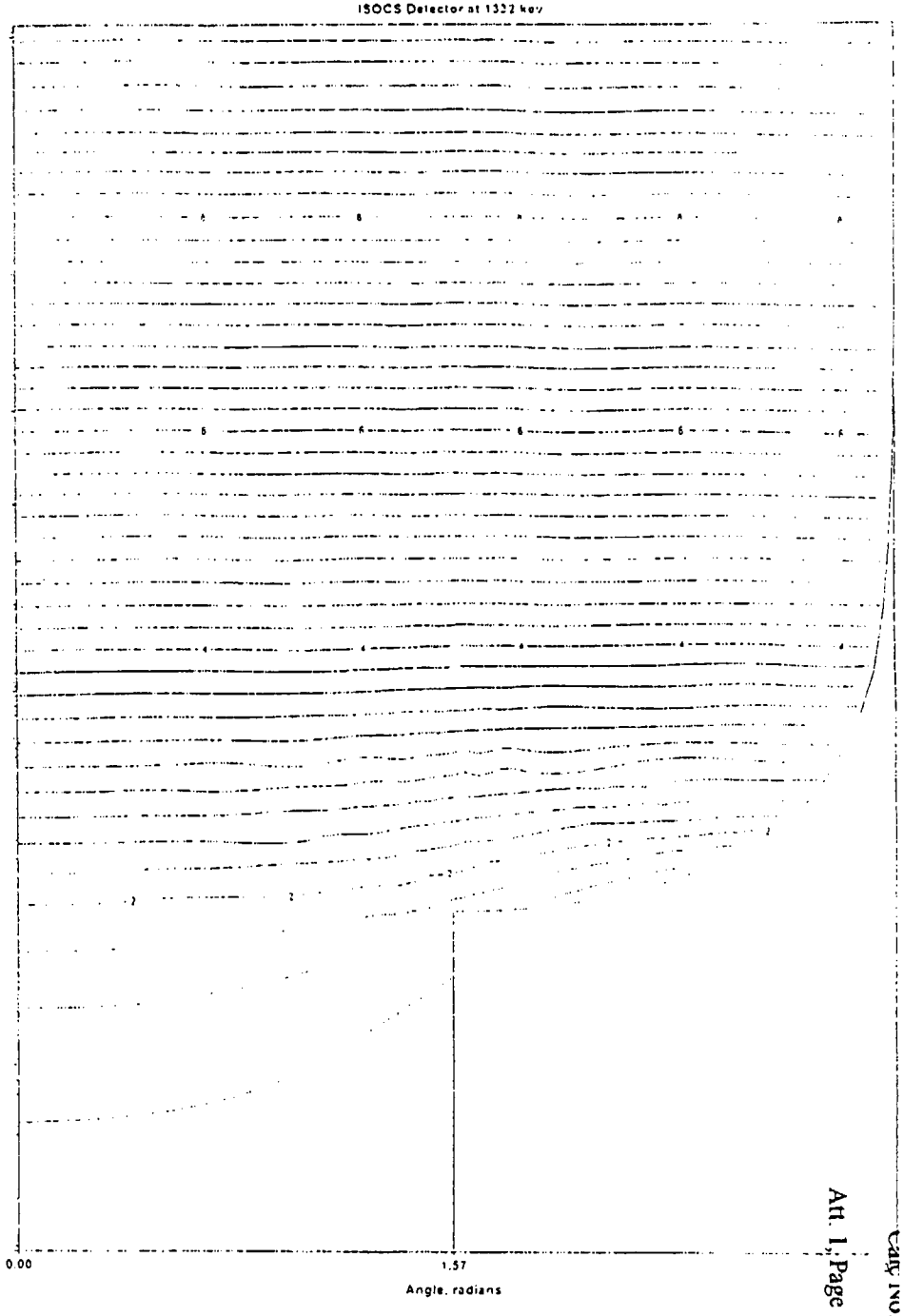

ISOCS Detector at 300 kev
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
1.57
3.14
Angle, radians

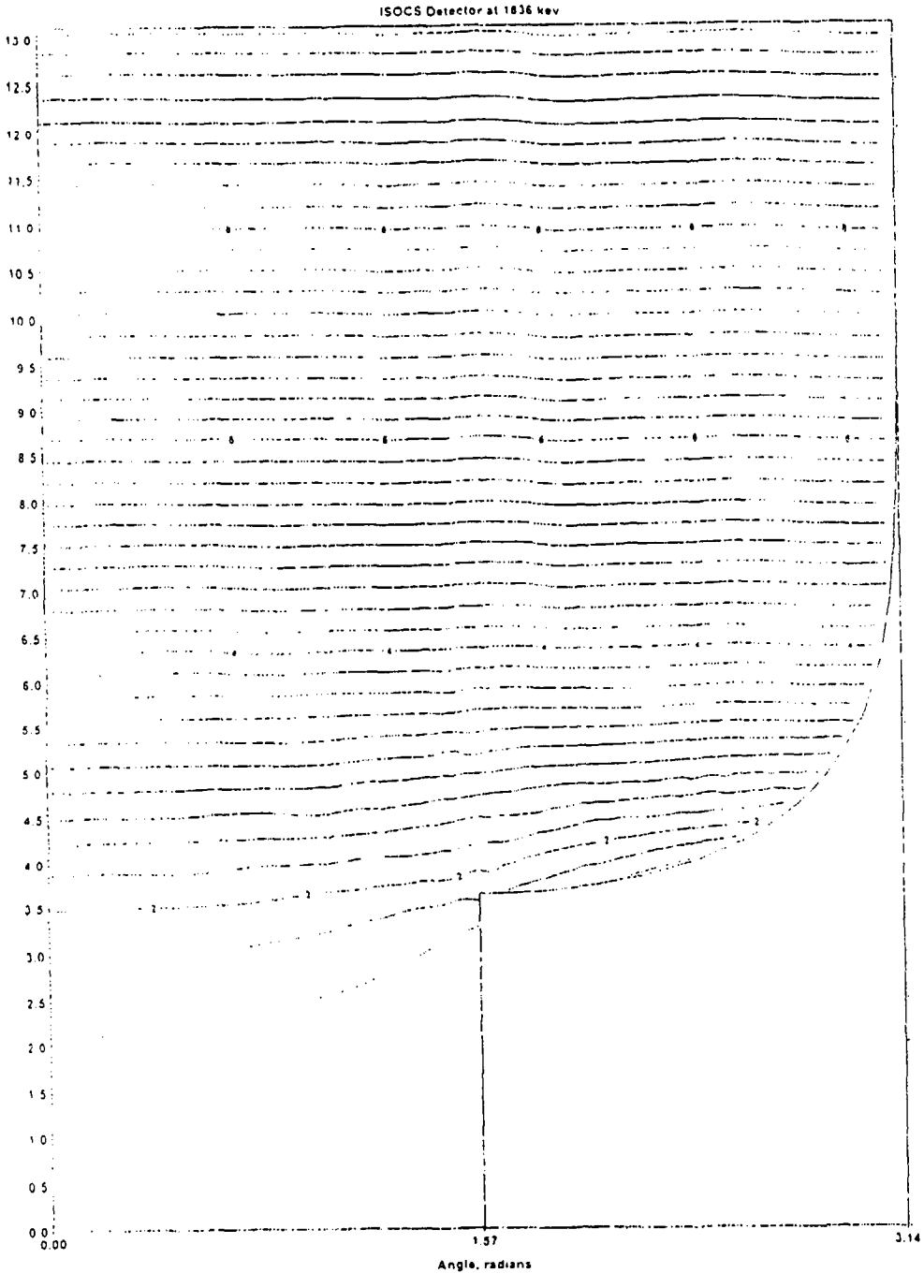

ISOCS Detector at 500 kev
0.00
1.57
Angle, radians

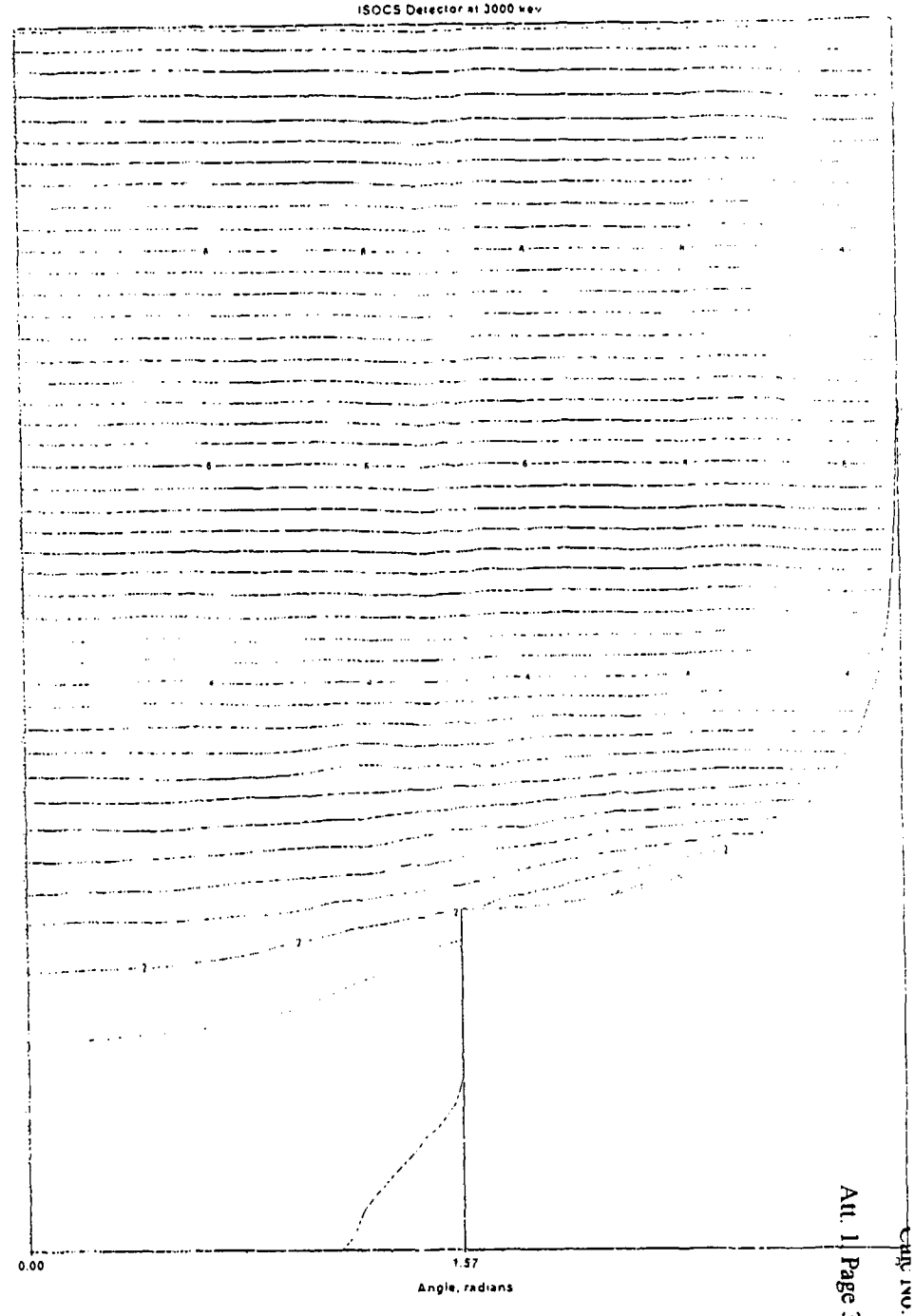

ISOCS Detector at 898 kev
1.57
Angle, radians
0.00

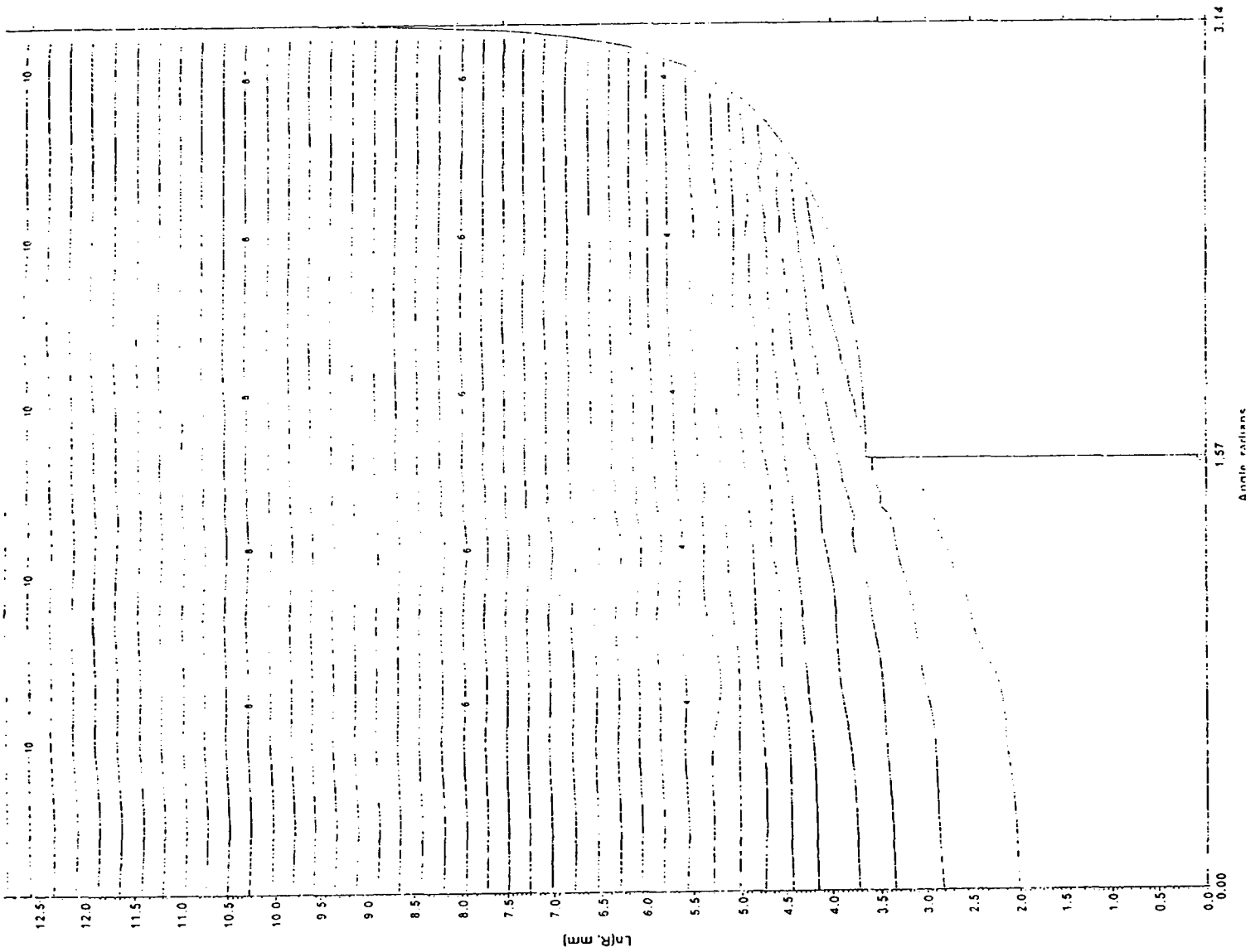

ISOCS Detector at 662 kev
3.14
1.57
Angle, radians
0.00
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.00


ISOCS Detector at 1173 kev
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
1.57
3.14
Angle, radians


ISOCS Detector at 1332 kev
0.00
1.57
Angle, radians


ISOCS Detector at 1836 kev
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
1.57
3.14
Angle, radians


ISOCS Detector at 3000 kev
0.00
1.57
Angle, radians


Ln(R, mm)
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
1.57
3.14
Angle radians

Appendix 5
Statistical Report

Date & Time: Mon Feb 03 14:01:27 2003

Statistical comparision between ISOCS output and MCNP input efficiency
[interpolation quality test using intermediate datapoints computed via grid]

DETECTOR NAME =7605

Region 1 is limited by 0.00<= X <=0.03 and 0.00<= Y <=0.06 m
Comment: REPRESENTATIVE OF A 20CC LIQUID SCINTILLATION VIAL

Region 2 is limited by 0.00<= X <=0.05 and 0.00<= Y <=0.01 m
Comment: REPRESENTATIVE OF A FILTER PAPER

Region 3 is limited by 0.00<= X <=0.10 and -0.10<= Y <=0.04 m
Comment: REPRESENTATIVE OF A 1 LITER MARINELLI BEAKER

Region 4 is limited by 0.20<= R <=1.00 m and 0<= Theta <=180 degrees
Comment: USEFUL REGION FOR BOTH IN SITU AND LABORATORY APPLICATIONS

Region 5 is limited by 1.00<= R <=2.00 m and 0<= Theta <=180 degrees
Comment: USEFUL REGION PRIMARILY FOR IN SITU APPLICATIONS

Region 6 is limited by 2.00<= R <=501.00 m and 0<= Theta <=180 degrees
Comment: USEFUL REGION PRIMARILY FOR IN SITU APPLICATIONS

Statistical quantities calculated in each region:

Pelative Deviation [RD]= 100*(ISOCSeff-MCNPeff)/MCNPeff

Average RD [ARD] = Sum(RD)/Pts, where the Pts is the points number in a region

Standard Deviation of RD [SD] = sqrt{Sum[(RD-ARD)^2]/Pts}

E, kev	Reg	N	ARD, %	SD, %	MCNP SD, %	RDs of data points distributed in various Confidence Intervals <1	(1,2]	(2,3]	>3	sigma
45	1	135	0.04	0.23	1.36	120	11	1	3	Pts
	2	109	-0.02	0.44	1.71	93	8	2	6	Pts
	3	397	-0.01	0.42	2.73	319	55	14	9	Pts
	4	57	-0.10	1.81	2.51	51	4	0	2	Pts
	5	19	0.11	0.40	2.52	17	1	0	1	Pts
	6	190	-0.04	0.75	2.53	129	47	14	0	Pts
60	1	135	0.01	0.16	0.89	114	14	5	2	Pts
	2	109	-0.03	0.30	1.02	95	7	3	4	Pts
	3	397	-0.01	0.24	1.75	314	63	12	8	Pts
	4	57	-0.00	0.34	1.52	46	8	1	2	Pts
	5	19	-0.01	0.09	1.53	14	4	1	0	Pts
	6	190	-0.01	0.80	1.54	129	49	12	0	Pts
80	1	135	0.02	0.13	0.73	111	15	6	3	Pts
	2	109	-0.01	0.23	0.79	94	7	4	4	Pts
	3	397	-0.01	0.21	1.38	337	41	7	12	Pts
	4	57	0.00	0.37	1.22	47	8	1	1	Pts
	5	19	0.01	0.11	1.23	15	3	0	1	Pts
	6	190	-0.03	0.76	1.23	130	47	13	0	Pts
100	1	135	0.02	0.14	0.69	111	18	4	2	Pts
	2	109	-0.00	0.25	0.72	95	8	2	4	Pts
	3	397	-0.01	0.21	1.27	332	48	8	9	Pts
	4	57	-0.01	0.27	1.14	45	6	6	0	Pts
	5	19	0.00	0.11	1.14	14	4	1	0	Pts
	6	190	-0.05	0.75	1.14	130	46	14	0	Pts
122	1	135	0.01	0.11	0.69	101	30	2	2	Pts
	2	109	-0.01	0.20	0.70	94	9	3	3	Pts
	3	397	-0.01	0.18	1.24	329	49	9	10	Pts
	4	57	-0.00	0.36	1.11	43	9	4	1	Pts
	5	19	0.01	0.09	1.11	12	7	0	0	Pts
	6	190	-0.05	0.75	1.11	129	46	15	0	Pts
186	1	135	0.01	0.10	0.76	96	29	9	1	Pts
	2	109	0.00	0.16	0.75	91	11	5	2	Pts
	3	397	0.00	0.16	1.31	308	69	12	8	Pts
	4	57	0.00	0.49	1.16	49	5	2	1	Pts
	5	19	0.05	0.10	1.16	14	3	2	0	Pts
	6	190	-0.04	0.75	1.16	128	49	13	0	Pts
300	1	135	-0.00	0.13	0.94	94	35	6	0	Pts
	2	109	-0.01	0.16	0.91	88	13	6	2	Pts
	3	397	-0.01	0.16	1.55	296	79	16	6	Pts
	4	57	-0.01	0.63	1.37	48	5	2	2	Pts
	5	19	0.07	0.13	1.37	14	3	2	0	Pts
	6	190	-0.04	0.77	1.36	129	49	12	0	Pts
500	1	135	-0.00	0.14	1.19	104	23	4	4	Pts

	2	109	-0.01	0.13	1.13	68	18	0	1	Pts
	3	397	-0.00	0.19	1.91	300	72	18	7	Pts
	4	57	-0.04	0.66	1.68	43	10	3	1	Pts
	5	19	0.02	0.14	1.68	13	5	1	0	Pts
	6	190	-0.03	0.72	1.68	131	45	14	0	Pts
662	1	135	0.00	0.13	1.36	100	23	12	0	Pts
	2	109	0.00	0.23	1.28	92	11	2	4	Pts
	3	397	-0.01	0.22	2.14	300	79	10	8	Pts
	4	57	-0.02	0.75	1.89	45	7	4	1	Pts
	5	19	-0.01	0.16	1.88	10	9	0	0	Pts
	6	190	-0.04	0.76	1.87	130	48	12	0	Pts
898	1	135	-0.01	0.15	1.53	98	31	4	2	Pts
	2	109	-0.01	0.23	1.44	95	8	2	4	Pts
	3	397	-0.00	0.27	2.38	329	44	12	12	Pts
	4	57	-0.05	1.09	2.10	52	3	0	2	Pts
	5	19	0.03	0.29	2.09	14	4	1	0	Pts
	6	190	-0.04	0.75	2.08	129	49	12	0	Pts
1173	1	135	0.02	0.17	1.70	99	26	8	2	Pts
	2	109	0.00	0.25	1.60	89	14	4	2	Pts
	3	397	0.01	0.34	2.60	294	74	23	6	Pts
	4	57	0.08	0.82	2.31	42	11	4	0	Pts
	5	19	-0.01	0.26	2.30	11	8	0	0	Pts
	6	190	-0.03	0.78	2.29	131	46	13	0	Pts
1332	1	135	-0.01	0.19	1.79	91	37	7	0	Pts
	2	109	-0.01	0.23	1.68	74	32	1	2	Pts
	3	397	0.00	0.37	2.68	327	52	10	8	Pts
	4	57	0.26	1.84	2.41	49	5	2	1	Pts
	5	19	-0.12	0.29	2.40	14	4	1	0	Pts
	6	190	-0.03	0.75	2.39	130	45	14	1	Pts
1836	1	135	-0.01	0.19	2.02	100	29	4	2	Pts
	2	109	0.01	0.26	1.90	85	18	4	2	Pts
	3	397	0.01	0.38	2.95	321	54	17	5	Pts
	4	57	0.02	0.89	2.75	41	12	2	2	Pts
	5	19	0.05	0.21	2.74	10	9	0	0	Pts
	6	190	-0.04	0.78	2.74	130	47	13	0	Pts
3000	1	135	0.00	0.19	2.47	106	16	11	2	Pts
	2	109	0.02	0.23	2.35	87	13	5	4	Pts
	3	397	0.01	0.33	3.31	302	75	15	5	Pts
	4	57	-0.08	0.82	3.40	43	10	4	0	Pts
	5	19	-0.01	0.29	3.38	13	5	1	0	Pts
	6	190	-0.03	0.78	3.38	137	40	11	2	Pts
7000	1	135	-0.03	0.51	3.61	102	24	8	1	Pts
	2	109	-0.01	0.60	3.51	87	18	2	2	Pts
	3	397	-0.00	0.53	3.84	312	64	12	9	Pts
	4	57	-0.34	2.25	4.00	48	5	3	1	Pts
	5	19	0.14	0.39	3.98	13	5	1	0	Pts
	6	190	-0.03	0.80	3.98	139	38	12	1	Pts

TARGET PERCENT AVERAGE RELATIVE DEVIATION VALUES

E,kev:	45	60	80	100	122	186	300	500	662	898	1173	1332	1836	3000	7000
Region #1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Region #2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Region #3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Region #4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Region #5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Region #6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

TARGET PERCENT STANDARD DEVIATION VALUES

E,kev:	45	60	80	100	122	186	300	500	662	898	1173	1332	1836	3000	7000
Region #1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Region #2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Region #3	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Region #4	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Region #5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Region #6	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

STATISTICAL BIAS SUMMARY REPORT
comparison between the average relative (|avr|) and standard (sd) deviations

E,kev:	45	60	80	100	122	186	300	500	662	898	1173	1332	1836	3000	7000
Region #1															
Region #2															
Region #3															
Region #4															
Region #5															
Region #6															

'*' means sd<|avr|<=2sd; the '**' means 2sd<|avr|<=3sd; etc.

ABSOLUTE BIAS SUMMARY REPORT
comparison between the ISOCS avg deviation (|avr|) and target bias (Tb)

E,kev:	45	60	80	100	122	186	300	500	662	898	1173	1332	1836	3000	7000
Region #1															
Region #2															
Region #3															
Region #4															
Region #5															
Region #6															

'*' means T%b<|avr|<=2Tb; the '**' means 2Tb<|avr|<=3Tb; etc.

STANDARD DEVIATION SUMMARY REPORT
comparison between the ISOCS std dev'n (sd) and target std dev'n (Tsd)

E,kev:	45	60	80	100	122	186	300	500	662	898	1173	1332	1836	3000	7000
Region #1															
Region #2															
Region #3															
Region #4															*
Region #5															
Region #6															

'*' means T%sd<sd<=2Tsd; the '**' means 2Tsd<sd<=3Tsd; etc.

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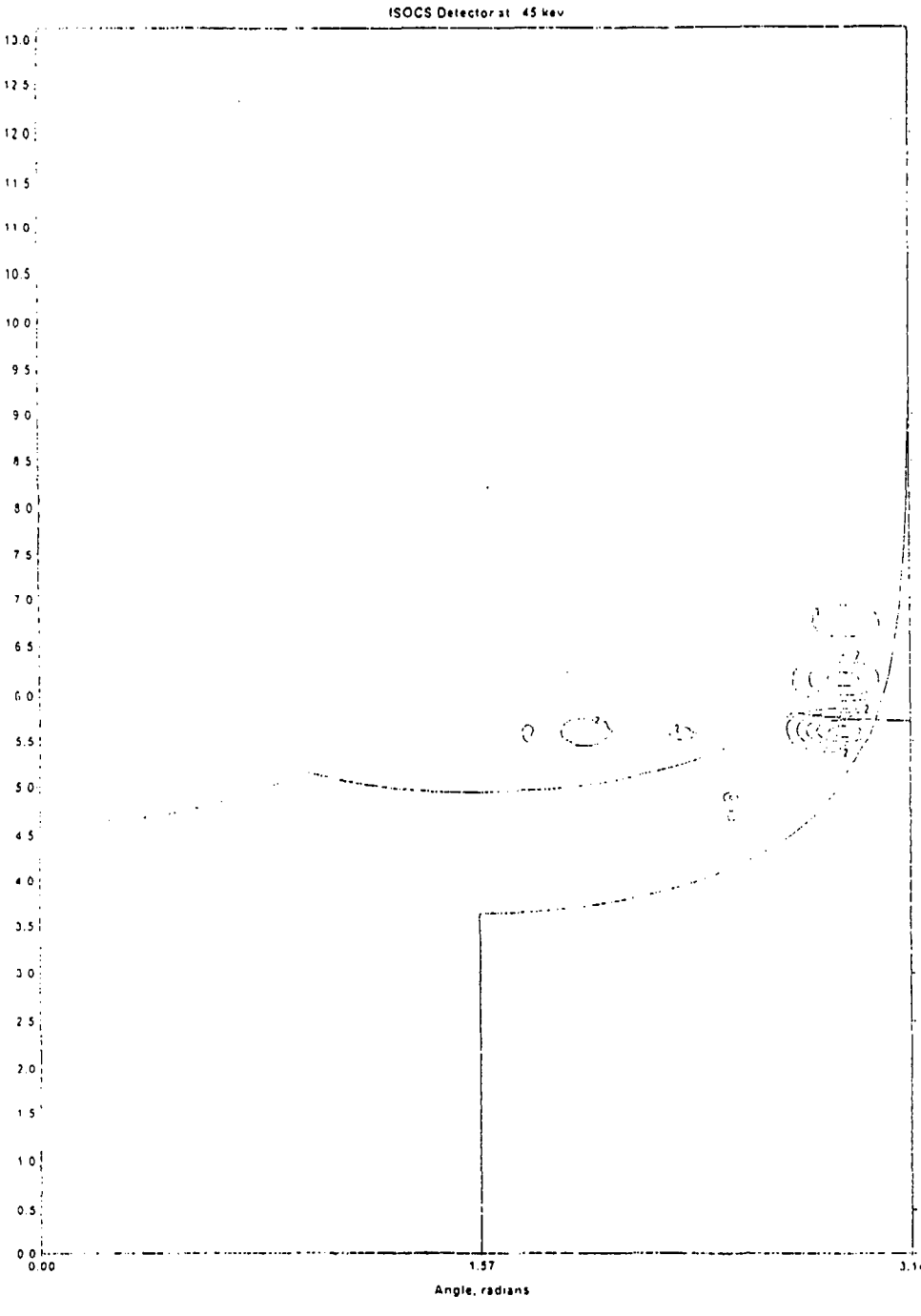
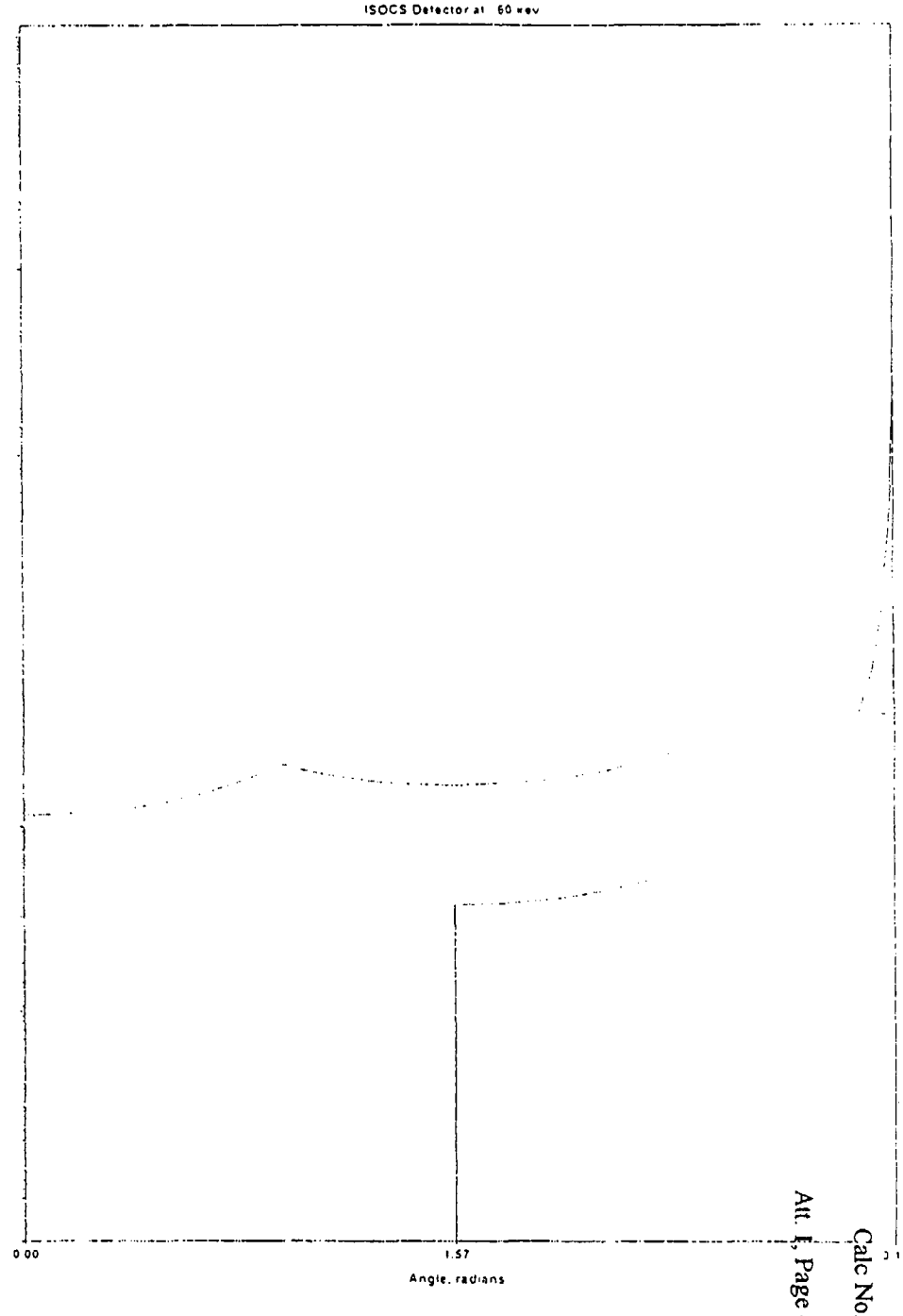
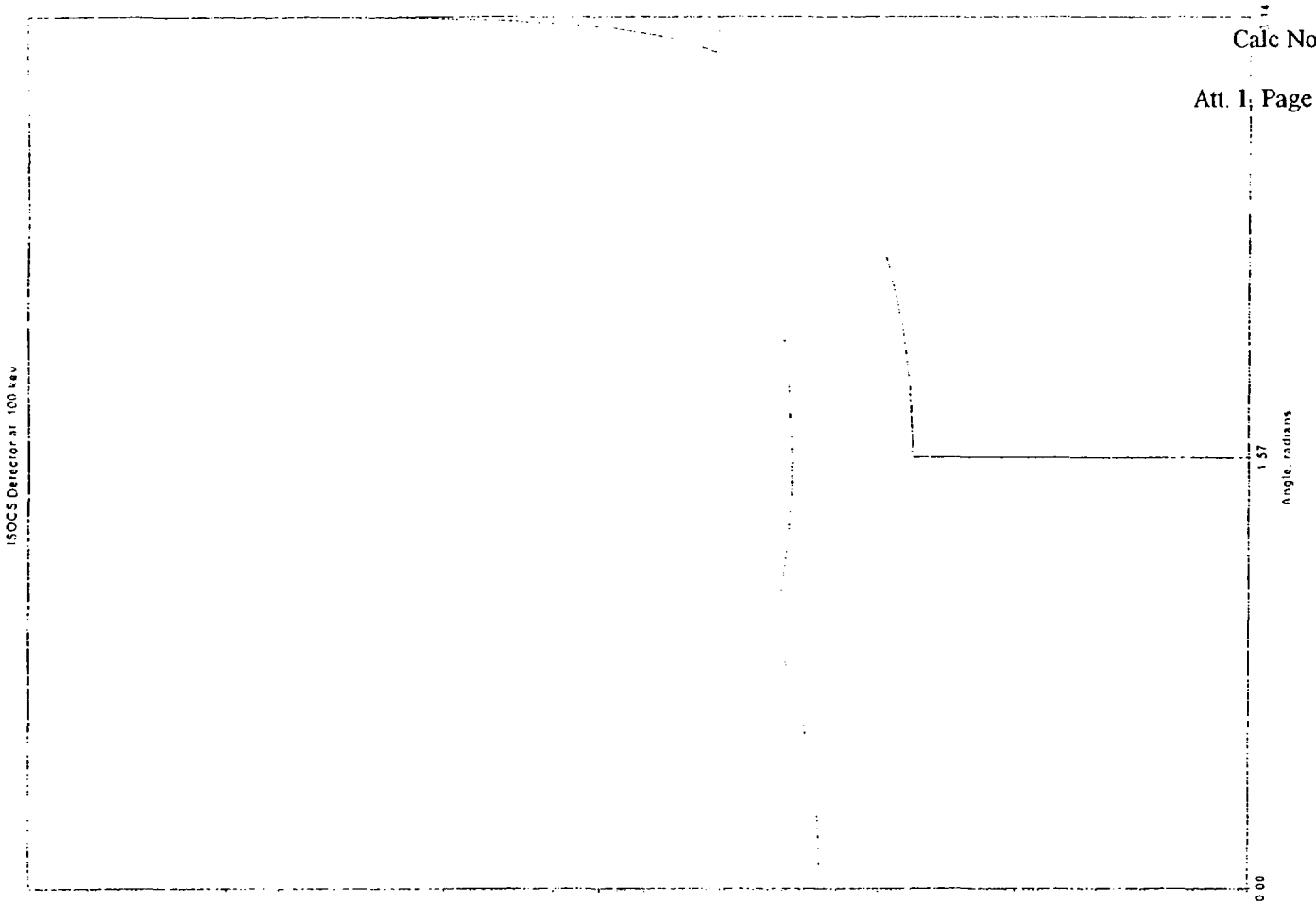
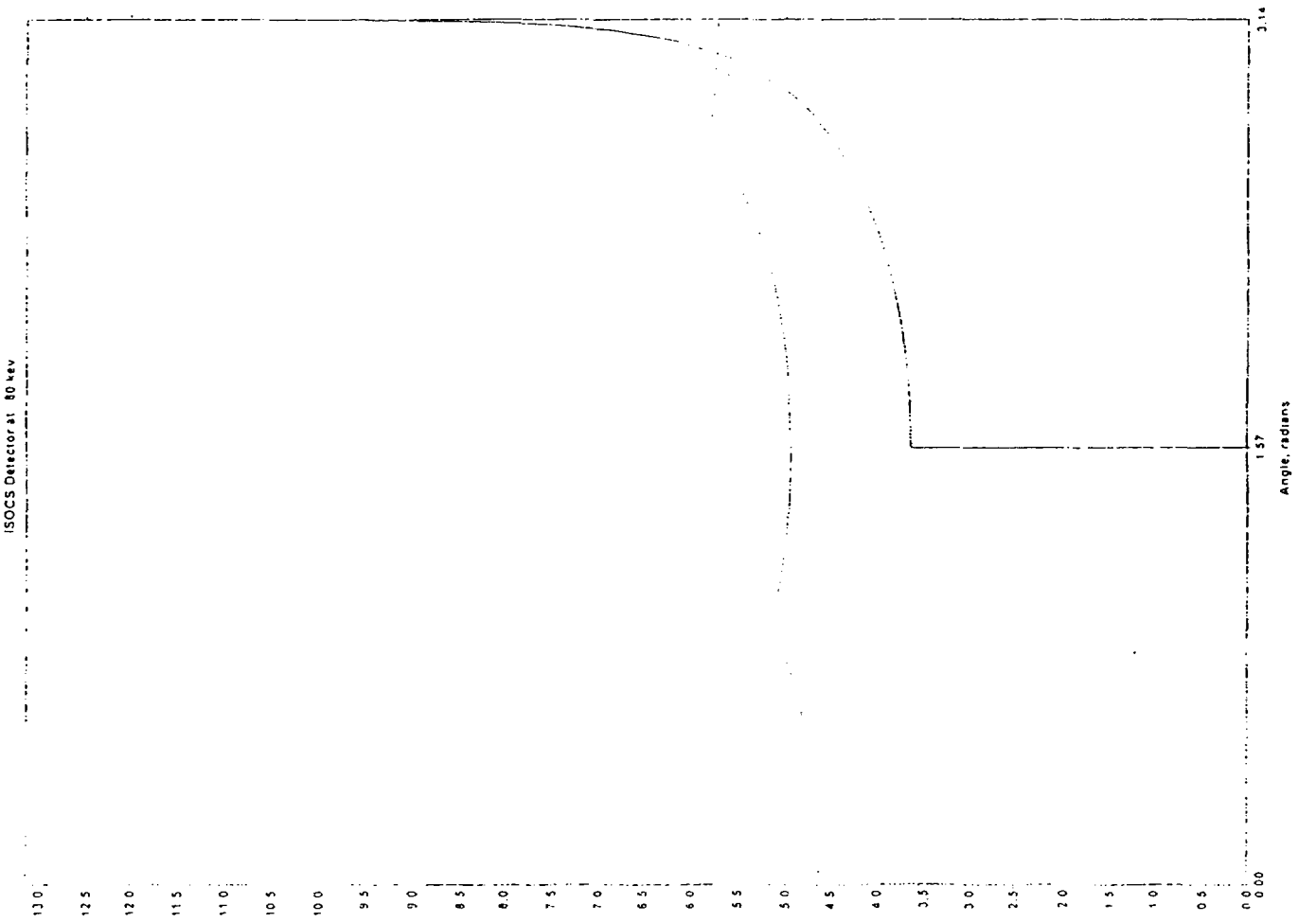
end of report

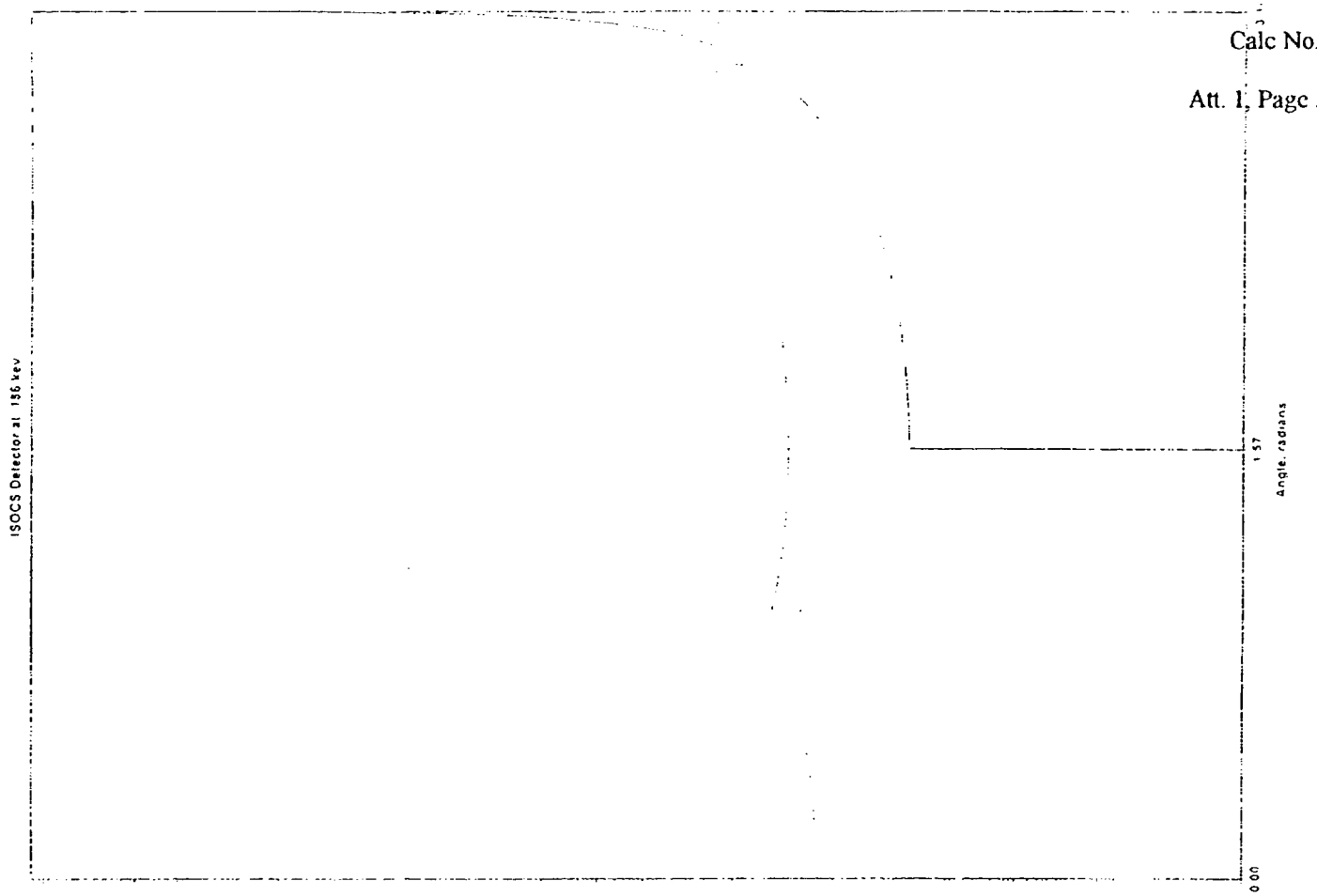
Appendix 6
Relative Deviation Contours

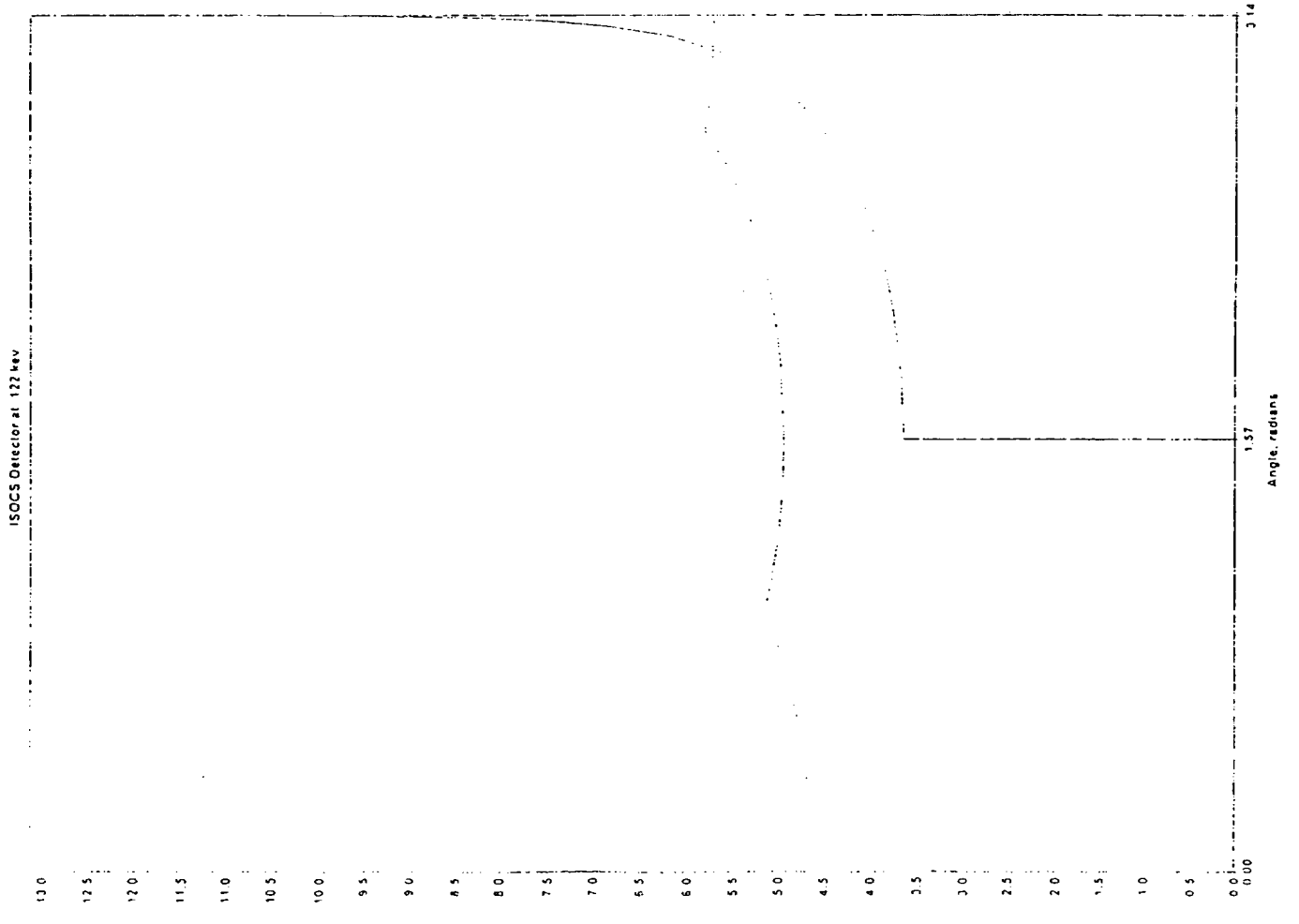

ISOCS Detector at 45 kev
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
1.57
3.14
Angle, radians

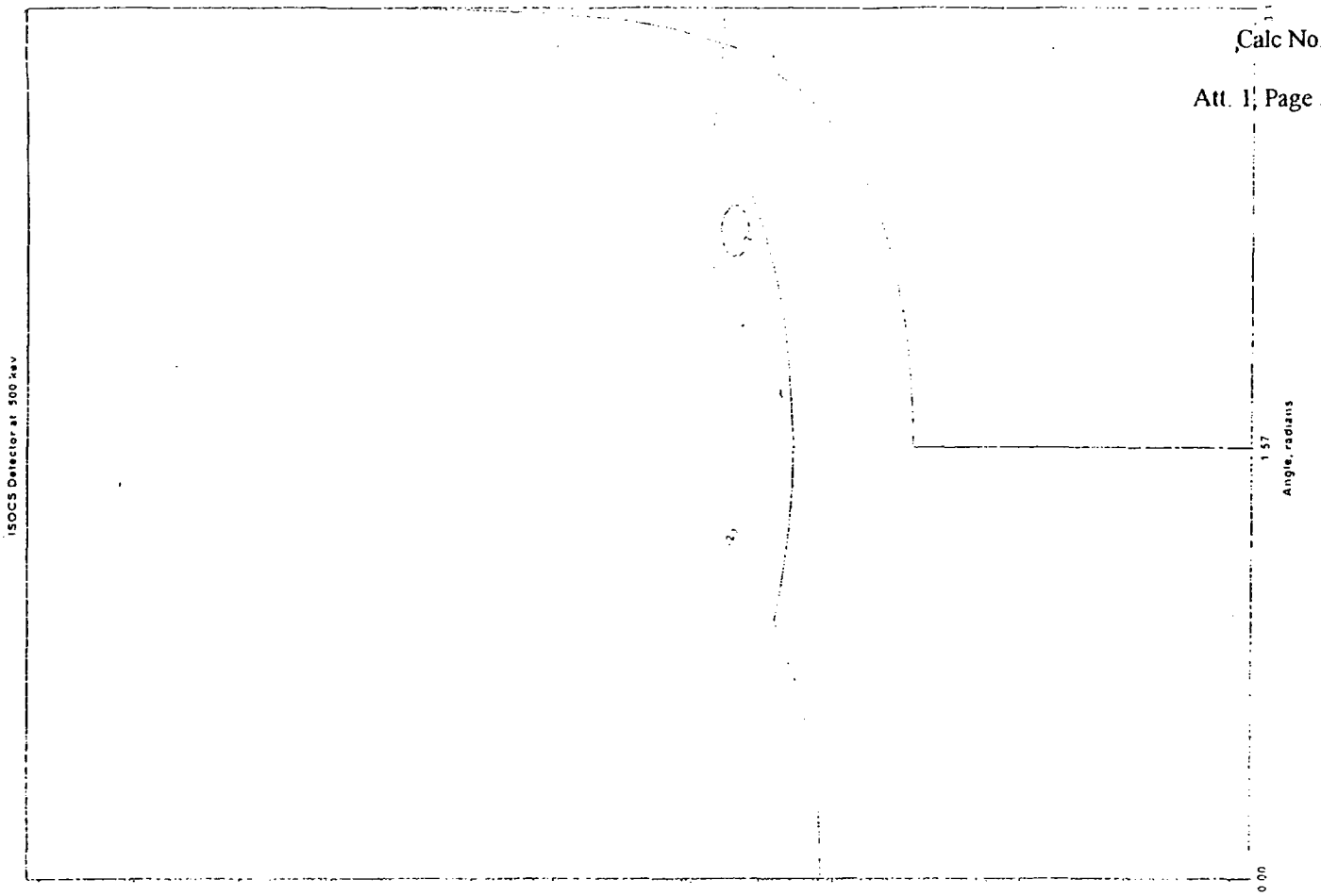

ISOCS Detector at 60 kev
0.00
1.57
Angle, radians

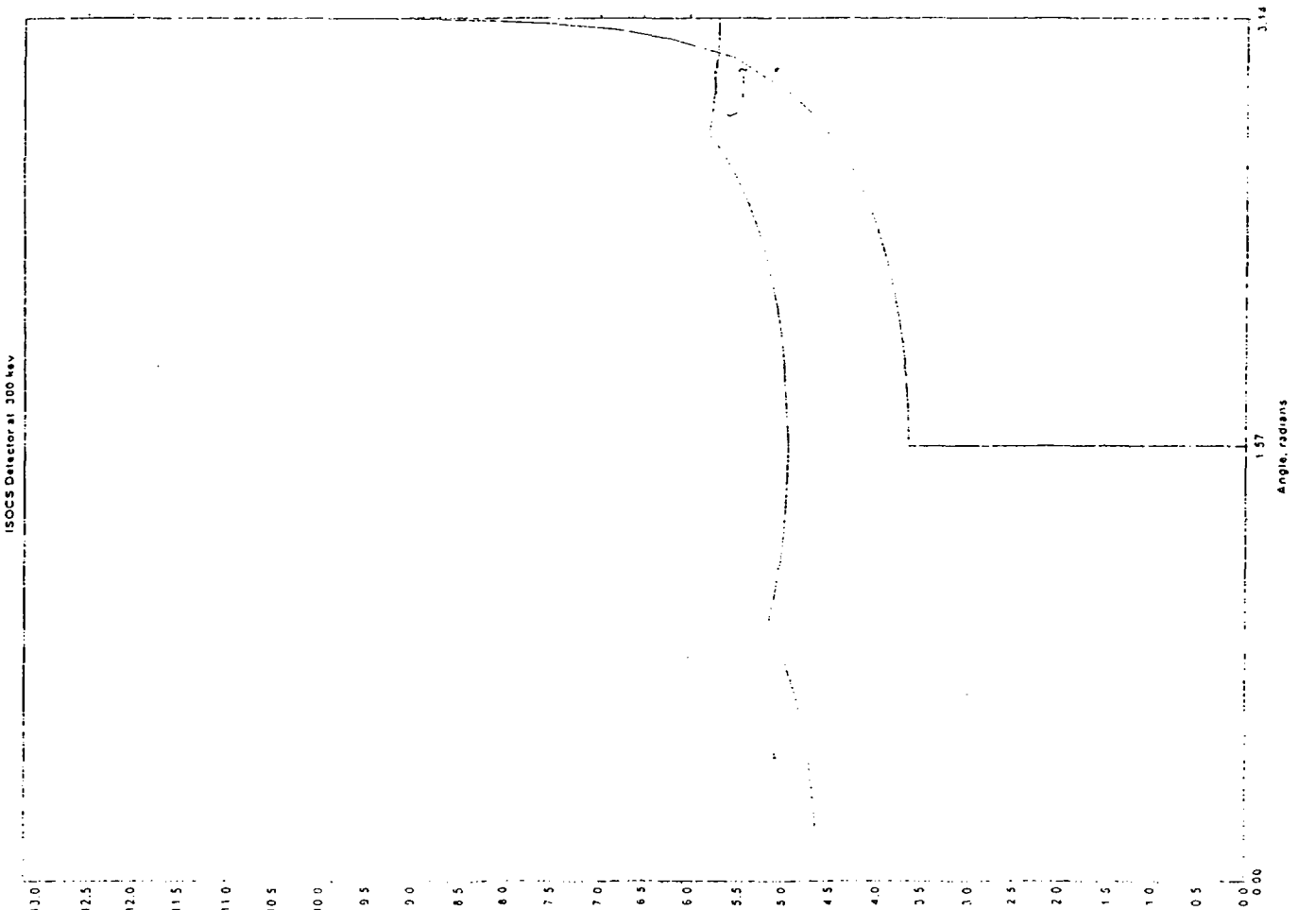

ISOCS Detector at 100 kev
0.00
1.57
Angle, radians

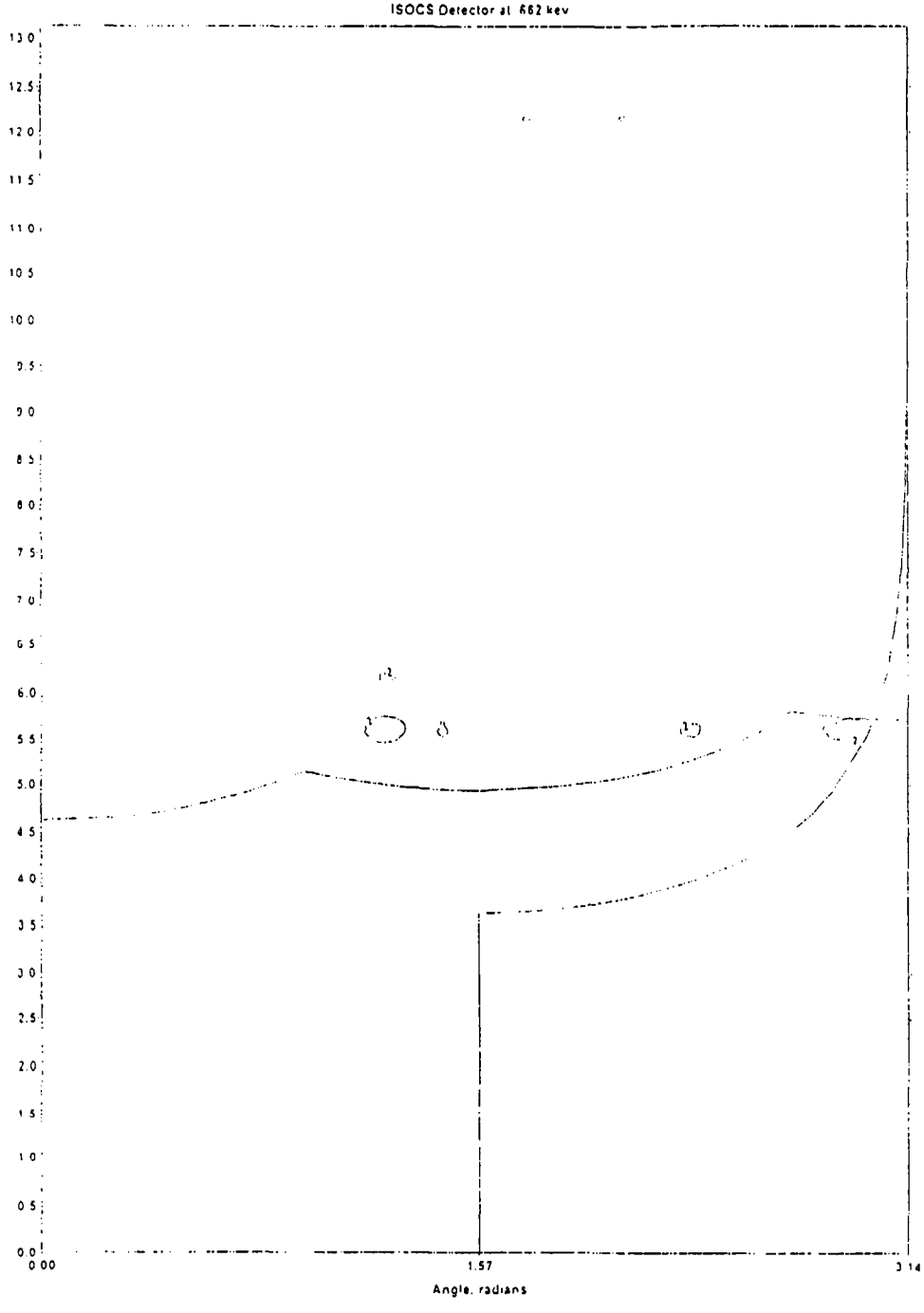

ISOCS Detector at 80 kev
0.00
1.57
3.14
Angle, radians

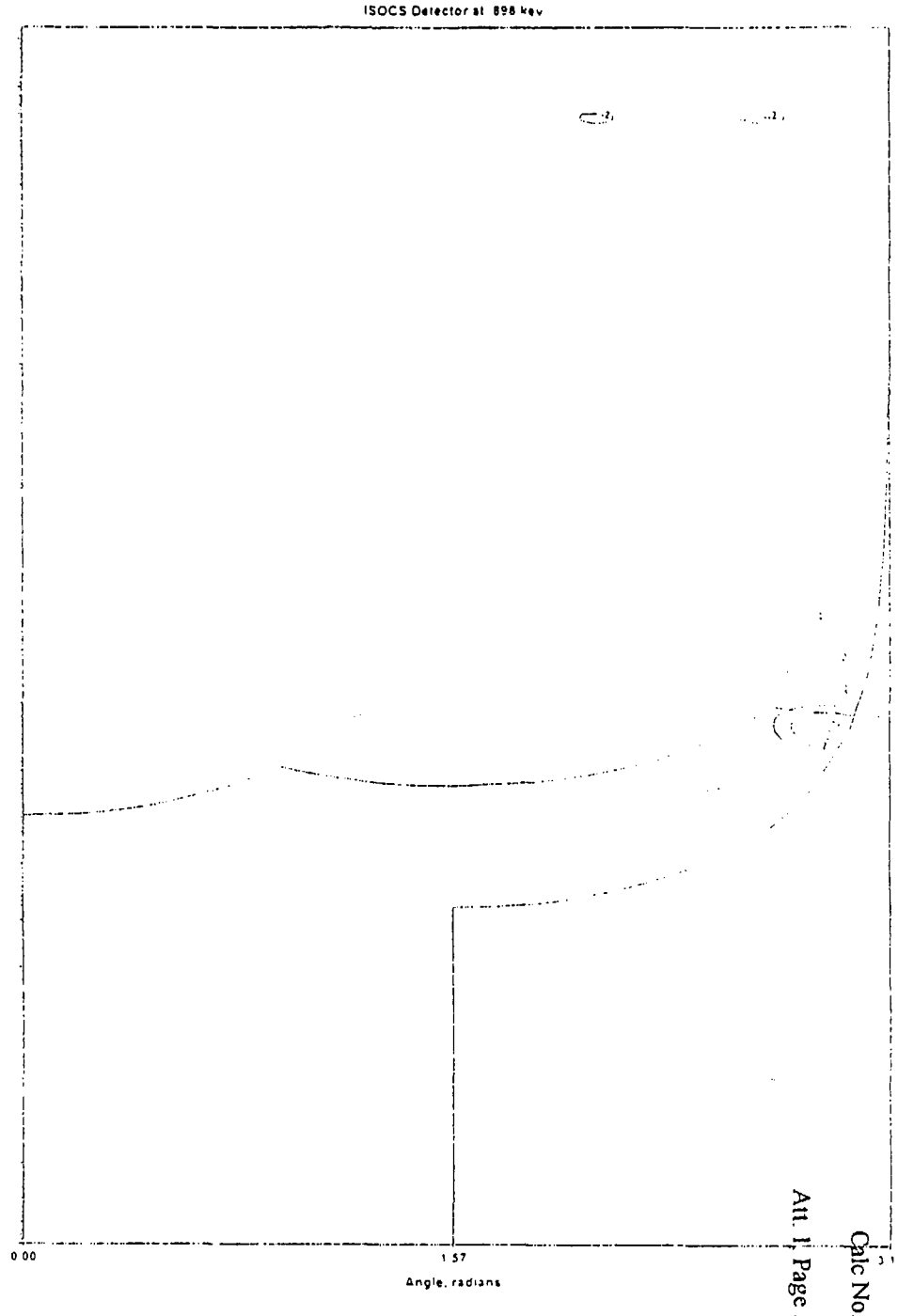

ISOCS Detector at 136 kev
0.00
1.57
3.14
Angle, radians

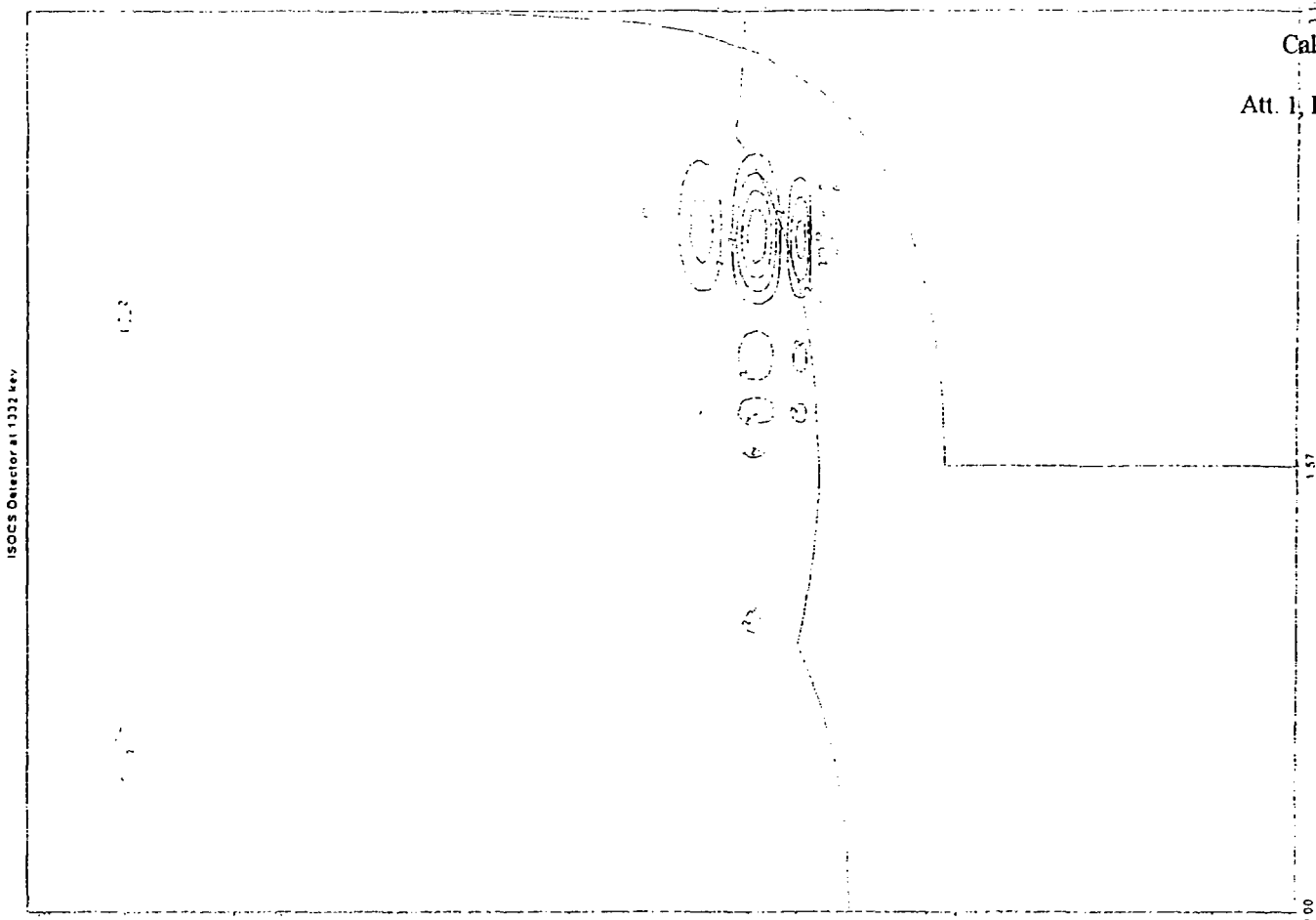

ISOCS Detector at 122 kev
0.00
1.57
3.14
Angle, radians

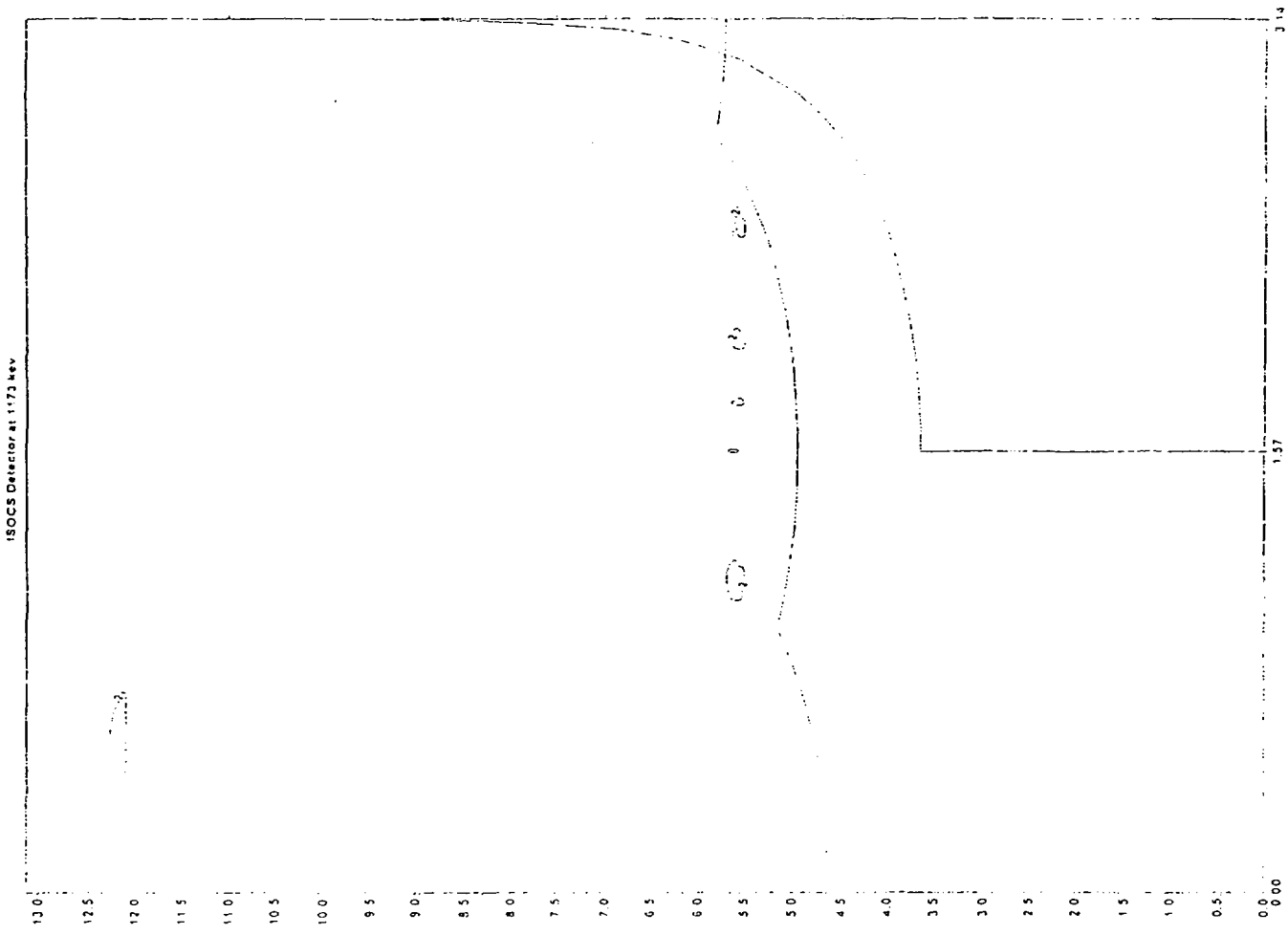

ISOCS Detector at 300 kev
Angle, radians
3.14
1.57
0.00

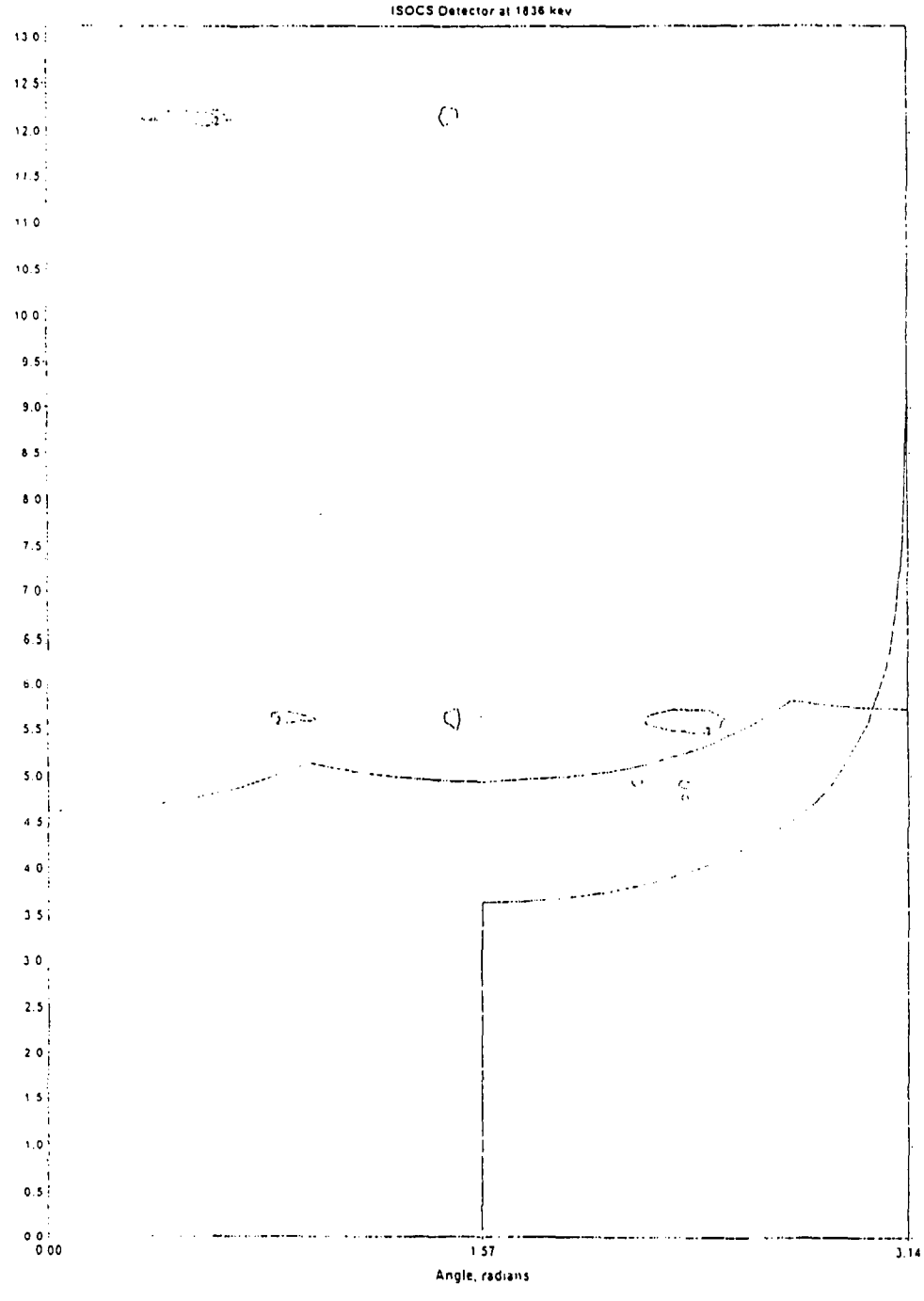

ISOCS Detector at 300 kev
Angle, radians
3.14
1.57
0.00
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.00

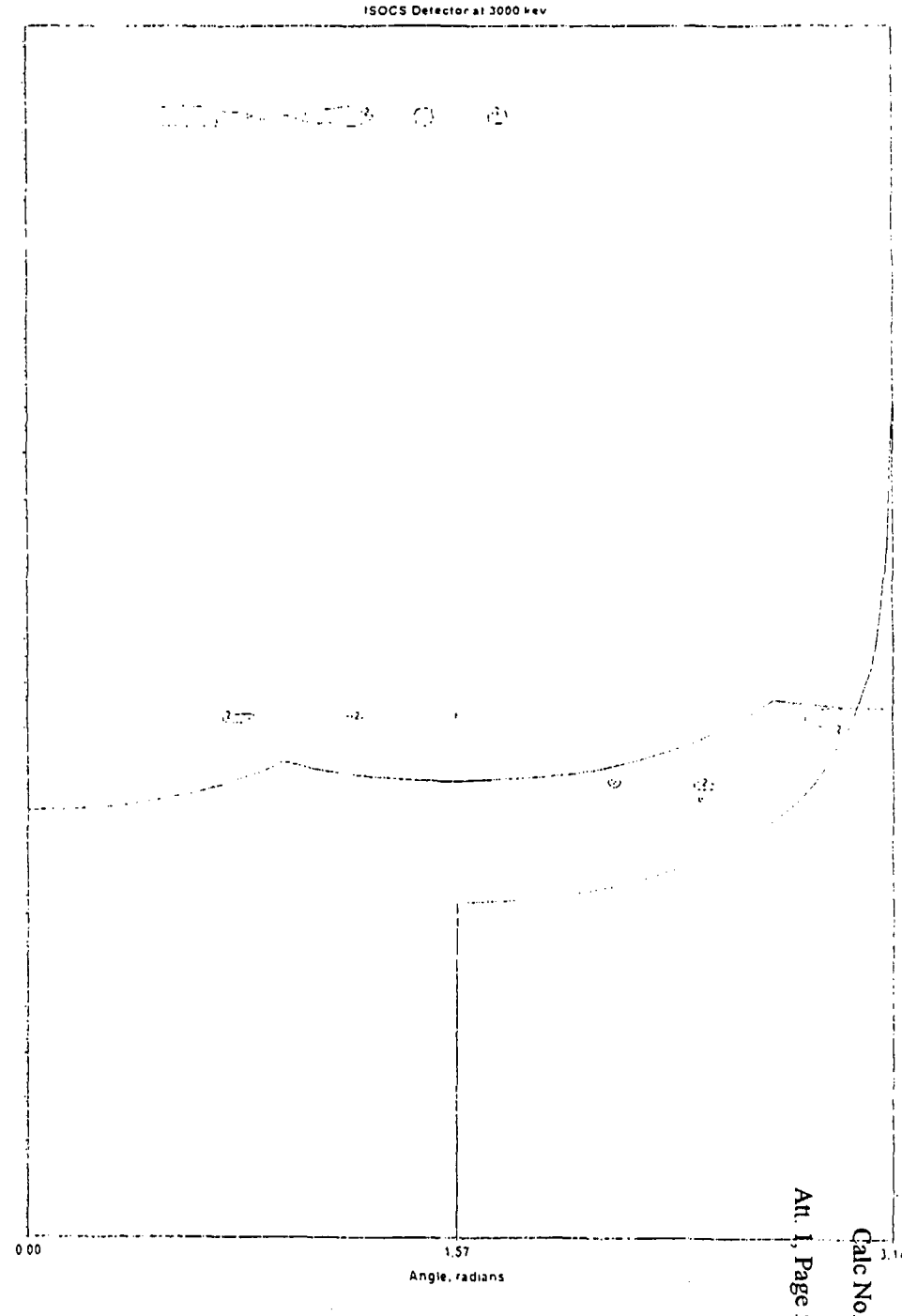

ISOCS Detector at 662 kev
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
1.57
3.14
Angle, radians

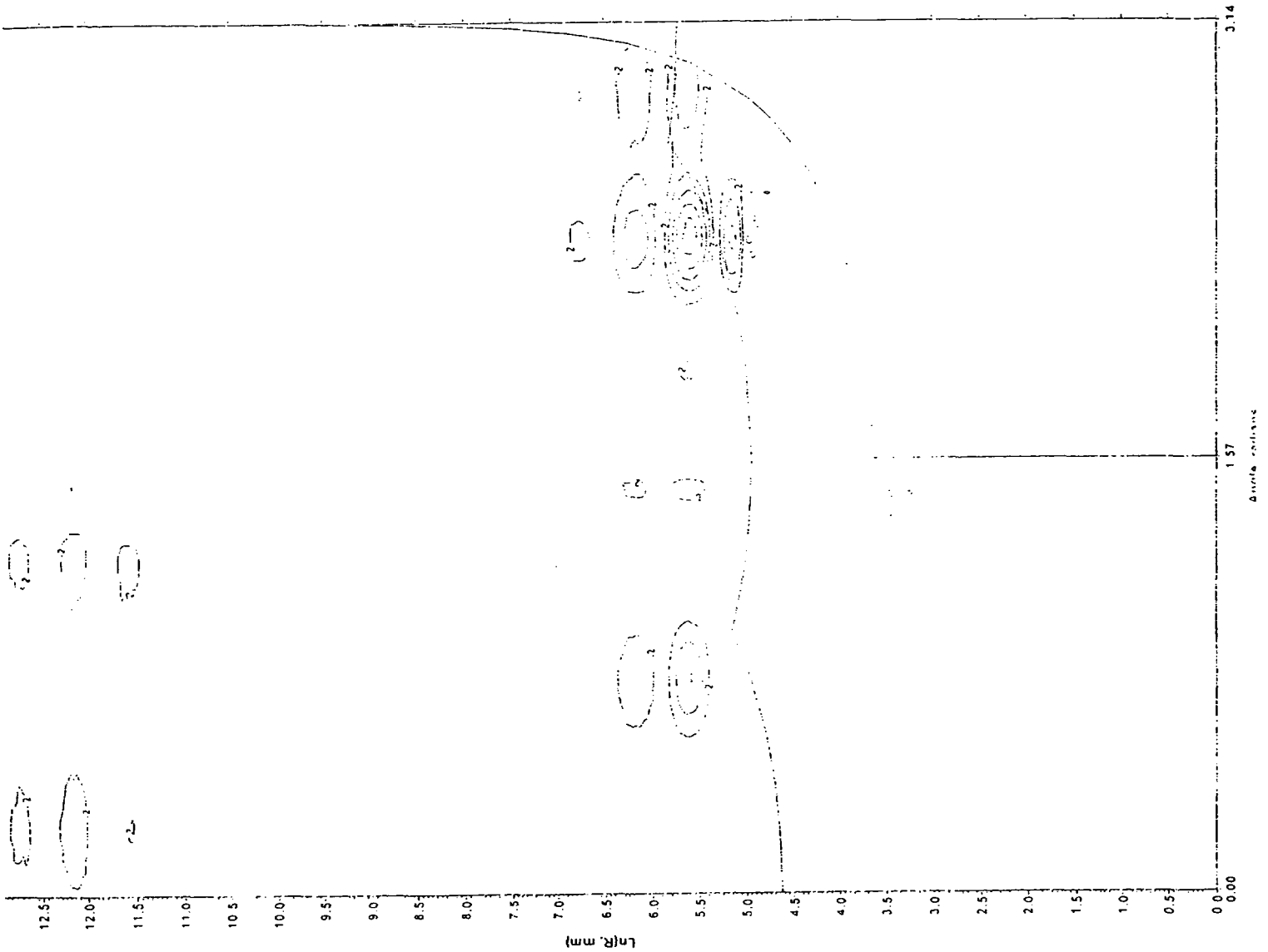

ISOCS Detector at 898 kev
0.00
1.57
Angle, radians


ISOCS Detector at 1332 kev
Angle, radians
3.14
1.57
0.00


ISOCS Detector at 1173 kev
Angle, radians
3.14
1.57
0.00
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
05
00


ISOCS Detector at 1836 kev
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
1.57
3.14
Angle, radians


ISOCS Detector at 3000 kev
0.00
1.57
3.14
Angle, radians


Ln(R, mm)
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
1.57
3.14

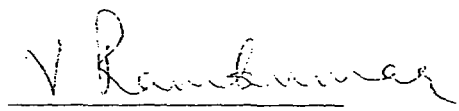
VERIFICATION OF THE ISOCS CHARACTERIZATION OF THE CANBERRA LABSOCS SYSTEM FOR MAINE YANKEE

ACK # 79813
DETECTOR S/N 7605
February 4, 2003

ISOXVRFY Measurements Performed By: Jennifer DeGumbia

ISOCS Data Analysis Performed By: Mike Field

Approved By:



Ram Venkataraman, Ph.D.

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800 Research Parkway
Meriden, CT USA

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Verification of ISOCS Characterization (ISOXVRFY)

Verification Tests:

In the Factory Integration and Test report supplied with the ISOCS characterization, validation results were provided for five geometries, namely, (i) a point source 29.04 cm away on-axis with respect to the detector, (ii) the point source 31 cm away and at 90°, (iii) the point source 31 cm away and at 135°, (iv) a glass fiber filter paper source on the endcap, and (v) the filter paper source placed a distance of 10.17 cm away from the endcap.

In this section, test results based on measurement of several additional standard source geometries are presented. The measurements were performed using the ISOCS characterized HPGe detector S/N 7605. The measurement geometries are as follows.

1. A glass fiber filter paper mounted on a Plexiglas centering plate, placed on the detector endcap (same as in the characterization measurement).
2. A 20cc acrylic cylinder with a solid resin matrix, resting on the Plexiglas centering plate, which is placed on the detector endcap.
3. A 400ml polypropylene container with a solid resin matrix, resting on the Plexiglas centering plate, which is placed on the detector endcap.
4. A 2.8-liter Marinelli beaker with a solid resin matrix, centered on the detector endcap.
5. The glass fiber filter paper at a distance of 10.17cm from the detector endcap (same as in the characterization measurement)
6. The 20cc acrylic cylinder at a distance of 10.17cm from the detector end cap.
7. The 400ml polypropylene container at a distance of 10.17cm from the detector endcap.

Refer to the attached schematic diagrams of the measurement geometries.

Each source is a multi-nuclide gamma ray standard, emitting gamma rays in the energy range from 59.5 keV (Am-241) to 1836 keV (Y-88). The measurements are performed in a shielded area, not influenced by other sources. Dedicated electronics and computer are used in acquiring data.

Verification Test Results:

The results for each of the seven verification tests are given in Tables 1 through 7 that are attached to this report. In each case, a brief description of the source-detector geometry is given at the top. Columns 1 and 2 of each table give the name of the nuclide and the energy of the gamma ray peak being measured. Column 3 gives the measured activity in units of gammas/sec, obtained using the measured peak area and the LabSOCS efficiency at the given energy. Column 4 gives the relative uncertainty (1σ) due to counting statistics. Columns 5 gives the true activity of the nuclides in units of gammas/sec at the source calibration date given in the certificate. Column 6 gives the true activity of the

Table 1. Glass Fiber Filter (48mm diameter) in contact with Detector End cap

Description:

This is a Glass Fiber Filter resting on the endcap of the detector.
The pre-defined beaker file used in the LabSOCS calculations is FILTER.BKR.
The diameter of the source matrix used in LabSOCS calculations is 48 mm.

Nuclide	Energy (keV)	Meas Activity (LabSOCS eff) gammas/s	Statistical uncertainty (1σ)		True Activity 11/15/02 gammas/s	True Activity 01/15/03 gammas/s	Source uncertainty (1σ)		Meas/True	rel. uncert (1σ)	Specified LabSOCS Uncert
Am-241	59.5	1218.3	0.18%		1211	1210.68	1.67%		1.01	1.68%	7.0%
Cd-109	88	804.8	0.17%		856.3	781.50	1.53%		1.03	1.54%	7.0%
Co-57	122	392.9	0.25%		443.4	379.52	1.37%		1.04	1.39%	7.0%
Ce-139	166	376.4	0.27%		545.9	401.51	1.47%		0.94	1.49%	6.0%
Sn-113	392	671.3	0.25%		957.3	662.97	1.40%		1.01	1.42%	6.0%
Cs-137	662	666.0	0.33%		659.4	656.86	1.60%		1.01	1.63%	4.3%
Mn-54	835	1917.4	0.19%		2254	1968.59	1.67%		0.97	1.68%	4.3%
*Y-88	898	1003.7	0.20%		1801	1211.41	1.37%		0.83	1.40%	4.3%
Zn-65	1115	1878.4	0.21%		2310	1942.33	1.67%		0.97	1.68%	4.3%
*Co-60	1173	911.6	0.31%		1152	1126.00	1.67%		0.81	1.69%	4.3%
*Co-60	1332	898.6	0.32%		1152	1126.00	1.30%		0.80	1.33%	4.3%
*Y-88	1836	988.3	0.33%		1901	1283.21	1.52%		0.77	1.57%	4.3%

* Activities of Co-60, and Y-88 are underestimated because of gamma ray cascade summing effect

Table 2. Glass Fiber Filter (48mm in diameter) 10.17 cm away from the Detector Endcap

Description:

This is a Glass Fiber Filter resting at a height of 10.17cm above the detector endcap.
The pre-defined beaker file used in the LabSOCS calculations is FILTER.BKR.
The diameter of the source matrix used in LabSOCS calculations is 48 mm

Nuclide	Energy (keV)	Meas Activity (LabSOCS eff) gammas/s	Statistical uncertainty (1σ)		True Activity 11/15/02 gammas/s	True Activity 01/15/03 gammas/s	Source uncertainty (1σ)		Meas/True	rel. uncert (1σ)	Specified LabSOCS Uncert
Am-241	59.5	1278.0	0.63%		1211	1210.68	1.67%		1.06	1.78%	7.0%
Cd-109	88	869.8	0.82%		856.3	781.50	1.53%		1.11	1.74%	7.0%
Co-57	122	401.0	1.48%		443.4	379.52	1.37%		1.06	2.02%	7.0%
Ce-139	166	433.0	1.16%		545.9	401.51	1.47%		1.08	1.87%	6.0%
Sn-113	392	722.8	0.87%		957.3	662.97	1.40%		1.09	1.65%	6.0%
Cs-137	662	706.2	1.03%		659.4	656.86	1.60%		1.08	1.91%	4.3%
Mn-54	835	2063.8	0.54%		2254	1968.59	1.67%		1.05	1.75%	4.3%
Y-88	898	1249.9	0.79%		1801	1211.44	1.37%		1.03	1.58%	4.3%
Zn-65	1115	1831.8	0.63%		2310	1942.33	1.67%		0.94	1.78%	4.3%
Co-60	1173	1135.5	0.81%		1152	1126.99	1.67%		1.01	1.85%	4.3%
Co-60	1332	1134.7	0.82%		1152	1126.99	1.40%		1.01	1.62%	4.3%
Y-88	1836	1265.6	0.81%		1907	1282.74	1.53%		0.99	1.73%	4.3%

Table 4. 20 ML Acrylic Cylinder (1.15 g/cc) 10.17cm from the Detector Endcap

Description:

This is a 20 mL Acrylic Cylinder with 1.16 g/cc active matrix resting on a 10.17cm tall cylindrical plexiglass spacer. The plexiglass spacer is placed on the detector endcap and centered.

Nuclide	Energy (keV)	Meas Activity (LabSOCS eff) gammas/s	Statistical uncertainty (1σ)		True Activity 11/15/02 gammas/s	True Activity 01/15/03 gammas/s	Source uncertainty (1σ)		Meas/True	rel. uncert (1σ)	Specified LabSOCS Uncert.
Am-241	59.5	2549.6	0.85%		2365	2364.37	1.67%		1.08	1.87%	7.0%
Cd-109	88	1740.4	1.00%		1673	1526.87	1.53%		1.14	1.83%	7.0%
Co-57	122	816.9	1.71%		866	741.23	1.37%		1.10	2.19%	7.0%
Ce-139	166	841.0	1.39%		1066	784.05	1.47%		1.07	2.02%	6.0%
Sn-113	392	1443.9	1.02%		1870	1295.06	1.40%		1.11	1.73%	6.0%
Cs-137	662	1394.4	1.29%		1288	1283.04	1.60%		1.09	2.05%	4.3%
Mn-54	835	4047.2	0.67%		4401	3843.73	1.67%		1.05	1.80%	4.3%
Y-88	898	2438.7	0.96%		3518	2366.38	1.37%		1.03	1.67%	4.3%
Zn-65	1115	3684.5	0.76%		4512	3793.86	1.67%		0.97	1.83%	4.3%
Co-60	1173	2267.9	0.98%		2250	2201.16	1.67%		1.03	1.93%	4.3%
Co-60	1332	2216.3	0.99%		2251	2202.14	1.40%		1.01	1.71%	4.3%
Y-88	1836	2437.1	0.97%		3725	2505.62	1.53%		0.97	1.82%	4.3%

Table 5. 400 ML Cylinder (1.15 g/cc) on the Detector Endcap

Description:

This is a 400 mL polypropylene container with 1.15 g/cc active matrix resting on a 0.3175cm thick plexiglass centering plate. The plexiglass plate is on top of the detector endcap.

Nuclide	Energy (keV)	Meas Activity (LabSOCS eff) gammas/s	Statistical uncertainty (1σ)		True Activity 11/15/02 gammas/s	True Activity 01/15/03 gammas/s	Source uncertainty (1σ)		Meas/True	rel uncert (1σ)	Specified LabSOCS Uncert.
Am-241	59.5	5482.4	0.37%		5046	5044.65	1.67%		1.09	1.71%	7.0%
Cd-109	88	3595.5	0.35%		3569	3257.25	1.53%		1.10	1.57%	7.0%
Co-57	122	1716.0	0.54%		1848	1581.76	1.37%		1.08	1.47%	7.0%
Ce-139	166	1769.4	0.52%		2275	1673.28	1.47%		1.06	1.56%	6.0%
Sn-113	392	2983.8	0.45%		3990	2763.26	1.40%		1.08	1.47%	6.0%
Cs-137	662	2872.5	0.57%		2748	2737.42	1.60%		1.05	1.70%	4.3%
Mn-54	835	8229.9	0.30%		9392	8202.75	1.67%		1.00	1.69%	4.3%
*Y-88	898	4811.7	0.43%		7507	5049.89	1.37%		0.95	1.43%	4.3%
Zn-65	1115	7928.6	0.32%		9627	8094.73	1.67%		0.98	1.70%	4.3%
*Co-60	1173	4237.4	0.44%		4801	4696.79	1.57%		0.90	1.72%	4.3%
*Co-60	1332	4283.9	0.15%		4802	4697.77	1.40%		0.91	1.42%	4.3%
*Y-88	1836	4661.7	0.46%		7044	5345.55	1.53%		0.87	1.60%	4.3%

* Activities of Co-60, and Y-88 are underestimated because of gamma ray cascade summing losses

Table 6. 400 ML Cylinder (1.15 g/cc) 10.17cm from the Detector Endcap

Description:

This is a 400 mL polypropylene container with 1.15 g/cc active matrix resting on a 10.17cm tall cylindrical plexiglass spacer. The plexiglass spacer is placed on the detector endcap and centered.

Nuclide	Energy (keV)	Meas Activity (LabSOCS eff) gammas/s	Statistical uncertainty (1σ)		True Activity 11/15/02 gammas/s	True Activity 01/15/03 gammas/s	Source uncertainty (1σ)		Meas/True	rel. uncert (1σ)	Specified LabSOCS Uncert.
Am-241	59.5	5392.1	0.75%		5046	5044.65	1.67%		1.07	1.83%	7.0%
Cd-109	88	3496.1	0.86%		3569	3257.25	1.53%		1.07	1.76%	7.0%
Co-57	122	1714.5	1.38%		1848	1581.76	1.37%		1.08	1.94%	7.0%
Ce-139	166	1749.1	1.26%		2275	1673.28	1.47%		1.05	1.93%	6.0%
Sn-113	392	2958.2	0.87%		3990	2763.26	1.40%		1.07	1.65%	6.0%
Cs-137	662	2938.2	1.05%		2748	2737.42	1.60%		1.07	1.91%	4.3%
Mn-54	835	8460.7	0.53%		9392	8202.75	1.67%		1.03	1.75%	4.3%
Y-88	898	5159.9	0.74%		7507	5049.59	1.37%		1.02	1.55%	4.3%
Zn-65	1115	8031.4	0.59%		9627	8094.73	1.67%		0.99	1.77%	4.3%
Co-60	1173	4761.0	0.78%		4801	4696.79	1.67%		1.01	1.84%	4.3%
Co-60	1332	4709.4	0.77%		4802	4697.77	1.40%		1.00	1.60%	4.3%
Y-88	1836	5183.6	0.77%		7947	5345.55	1.53%		0.97	1.72%	4.3%

Table 7. 2.8L MARINELLI BEAKER (1.15 g/cc) on the Detector Endcap

Description:

This is a 2.8L Marinelli Beaker with 1.16 g/cc active matrix resting on the endcap of the detector.

Nuclide	Energy (keV)	Meas Activity (LabSOCS eff) gammas/s	Statistical uncertainty (1σ)		True Activity 11/15/02 gammas/s	True Activity 01/15/03 gammas/s	Source uncertainty (1σ)		Meas/True	rel. uncert (1σ)	Specified LabSOCS Uncert.
Am-241	59.5	5453.8	0.51%		5604	5602.50	1.67%		0.97	1.74%	7.0%
Cd-109	88	3533.4	0.45%		3581	3268.21	1.53%		1.08	1.60%	7.0%
Co-57	122	1693.9	0.71%		1854	1586.89	1.37%		1.07	1.54%	7.0%
Ce-139	166	1773.2	0.62%		2283	1679.17	1.47%		1.06	1.59%	6.0%
Sn-113	392	3004.4	0.48%		4004	2772.95	1.40%		1.08	1.48%	6.0%
Cs-137	662	2968.3	0.61%		2758	2747.39	1.60%		1.08	1.71%	4.3%
Mn-54	835	8496.1	0.32%		9425	8231.57	1.67%		1.03	1.70%	4.3%
*Y-88	898	5064.5	0.47%		7533	5067.07	1.37%		1.00	1.44%	4.3%
Zn-65	1115	8532.7	0.35%		9661	8123.32	1.67%		1.05	1.70%	4.3%
*Co-60	1173	4719.7	0.48%		4818	4715.42	1.67%		1.00	1.73%	4.3%
*Co-60	1332	4653.4	0.49%		4819	4714.40	1.40%		0.99	1.18%	4.3%
*Y-88	1836	5169.1	0.49%		7975	5364.39	1.53%		0.96	1.61%	4.3%

* Activities of Co-60, and Y-88 are underestimated because of gamma ray cascade summing losses

ISOXVRFY Measurement Results

Figure 1. Glass Fiber Filter Paper on Endcap

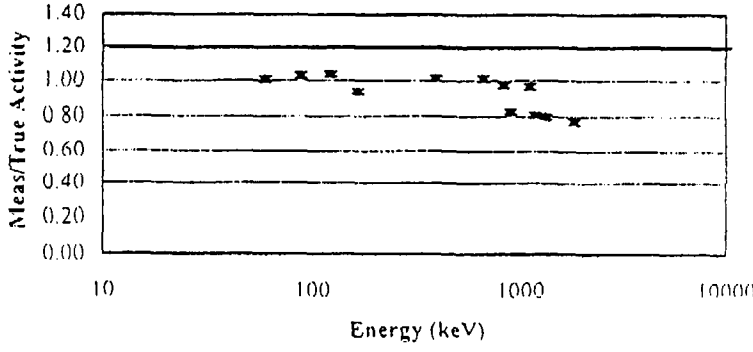


Figure 2. Glass Fiber Filter Paper 10.17 cm away

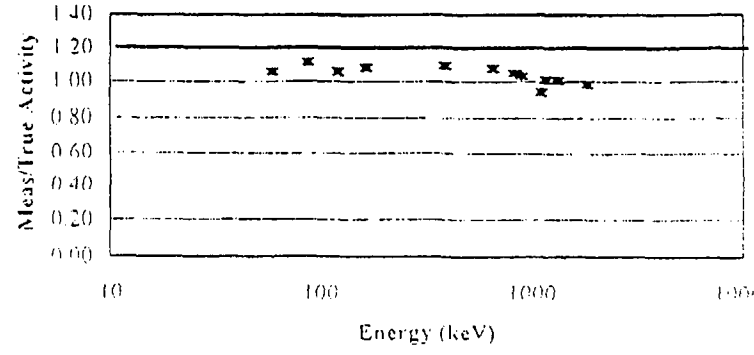


Figure 3. 20ml Acrylic Cylinder on Endcap

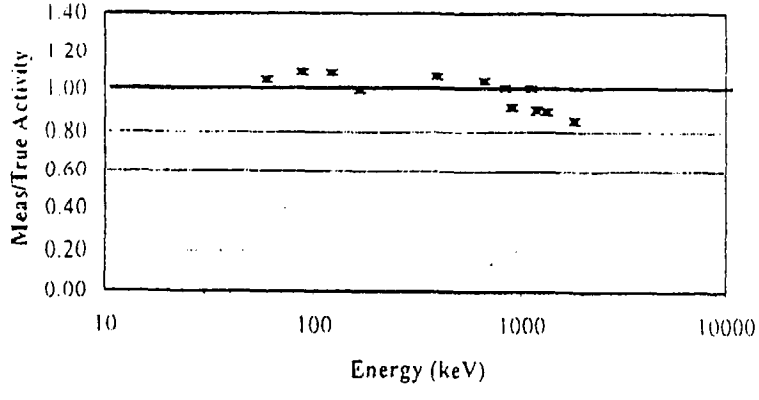


Figure 4. 20ml Acrylic Cylinder 10.17 cm away

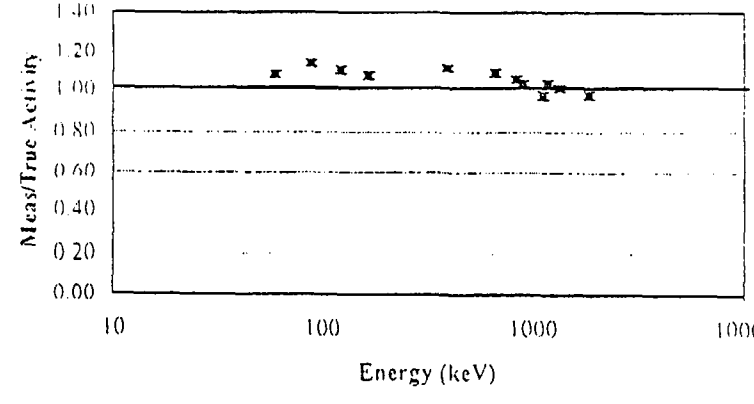


Figure 5. 400ml Cylinder on Endcap

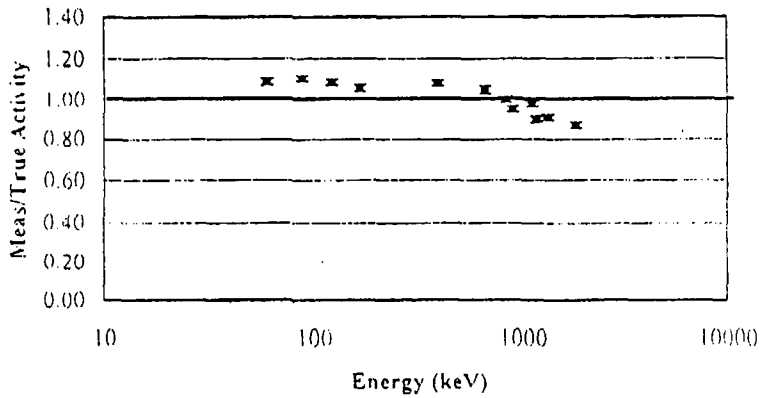


Figure 6. 400ml Cylinder 10.17 cm away

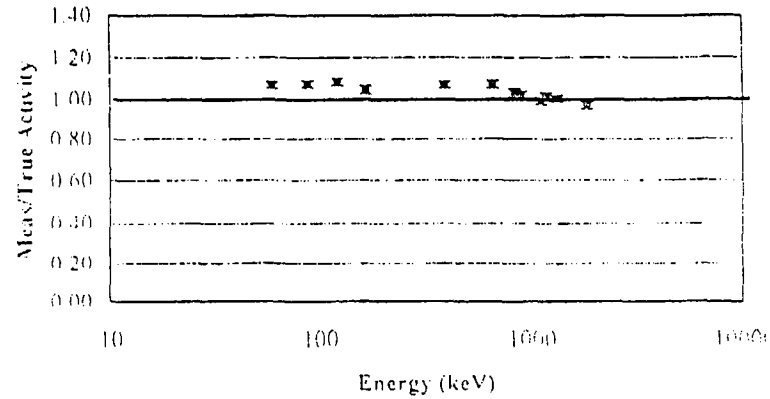
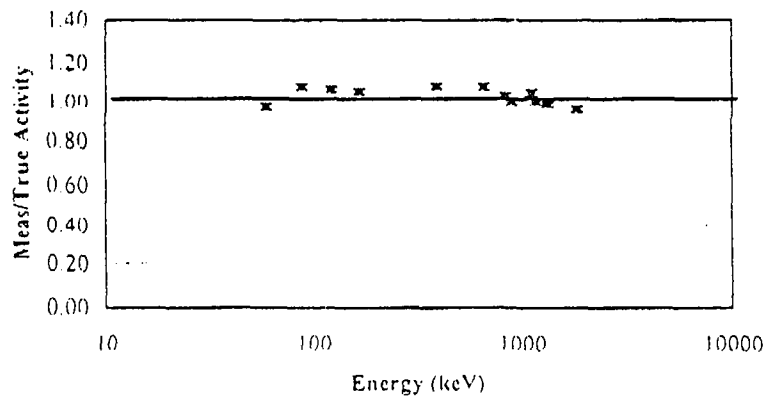
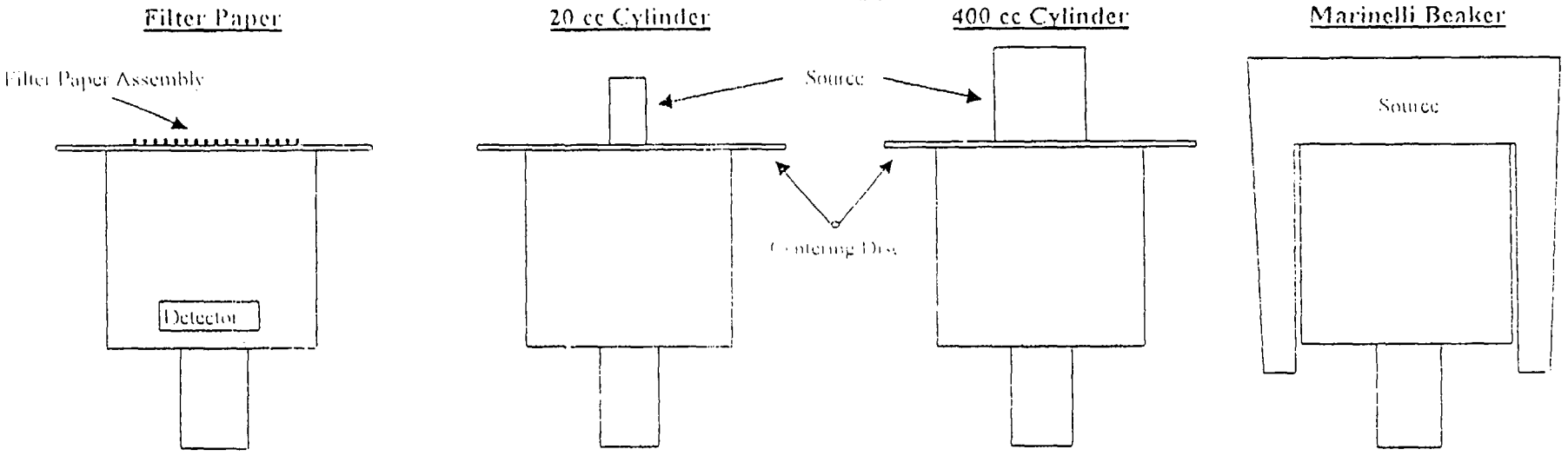


Figure 7. 2.8 Liter Marinelli Beaker

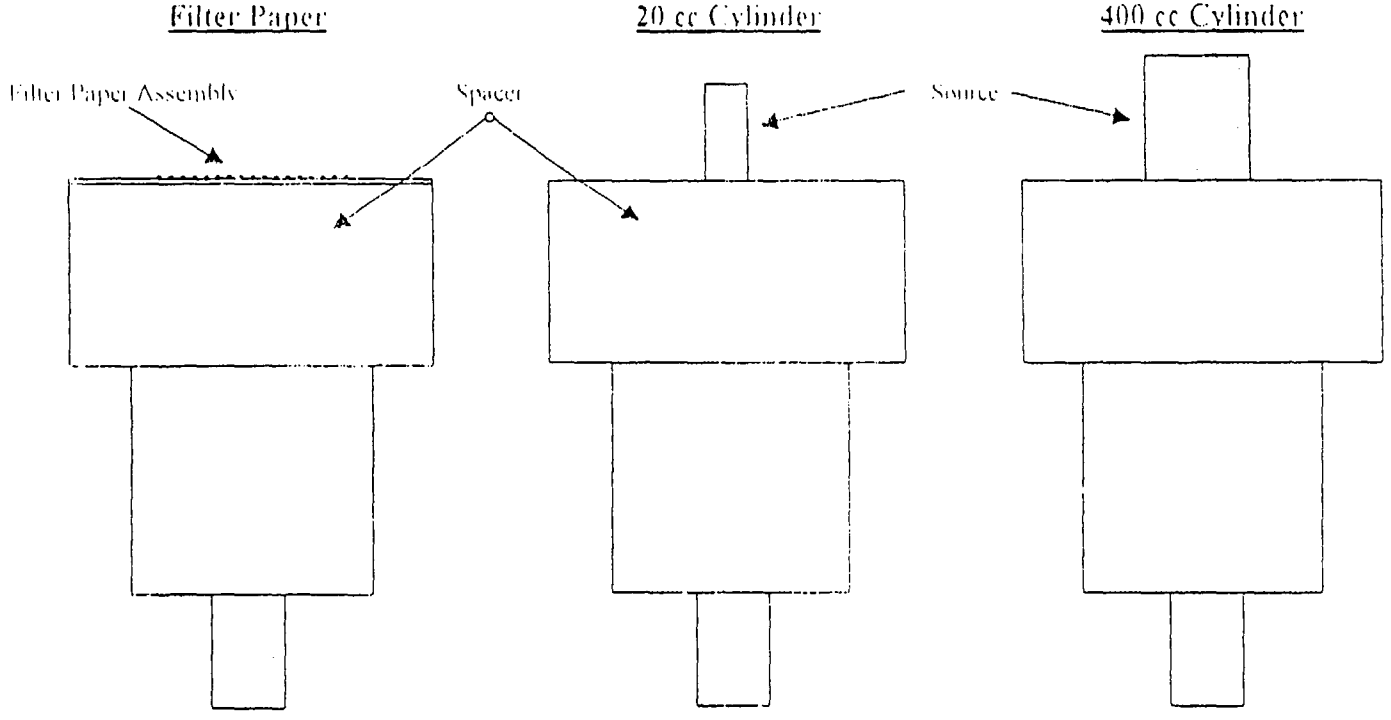


Schematic Drawings of ISOXVRFY Geometries

POSITION 1



POSITION 2



ISOXVRFY Source Certificates

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 - U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

64322J-121

20 mL Solid in Custom Acrylic Cylinder

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide sources. The master Cr-51, Sr-85, Mn-54, and Zn-65 sources were calibrated in an ion chamber that was calibrated by the National Physical Laboratory Teddington, U.K. and is directly traceable to national standards. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using germanium gamma spectrometer systems. Calibration and purity of the final mixture were confirmed using germanium gamma spectrometer systems. At the calibration time no interfering gamma-ray emitting impurities were detected. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in US NRC Regulatory Guide 4.15, Revision 1, February, 1979. The certified emission rates in gamma rays per second (GPS) from this standard source are listed below. US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776. Density of solid matrix 1.15 g/cc.

Calibration Date: November 15, 2002 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432.2	y	2368	4.5
Cd-109	88	462.6	d	1675	4.9
Co-57	122	271.79	d	867.2	4.2
Ce-139	166	137.6	d	1068	4.1
Cr-51	320	27.70	d	4523	4.0
Sn-113	392	115.1	d	1872	3.9
Sr-85	514	64.84	d	3587	4.1
Cs-137	662	30.07	y	1290	4.4
Mn-54	835	312.1	d	4407	4.0
Y-88	898	106.6	d	3523	3.8
Zn-65	1116	244.3	d	4518	4.0
Co-60	1173	5.271	y	2253	4.0
Co-60	1332	5.271	y	2254	3.9
Y-88	1836	106.6	d	3730	3.9

P O NUMBER: 78926AA, Item 3 (C12580-3)

SOURCE PREPARED BY: M Taskaeva for
E. A. Taskaev, Production Manager

Q A APPROVED: ACM 11/11/02

This standard will expire one year after the calibration date.

ANALYTICS

3380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

64321A-121

400 mL Solid in 400 mL PP MRP Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide sources. The master Cr-51, Sr-85, Mn-54, and Zn-65 sources were calibrated in an ion chamber that was calibrated by the National Physical Laboratory Teddington, U.K. and is directly traceable to national standards. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using germanium gamma spectrometer systems. Calibration and purity of the final mixture were confirmed using germanium gamma spectrometer systems. At the calibration time no interfering gamma-ray emitting impurities were detected. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in US NRC Regulatory Guide 4.15, Revision 1, February, 1979. The certified emission rates in gamma rays per second (GPS) from this standard source are listed below. US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776. Density of solid matrix 1.15 g/cc.

Calibration Date: November 15, 2002 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432.2	y	4941	4.5
Cd-109	88	462.6	d	3495	4.9
Co-57	122	271.79	d	1809	4.2
Ce-139	166	137.6	d	2228	4.1
Cr-51	320	27.70	d	9437	4.0
Sn-113	392	115.1	d	3907	3.9
Sr-85	514	64.84	d	7484	4.1
Cs-137	662	30.07	y	2691	4.4
Mn-54	835	312.1	d	9192	4.0
Y-88	898	106.6	d	7351	3.8
Zn-65	1116	244.3	d	9426	4.0
Co-60	1173	5.271	y	4701	4.0
Co-60	1332	5.271	y	4702	3.9
Y-88	1836	106.6	d	7782	3.9

P O NUMBER: 78926AA, Item 2 (C12580-2)

SOURCE PREPARED BY: M Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: 11/13/02

This standard will expire one year after the calibration date.

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

64320A-121

2.8 Liter Solid in 445N GA-MA Beaker

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide sources. The master Cr-51, Sr-85, Mn-54, and Zn-65 sources were calibrated in an ion chamber that was calibrated by the National Physical Laboratory Teddington, U.K. and is directly traceable to national standards. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using germanium gamma spectrometer systems. Calibration and purity of the final mixture were confirmed using germanium gamma spectrometer systems. At the calibration time no interfering gamma-ray emitting impurities were detected. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in US NRC Regulatory Guide 4.15, Revision 1, February, 1979. The certified emission rates in gamma rays per second (GPS) from this standard source are listed below. US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776. Density of solid matrix 1.15 g/cc.

Calibration Date: November 15, 2002 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432.2	y	4908	4.5
Cd-109	88	462.6	d	3471	4.9
Co-57	122	271.79	d	1797	4.2
Ce-139	166	137.6	d	2213	4.1
Cr-51	320	27.70	d	9373	4.0
Sn-113	392	115.1	d	3880	3.9
Sr-85	514	64.84	d	7434	4.1
Cs-137	662	30.07	y	2673	4.4
Mn-54	835	312.1	d	9134	4.0
Y-88	898	106.6	d	7301	3.8
Zn-65	1116	244.3	d	9363	4.0
Co-60	1173	5.271	y	4670	4.0
Co-60	1332	5.271	y	4671	3.9
Y-88	1836	106.6	d	7730	3.9

P O NUMBER: 78926AA, Item 1 (C12580-1)

SOURCE PREPARED BY: M Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: [signature] 11/13/02

This standard will expire one year after the calibration date.

Atlanta, Georgia 30318 U.S.A.
Phone (404) 352-8677
Fax (404) 352-2837

03-04

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

65057-121

2 Inch Diameter Glass Fiber Filter in Tape

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide sources. The master Cr-51, Sr-85, Mn-54, and Zn-65 sources were calibrated in an ion chamber that was calibrated by the National Physical Laboratory Teddington, U.K. and is directly traceable to national standards. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using germanium gamma spectrometer systems. Calibration and purity of the final mixture were confirmed using germanium gamma spectrometer systems. At the calibration time no interfering gamma-ray emitting impurities were detected. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in US NRC Regulatory Guide 4.15, Revision 1, February, 1979. The certified emission rates in gamma rays per second (GPS) from this standard source are listed below.

Calibration Date: November 15, 2002 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432.2	y	1211	4.5
Cd-109	88	462.6	d	856.3	4.9
Co-57	122	271.79	d	443.4	4.2
Ce-139	166	137.6	d	545.9	4.1
Cr-51	320	27.70	d	2313	4.0
Sn-113	392	115.1	d	957.3	3.9
Sr-85	514	64.84	d	1834	4.1
Cs-137	662	30.07	y	659.4	4.4
Mn-54	835	312.1	d	2254	4.0
Y-88	898	106.6	d	1801	3.8
Zn-65	1116	244.3	d	2310	4.0
Co-60	1173	5.271	y	1152	4.0
Co-60	1332	5.271	y	1152	3.9
Y-88	1836	106.6	d	1907	3.9

Diameter of active area: 2 inch

P O NUMBER: C33347, Rev., Item 4

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: M. Mc 12-23-02

This standard will expire one year after the calibration date.

Attachment 2

Calibration Geometries

Note: These are prested to demonstrate the input parameters required to produce an ISOCS geometry for a particular detector. Output can be compared by applying different geometries to analysis routines applied to a spectrum count acquired by the detector.

DEVELOPMENT OF ISOCS COUNT GEOMETRIES FOR UNDERWATER SURVEY APPLICATIONS

PURPOSE

The purpose is to document and provide a discussion of the method of developing and applying various In-Situ Object Counting System (ISOCS) geometries for the Forebay remediation project.

INTRODUCTION

The ISOCS system uses a different approach to calibration than traditional radiation monitoring instruments. The calibration is primarily a mathematical model generated by the manufacturer (Canberra Industries, Inc.). While building an ISOCS system, Canberra performs a characterization of the detector where multiple counts are performed using sources in various geometrical relationships to the detector. This data is then input into a Monte Carlo Numerical Processor (MCNP) which mathematically generates efficiency information for that specific detector. A characterization file is then created that records how that particular detector will respond to a source (or sources) with information regarding the geometric relationships for the measurements.

Once the ISOCS system has been received, the user simply has to determine their particular analytical needs... i.e. what energy range and what peak resolution is desired. With that determined, an energy calibration is performed that tells the software the location of energy peaks as per the user preferences. A generic efficiency calibration is also done so that an accurate record of the detector response to the calibration source may be maintained. In actual use, the generic efficiency calibration is replaced by the MCNP generated ISOCS efficiency calibration.

GEOMETRY COMPONENTS

The ISOCS software includes a component, the 'Geometry Composer', that aids the user in creating the necessary data file that will then be combined with the detector characterization to generate the efficiency curve. Canberra provides numerous templates that cover a range of generic counting needs. These templates address the vast majority of applications for the use of the ISOCS system. The more geometry components the user can identify and provide to the count software, the more accurate the analysis will be.

Common to all templates is the ability to specify the detector used, whether collimation was used and which type, and if the detector was in a housing (such as a submarine) and the associated parameters of that housing. The user can also specify environmental conditions such as temperature, barometric pressure, and relative humidity. While these features may have use in some instances, for the Forebay project, the default values were used.

The template used for the Forebay geometries was the 'circular plane'. This template provides for a circular detection area with sidewalls, ten layers of contaminated materials and two absorber layers. The sidewalls have data fields for wall thickness and diameter, material, and density. Each contaminated layer requires a thickness value, a material, density and relative concentration. For the Forebay project, a checkbox for 'water' as the 'Housing outside material' in the housing parameters screen was utilized, therefore no absorber layers were used.

DEVELOPMENT OF ISOCS COUNT GEOMETRIES FOR UNDERWATER SURVEY APPLICATIONS

GEOMETRY CREATION AND APPLICATION

The basic concept used in creating the count geometries was to utilize up to three layers of material. These layers would be the defined contaminated layer and up to two shielding layers. The thickness of the contaminated layer, listed as "sediment" in the 'Geometry Composer' reports, was up to 15-cm. This was chosen to correspond to the depth of a typical volumetric soil sample. Lesser values were used in instances where it was obvious the contaminated layer would not reach that depth... e.g. concrete and/or ledge surfaces.

The shielding layers were dependent upon the materials present in the count location. Typically these are sand, gravel, and rock from the Forebay, listed in the 'Geometry Composer' reports as "fb_rock". The thickness of these shielding layers also was dictated by the parameters of the count location and was up to 15-cm.

In each geometry, except concrete, a preliminary geometry was created and applied that considered all of the layers as contaminated. This was done to quantify the K-40 concentration in an effort to estimate the distance from the source to the detector. The Average value of K-40 in the Forebay materials is approximately 17-20 pCi/g. To maintain conservative reporting, the source to detector distance was adjusted in the geometries to achieve a K-40 value of 20-25 pCi/g. While it is acknowledged that this might lead to a greater than desired margin of error, it is considered the best available method of determining the distance. Efforts at actual measurements via remote means proved ineffective. Several trial counts during the 'Test Patch' evaluations were performed that involved using a diver to take a measurement with a ruler from the face of detector end of the submarine housing to the surface being measured. These counts were analyzed using the known distance and then again with the derived distance and were found to compare favorably to each other.

Once a source to detector distance was derived, the final geometry was applied that set the relative concentration of the shielding layers to zero. This has the effect of removing any contribution of radioactive material in these layers to the concentration detected by the instrument. Consequently, any naturally occurring radioactive material (NORM) contained in the shielding layers resulted in concentrations for that isotope that are grossly overstated in the final report and should be ignored. The attachments provide a representation of the count geometries used for distance determination. Additional geometries were used that are identical to these except for the source to detector distances and the relative concentration of the shielding layers.

DEVELOPMENT OF ISOCS COUNT GEOMETRIES FOR UNDERWATER SURVEY APPLICATIONS

Attachments

Geometry Composer Reports

Geometry Composer Report

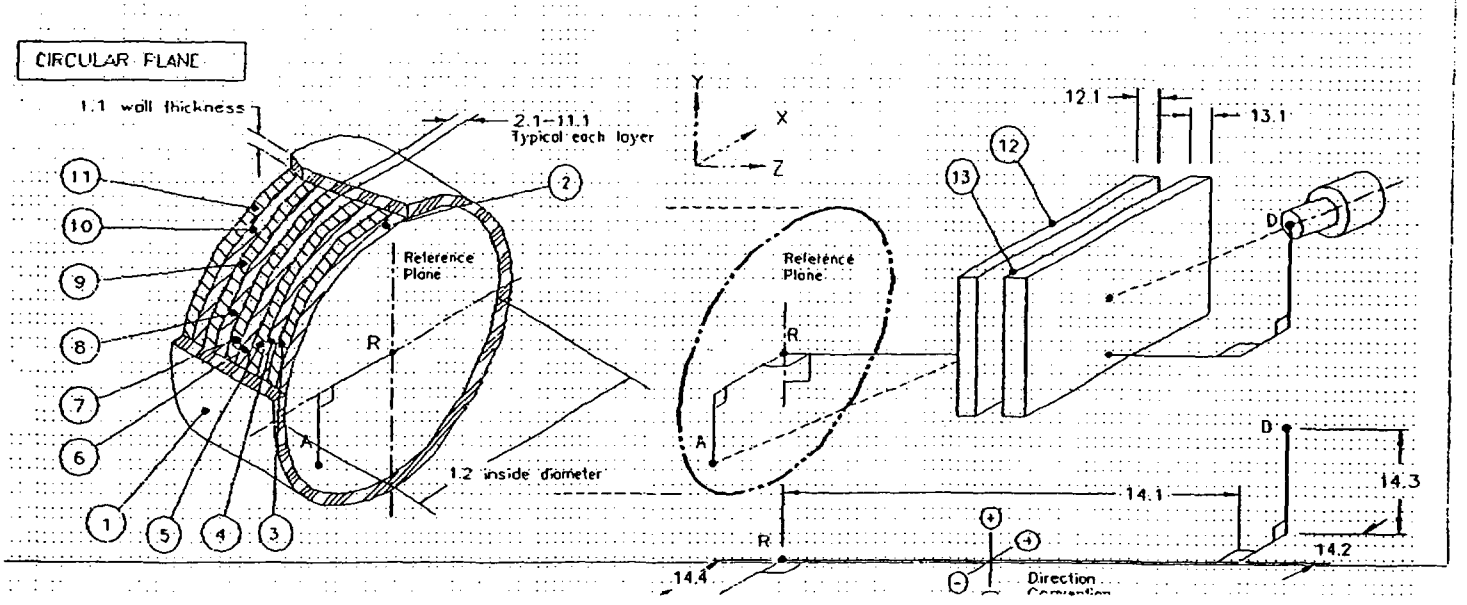
Date: Tuesday, August 12, 2003
Description: ShotPk_Wet
Comment: Seal_Pit_Shotrock_Wet
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\sr_wet.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		260.00					none		
2	Layer 1	5.00						sediment	1.60	1.00
3	Layer 2	15.00						gravel	2.60	
4	Layer 3	5.00						sediment	1.60	0.50
5	Layer 4	10.00						gravel	2.60	
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	48.00								

ousing: CI_7411_TYP
Typical_Canberra_Submarine_Housing
Housing outside material: Water

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0



Geometry Composer Report

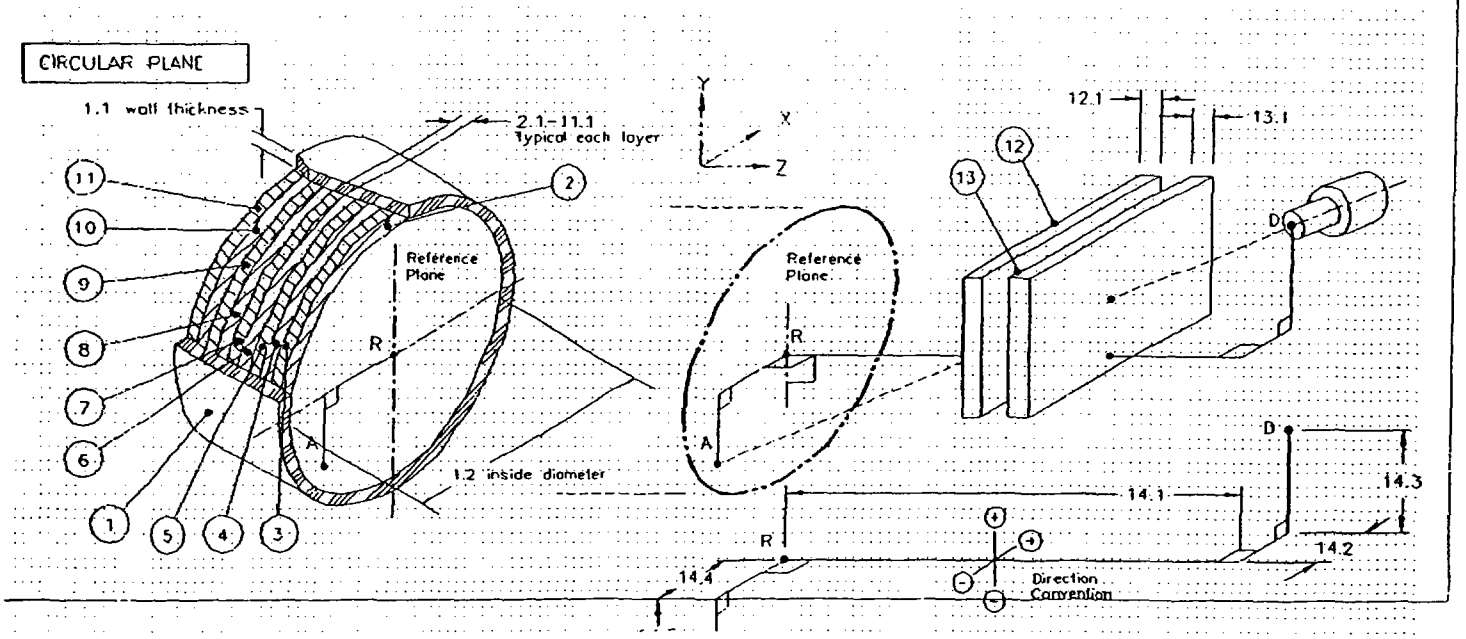
Date: Tuesday, August 12, 2003
Description: ShotRk_Mud
Comment: Seal_Pit_Shotrock_Mud
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\sr_mud.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

# Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1 Side Walls		260.00					none		
2 Layer 1	5.00						sediment	1.60	1.00
3 Layer 2	15.00						gravel	2.60	
4 Layer 3	5.00						sediment	1.60	0.50
5 Layer 4	10.00						gravel	2.60	
6 Layer 5							none		
7 Layer 6							none		
8 Layer 7							none		
9 Layer 8							none		
10 Layer 9							none		
11 Layer 10							none		
12 Absorber1							none		
13 Absorber2							none		
14 Source-Detector	48.00								

Housing: CI_7411_TYP
Typical_Canberra_Submarine_Housing

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0



Geometry Composer Report

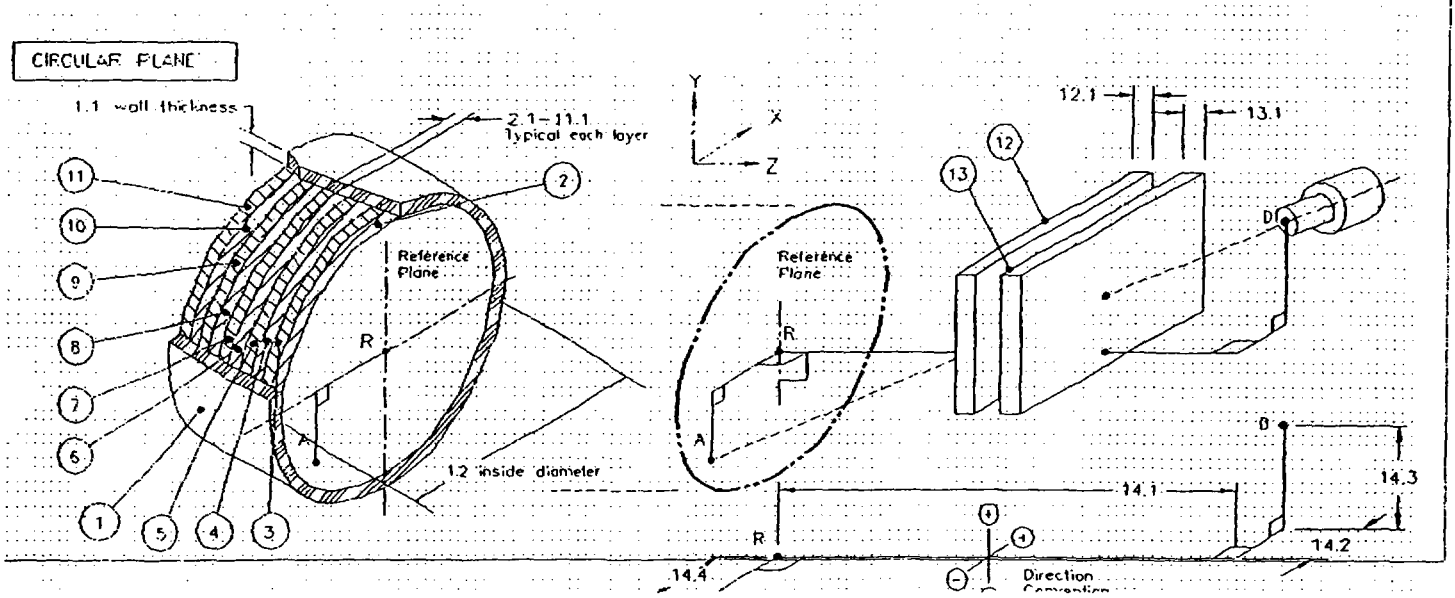
Date: Tuesday, August 05, [illegible]
Description: Slope_Sed20
Comment: Slope_Underwater_20cm
File Name: C:\GENIE2K\isocs\data\GEOMETRY-In-Situ\CIRCULAR_PLANE\Slope_Sed20.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRFN= 2^(4) CRFN= 2^(4)

	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		260.00					none		
2	Layer 1	20.00						seawater	1.03	
3	Layer 2	15.00						fb_rock	2.68	
4	Layer 3	5.00						sediment	1.20	1.00
5	Layer 4	15.00						gravel	2.00	1.00
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	21.27								

Housing: CI_7411_TYP
Typical_Canberra_Submarine_Housing

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0



Geometry Composer Report

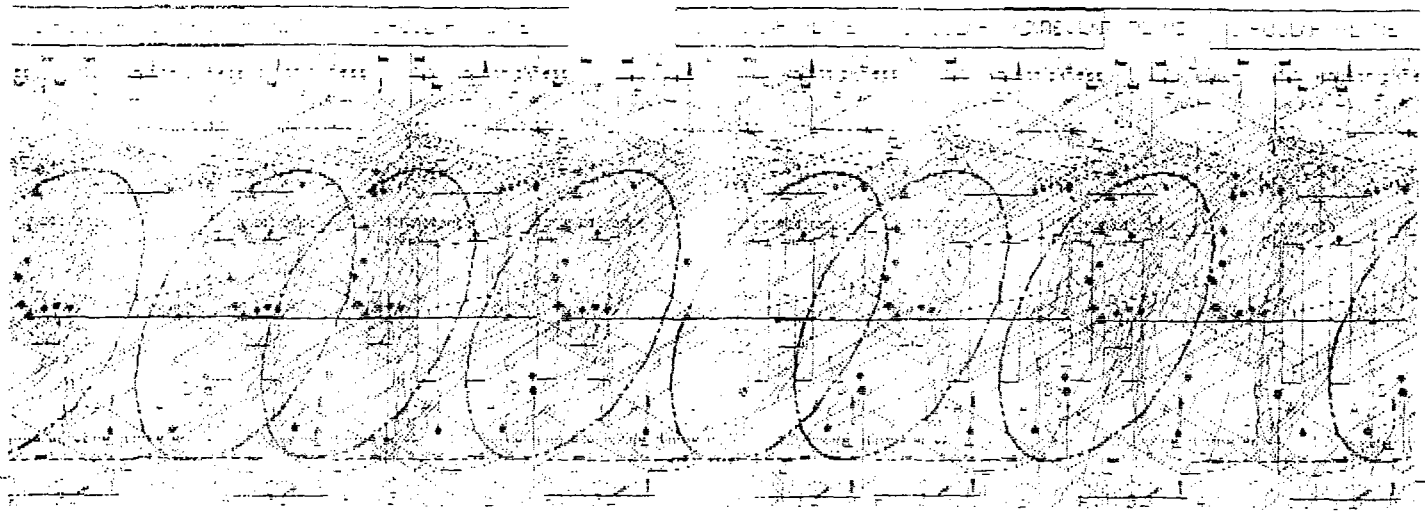
Date: Thursday, April 22, 2004
Description: Rock_30cm
Comment: Forebay_Floor_Underwater
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Floor_Lrg_Rock\Rock_30cm.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		300.00					none		
2	Layer 1	15.00						fb_rock	2.68	
3	Layer 2	15.00						sediment	1.60	1.00
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	30.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]
Housing: BigSub
Submarine_for_Large_Detector

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

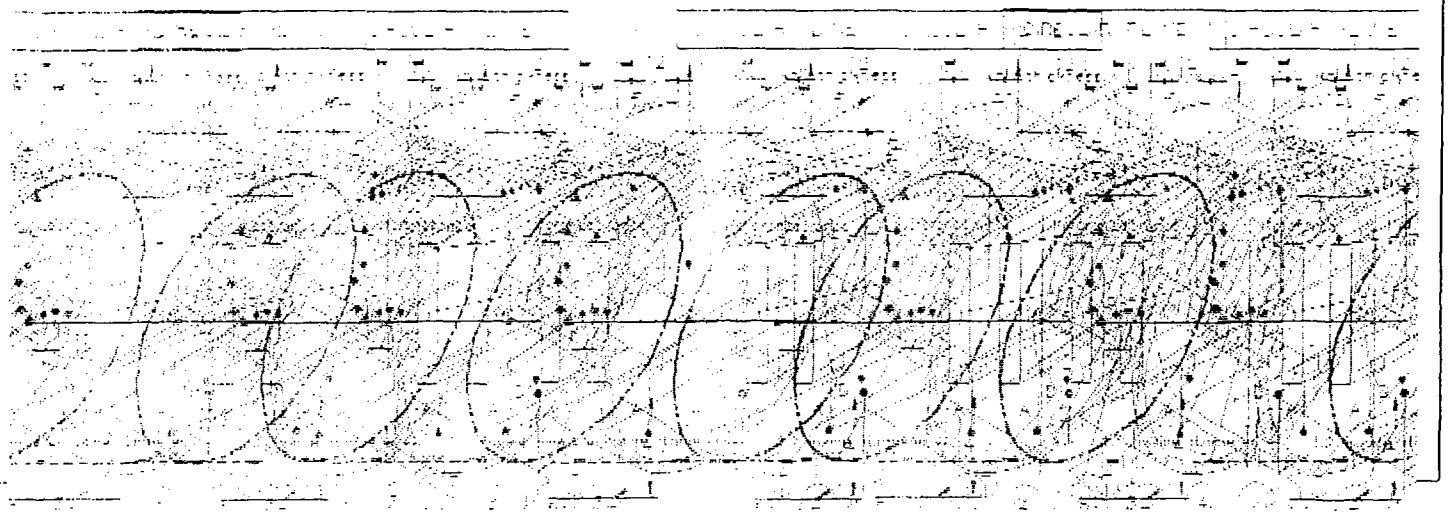
Date: Thursday, April 22, 2004
Description: Rock_30cm_K40
Comment: Forebay_Floor_Underwater
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Floor_Lrg_Rock\Rock_30cm_K40.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		300.00					none		
2	Layer 1	15.00						fb_rock	2.68	1.00
3	Layer 2	15.00						sediment	1.60	1.00
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	30.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]
Housing: BigSub
Submarine_for_Large_Detector

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Date: Thursday, April 22, 2004
Description: Sht_Rk_30cm_K40
Comment: Forebay_Floor_Underwater
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Floor_Shot_Rock\Shot_Rock_30cm.bak
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		300.00					none		
2	Layer 1	5.00						fb_rock	2.68	1.00
3	Layer 2	15.00						sediment	1.60	1.00
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	30.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]
Housing: BigSub
Submarine_for_Large_Detector

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5

Geometry Composer Report

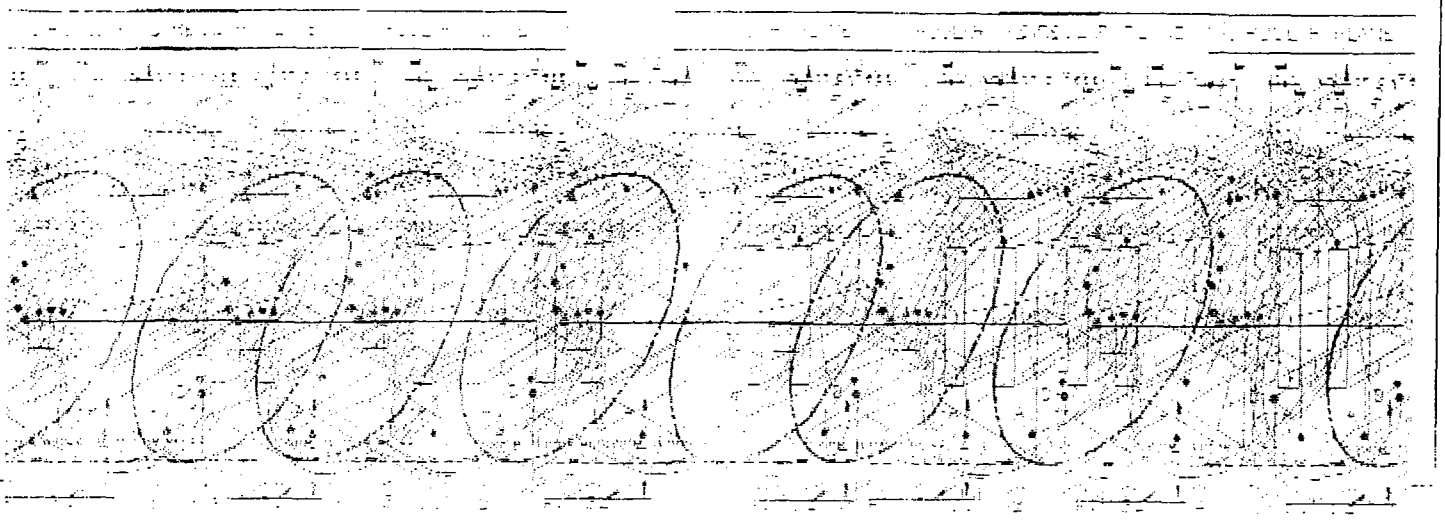
Date: Thursday, April 22, 2004
Description: Sht_Rk_30cm_K40
Comment: Forebay_Floor_Underwater
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Floor_Shot_Rock\Shot_Rock_30cm_K40.bak
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		300.00					none		
2	Layer 1	15.00						fb_rock	2.68	1.00
3	Layer 2	15.00						sediment	1.60	1.00
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	30.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]
Housing: BigSub
Submarine_for_Large_Detector

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

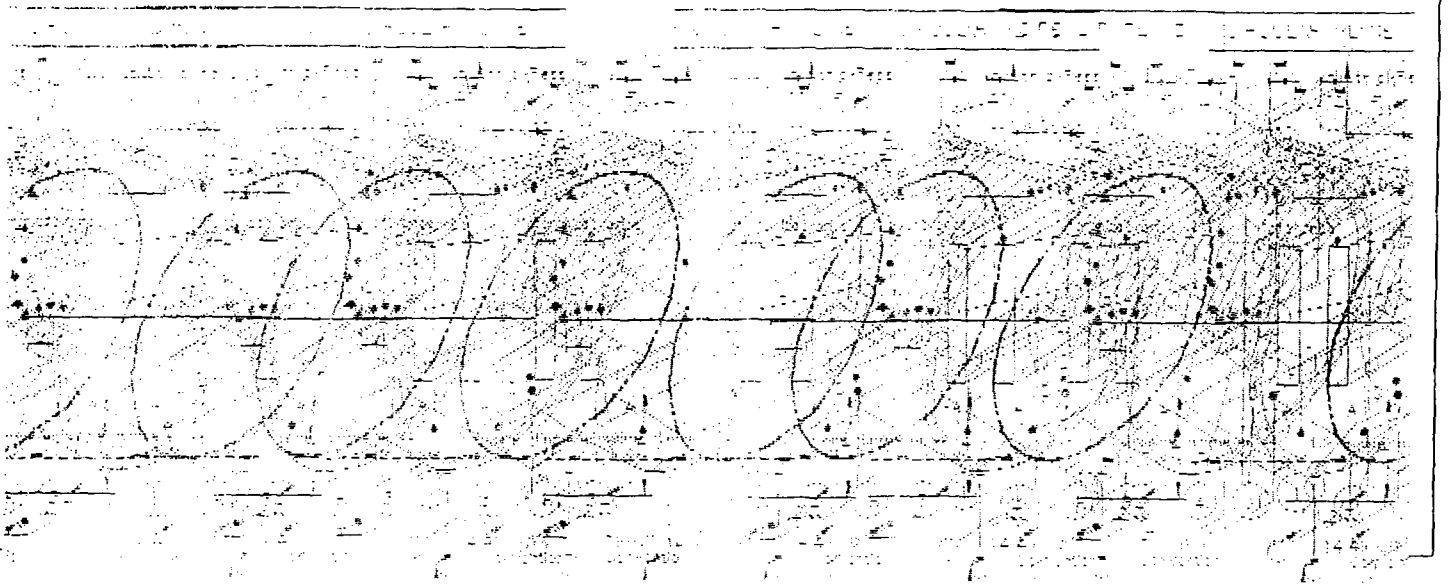
Date: Thursday, April 22, 2004
Description: Ledge_Wet
Comment: Ledge_Underwater
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Slope_Ledge\Ledge_30cm_K40.bak
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		240.00					none		
2	Layer 1	2.00						sediment	1.60	1.00
3	Layer 2	15.00						fb_rock	2.68	1.00
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	30.00								

Housing: CI_7411_TYP
Typical_Canberra_Submarine_Housing

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

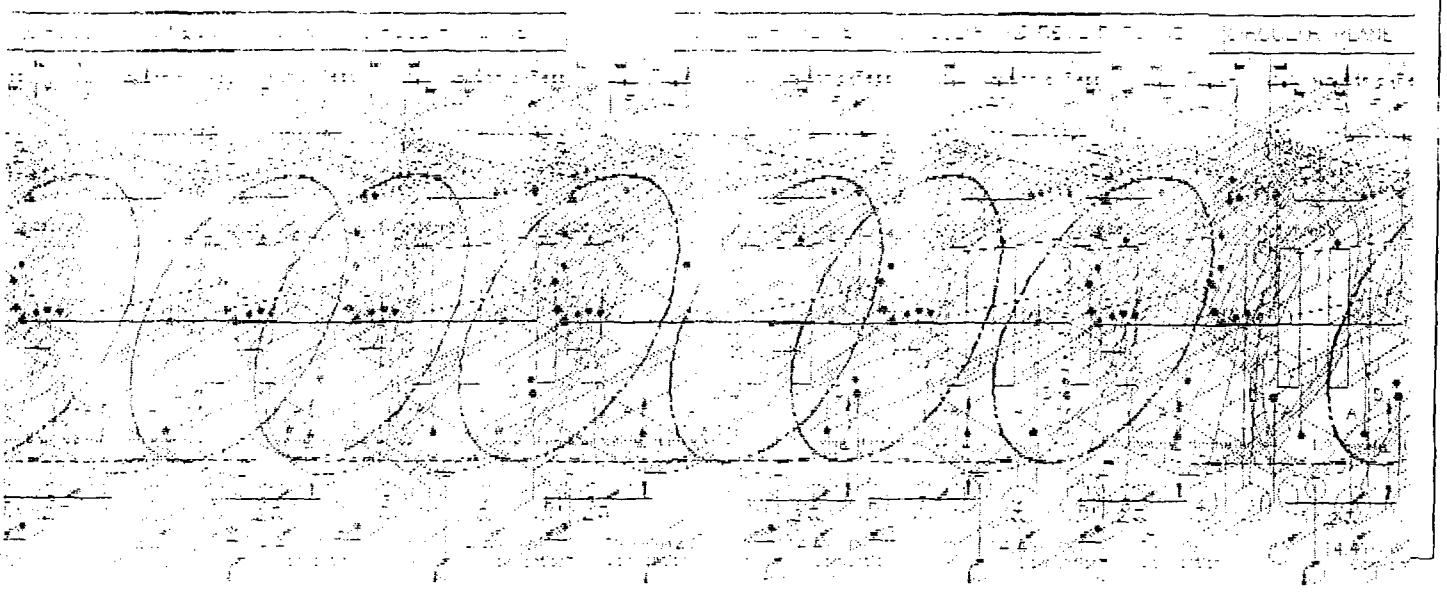
Date: Thursday, April 22, 2004
Description: Ledge_Wet
Comment: Ledge_Underwater
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Slope_Ledge\Ledge_30cm.bak
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		240.00					none		
2	Layer 1	2.00						sediment	1.60	1.00
3	Layer 2	15.00						fb_rock	2.68	
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	30.00								

Housing: CI_7411_TYP
Typical_Canberra_Submarine_Housing

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

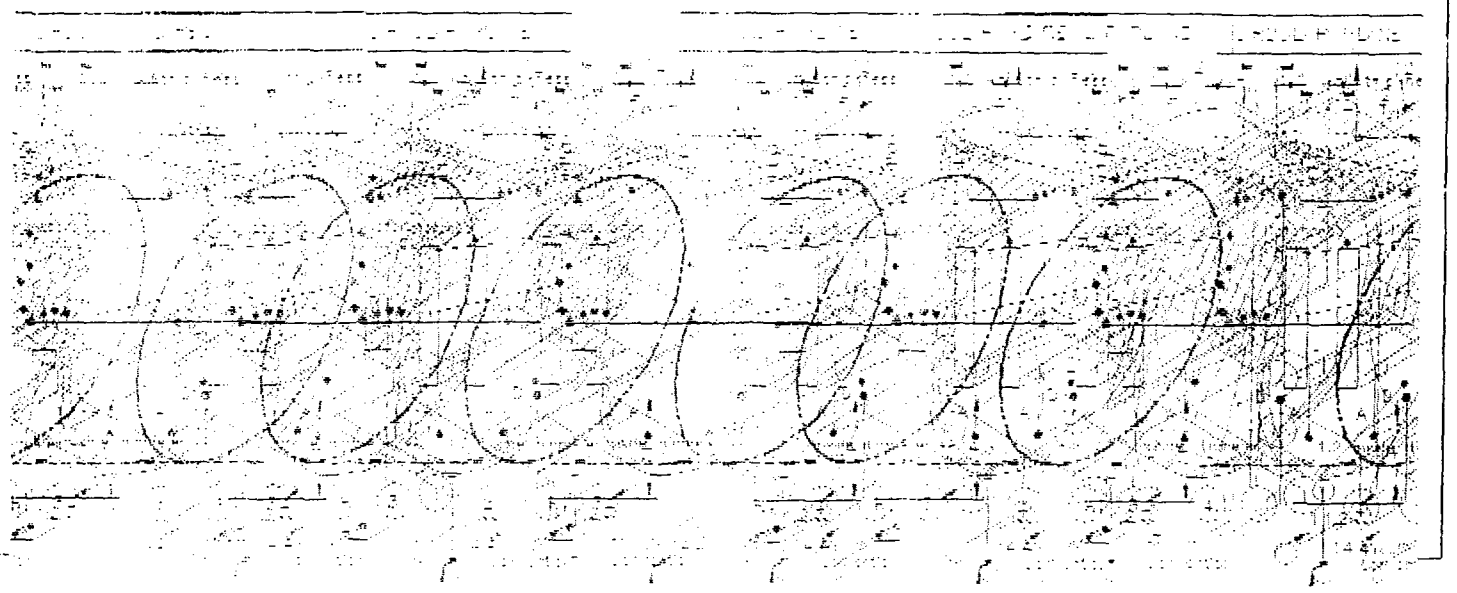
Date: Thursday, April 22, 2004
Description: Slp_30cm_K40
Comment: Underwater_Slope
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Slope_Rock\Slope_30cm_K40.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		240.00					none		
2	Layer 1	15.00						fb_rock	2.68	1.00
3	Layer 2	15.00						sediment	1.60	1.00
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	30.00								

Housing: CI_7411_TYP
Typical_Canberra_Submarine_Housing

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

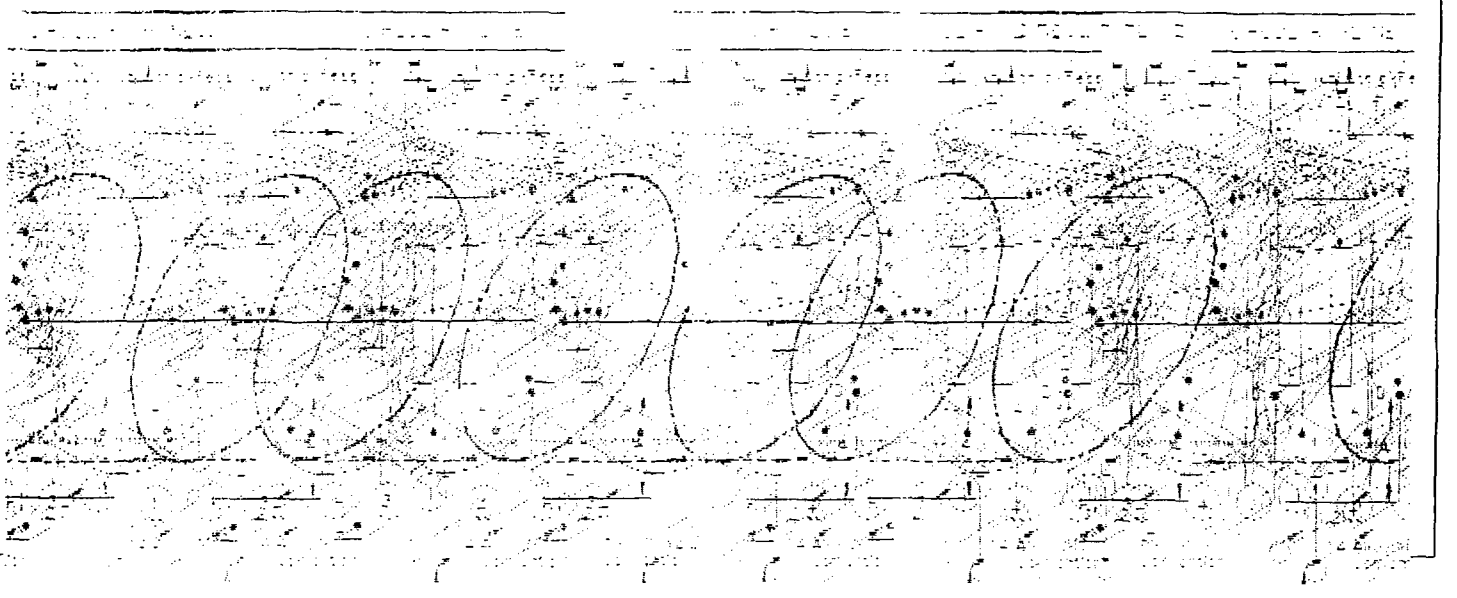
Date: Thursday, April 22, 2004
Description: Slp_30cm
Comment: Underwater_Slope
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Slope_Rock\Slope_30cm.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		240.00					none		
2	Layer 1	15.00						fb_rock	2.68	
3	Layer 2	15.00						sediment	1.60	1.00
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	30.00								

Housing: CI_7411_TYP
Typical_Canberra_Submarine_Housing

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

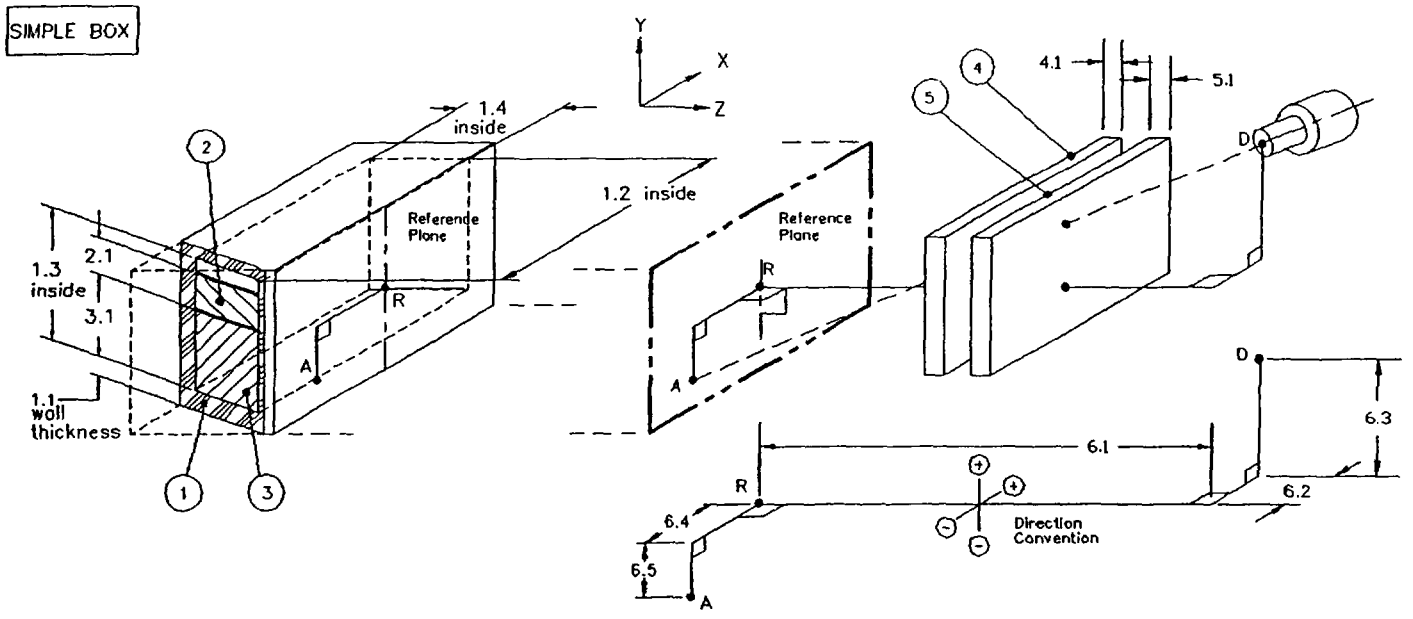
Date: Tuesday, August 10, 2004
Description: Gen_Truck_Backyard
Comment: Backyard
File Name: C:\7607 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\SIMPLE_BOX\generic truck backyard.geo
Software: ISOCS
Template: SIMPLE_BOX, Version: default
Detector: 7607
Environment: Temperature= 0 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Box		16.01	7.00	4.50			none		
2	Source-Top Layer	4.50						dirt1	1.60	1.00
3	Source-Bottom Layer							none		
4	Absorber1							none		
5	Absorber2							none		
6	Source-Detector	9.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

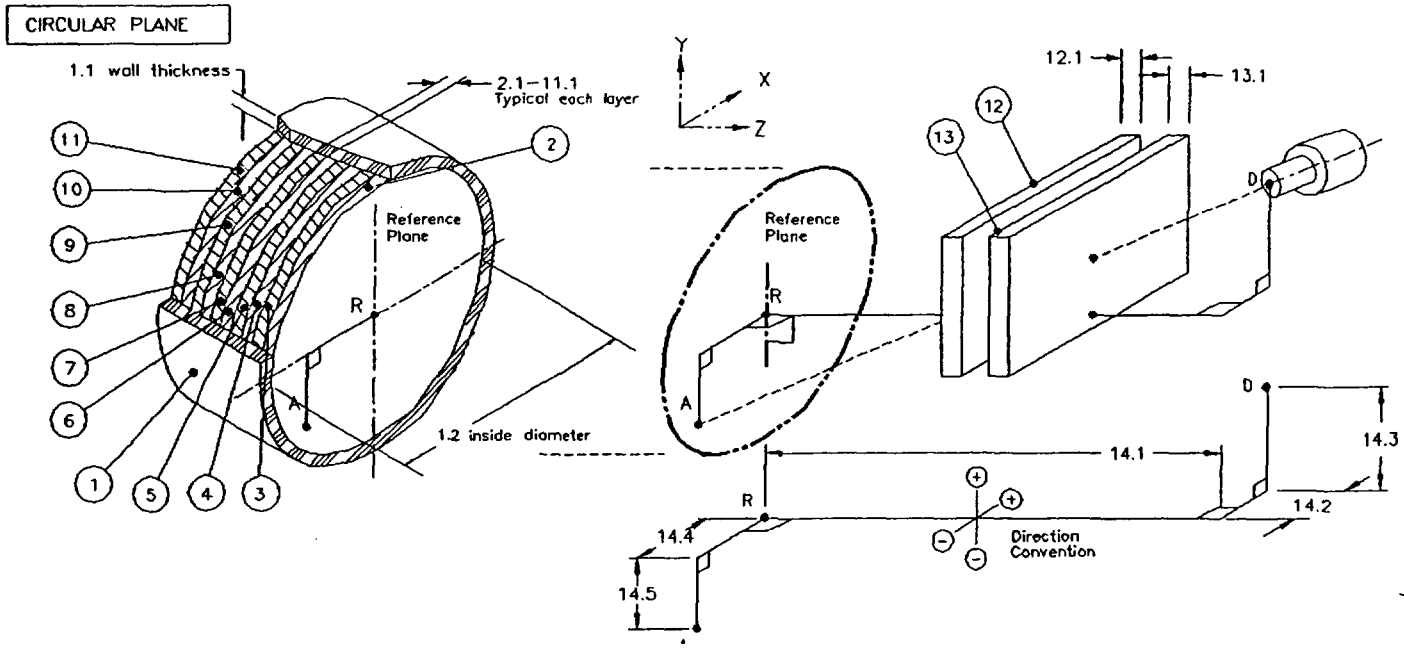
Date: Tuesday, August 10, 2004
Description: Soil_at_3m90d
Comment: Surface
File Name: C:\7607 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_at_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt4	1.70	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

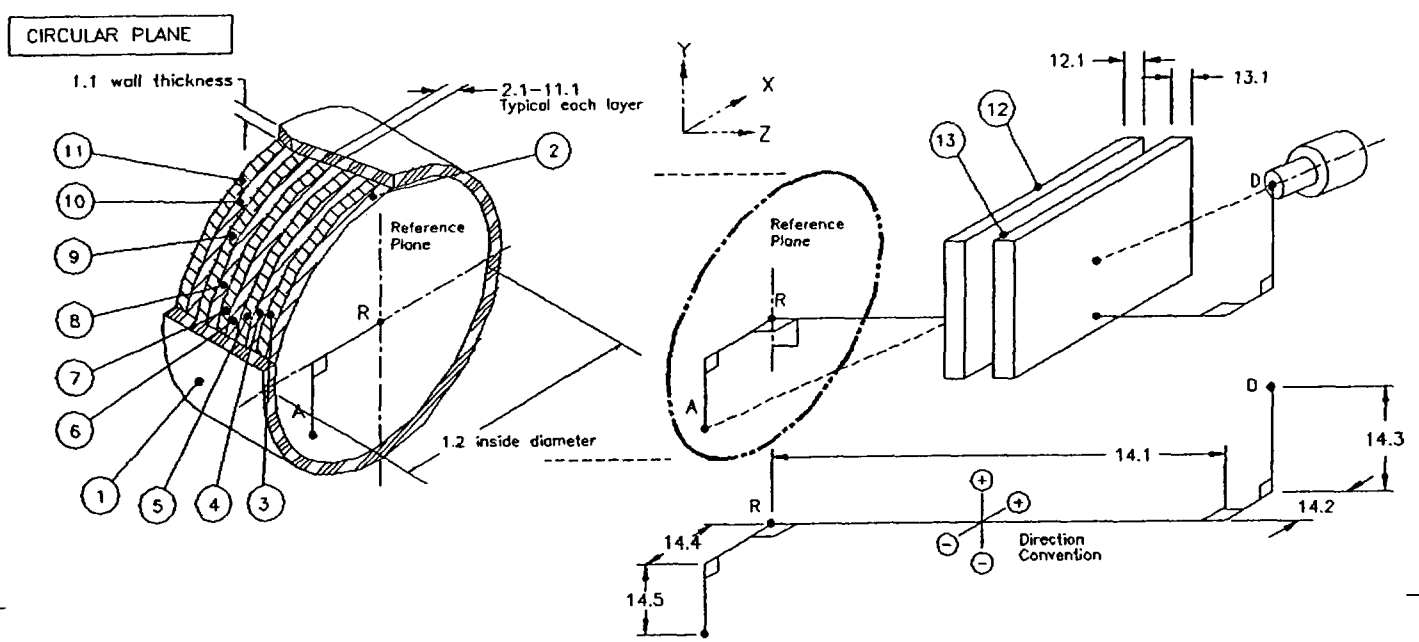
Date: Tuesday, August 10, 2004
Description: Activated_Concrete
Comment: ICI_Sump
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\7722- ICI Activated_Concrete.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7722
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		640.08					none		
2	Layer 1	1.27						concrete	2.20	0.86
3	Layer 2	1.27						concrete	2.20	0.88
4	Layer 3	1.27						concrete	2.20	0.91
5	Layer 4	1.27						concrete	2.20	1.00
6	Layer 5	1.27						concrete	2.20	0.93
7	Layer 6	1.27						concrete	2.20	0.54
8	Layer 7	1.27						concrete	2.20	0.33
9	Layer 8	1.27						concrete	2.20	0.31
10	Layer 9	2.54						concrete	2.20	0.09
11	Layer 10	2.54						concrete	2.20	0.04
12	Absorber1	0.95						304ss	7.81	
13	Absorber2							none		
14	Source-Detector	320.04								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Attachment 3

SSPA-3 Detector Array for Scans
and
Scan Test Data

[Part o9f NRC submission, here for information only]

1. Introduction Rev. 1

Remediation of the Forebay will require Final Status Survey (FSS) designed to meet the release requirements set forth in the MARSSIM and Revision 3 of the Maine Yankee License Termination Plan (LTP Rev 3). The design and construction of the Forebay makes it impractical or even impossible to drain the water to provide a dry surface for FSS area scans and direct measurement surveys. Therefore, methods for underwater surveys need to be developed that are capable of determining compliance with the established release criteria. This document will discuss the approach for scanning of the floor surface of the Forebay in support of the FSS activities.

2. Assumptions

Several assumptions were made prior to determining acceptable scan requirements and conditions.

- The primary concern is a small area (<100-cm^2) with high activity (≥100,000 DPM)
- Cobalt-60 (Co^{60}) is the primary contaminant providing the majority of the exposure (~98% as indicated in MicroShield 5.04)
- The Forebay floor surface is relatively level with divots and peaks of approximately 10 cm and a few rocks
- A minimum $DCGL_{emc}$ of 100,000 DPM/100-cm^2 decayed to 1/1/2004
- Nuclide fraction is taken from LTP Rev 3 Table 2-13
- Scanning would occur after remediation
- Scan needs to be capable of detecting activity less than or equal to an exposure rate equivalent of the $DCGL_{emc}$
- Sediment has a density of approximately 1.57 g/cm^3 (typical of sand)
- Water density is typical of seawater (1.03 g/cm^3)
- The granite ledge has typical NORM activity (Reference: *Environmental Radioactivity 4th Edition* by Merril Eisenbud and Thomas Gesell)
- The granite ledge has a typical density of 2.69 g/cm^3
- Cosmic background would be essentially nonexistent below three feet of water
- NORM suspended in the Forebay water is insignificant

3. Equipment

Delivery Method: Pole-mounted SPA-3 that can be lowered to the floor of the Forebay.

Detector Housing: A detector housing made from a combination of schedule 80 PVC pipe approximately 8"x3" inside diameter and a water-proof cable conduit. The PVC pipe would connect to the conduit via a threaded or pressure fit connection. This would need to be easily disconnected to provide access to the detectors each day for operational checks.

Instruments and Detectors: Two or more properly calibrated SSPA-3 detectors connected to E-600 instruments via 30' cable.

4. Detection of Residual Activity

Gamma emissions from the Co^{60} will be the most abundant source of the exposure due to residual activity in the Forebay. The primary peaks of Co^{60} (1172 and 1332 KeV) are reasonably detectable through water. Empirical testing indicates that detector sensitivity increases in the water. The test data suggests that the presence of approximately 5-cm of water increases the detection sensitivity of the SSPA-3 from ~990 net counts per minute per microRem per hour (nCPM/μR/hr) to ~1,270 nCPM/μR/hr. Additional water presence (>5-cm) does not improve the sensitivity to the non-detect distance of the material. The non-detect distance is defined as the point at which the residual activity is no longer distinguishable from the minimum detectable concentration of the scan (MDC_{scan}).

4.1. Minimum Detectable Concentration for Scanning

An MDC_{scan} was calculated using a modified version of the equation contained in Engineering Calculation EC009-01(MY). The equation used background values for granite containing naturally occurring radioactive material (NORM) that was calculated by MicroShield™ for each of the water distances using published NORM values. The relative detection response provided by the manufacturer for Cs^{137} of 1,200 nCPM/μR/hr was used for the calculation. Empirical testing has shown that the relative detector response to Co^{60} in water is comparable to the relative response for Cs^{137} in air. The MDC_{scan} was calculated using a scan rate of 8-cm per second which equates to a time constant of 3.125 if a detection radius of 12.5-cm is assumed ([12.5*2]/8=3.125).

4.2. MicroShield™ Simulations

All MicroShield™ simulations were performed using typical density values for the anticipated shielding. Shields were set to account for typical sea-water and the PVC wall (7.62-mm thickness) of the water proof canister.

Background Exposure from NORM

Approximately one-half of the floor of the Forebay is granite ledge. To determine an expected background exposure rate from NORM contained in the granite, published values of typical granite were used in a MicroShield™ model. The model (Attachment 1) was created for a 10-meter thick infinite slab of granite containing Potassium-40 (K^{40}), Radium-226 (Ra^{226}), Thorium-232 (Th^{232}), and Uranium-238 (U^{238}). A model was run for water shields of 2-cm and 5- through 25-cm (at 5-cm increment) thickness.

Non-Detect Distance

At the assumed $DCGL_{emc}$ of 100,000 DPM, MicroShield™ analysis indicates the non-detect distance to be approximately 25-cm at the outer edge of the radius of the source. This is variable depending on

the background rate and geometric relationship of the source to the detector. For example, as the detector moves beyond the edge of the source, the non-detect is a maximum of 25-cm, while the non-detect distance at the center of the source may be as much as 30-cm.

The non-detect distance was calculated by modeling a disc source (DISC) with a radius of 5.64-cm (surface area ~100-cm^2) at the $DCGL_{emc}$ of 100,000 DPM distributed over the area of the source and using the nuclide fraction established in the LTP Rev 3. These isotopes were decay corrected from January 1, 2004 to August 1, 2003. Because the actual start date of scanning is not known, August 1 was chosen to allow the calculated values to be realistic of the conditions liable to be encountered.

Studies were performed on the DISC model that set the X-axis (depth) to various values of 2-cm and 5-cm through 25-cm at 5-cm intervals. The X-axis study was repeated with the Y-axis (lateral) placed at 12.5-cm. In this model the exposure point is actually placed 7.5-cm beyond the edge of the DISC.

The exposure rate results were converted into an equivalent count rate using the manufacturers stated relative detector response (1,200 CPM/μR/hr). The equivalent count rates for the MDC_{scan} at the water depths were compared against the equivalent count rates for the DISC.

Table 1 shows the results of the comparison between the MDC_{scan} values based on the anticipated background exposure rate from NORM-containing granite and the center and edge analyses of the DISC. This table is indicative of data that would be collected with SSPA-3 detectors.

Table 1
Comparison of Background Exposure Rates for NORM-Containing Granite and MDC_{scan} for 100,000 DPM $DCGL_{emc}$

Water Shield (cm)	BKG (μR/hr)	BKG Countrate Equiv.	MDC_{scan} (net μR/hr)	MDC_{scan} Countrate Equiv.	DISC Edge (net μR/hr)	DISC Edge Countrate Equiv.	Net Countrate Difference DISC Edge vs. MDC_{scan}	DISC Center (net μR/hr)	DISC Center Countrate Equiv.	Net Countrate Difference DISC Center vs. MDC_{scan}
2	1.84	2210	0.52	618	1.80	2159	1541	9.11	10926	10308
5	1.28	1537	0.43	515	1.32	1585	1070	4.14	4962	4447
10	0.76	916	0.33	398	0.77	919	521	1.54	1843	1445
15	0.48	575	0.26	315	0.45	536	221	0.72	859	544
20	0.31	372	0.21	253	0.27	320	67	0.38	452	199
25	0.20	245	0.17	206	0.16	196	-10	0.21	256	50

Because actual background exposure rates are not known, Table 1 was recreated with background exposure rates increased by 1, 2, and 3 μR/hr. This data is presented in Tables 2, 3 , and 4 respectively.

Underwater Scanning with SSPA-3 Detectors

Table 2
Comparison of Background Exposure Rates for NORM-Containing Granite + 1 µR/hr and MDC_{scan} for 100,000 DPM $DCGL_{emc}$

Water Shield (cm)	BKG (µR/hr)	BKG Countrate Equiv.	MDC_{scan} (net µR/hr)	MDC_{scan} Countrate Equiv.	DISC Edge (net µR/hr)	DISC Edge Countrate Equiv.	Net Countrate Difference DISC Edge vs. MDC_{scan}	DISC Center (net µR/hr)	DISC Center Countrate Equiv.	Net Countrate Difference DISC Center vs. MDC_{scan}
2	2.84	3410	0.64	768	1.80	2159	1391	9.11	10926	10158
5	2.28	2737	0.57	688	1.32	1585	897	4.14	4962	4274
10	1.76	2116	0.50	605	0.77	919	314	1.54	1843	1239
15	1.48	1775	0.46	554	0.45	536	-18	0.72	859	305
20	1.31	1572	0.43	521	0.27	320	-201	0.38	452	-69
25	1.20	1445	0.42	500	0.16	196	-304	0.21	256	-244

Table 3
Comparison of Background Exposure Rates for NORM-Containing Granite + 2 µR/hr and MDC_{scan} for 100,000 DPM $DCGL_{emc}$

Water Shield (cm)	BKG (µR/hr)	BKG Countrate Equiv.	MDC_{scan} (net µR/hr)	MDC_{scan} Countrate Equiv.	DISC Edge (net µR/hr)	DISC Edge Countrate Equiv.	Net Countrate Difference DISC Edge vs. MDC_{scan}	DISC Center (net µR/hr)	DISC Center Countrate Equiv.	Net Countrate Difference DISC Center vs. MDC_{scan}
2	3.84	4610	0.74	893	1.80	2159	1266	9.11	10926	10033
5	3.28	3937	0.69	825	1.32	1585	760	4.14	4962	4137
10	2.76	3316	0.63	757	0.77	919	162	1.54	1843	1086
15	2.48	2975	0.60	717	0.45	536	-181	0.72	859	142
20	2.31	2772	0.58	692	0.27	320	-372	0.38	452	-240
25	2.20	2645	0.56	676	0.16	196	-480	0.21	256	-420

Table 4
Comparison of Background Exposure Rates for NORM-Containing Granite + 3 µR/hr and MDC_{scan} for 100,000 DPM $DCGL_{emc}$

Water Shield (cm)	BKG (µR/hr)	BKG Countrate Equiv.	MDC_{scan} (net µR/hr)	MDC_{scan} Countrate Equiv.	DISC Edge (net µR/hr)	DISC Edge Countrate Equiv.	Net Countrate Difference DISC Edge vs. MDC_{scan}	DISC Center (net µR/hr)	DISC Center Countrate Equiv.	Net Countrate Difference DISC Center vs. MDC_{scan}
2	4.84	5810	0.84	1002	1.80	2159	1157	9.11	10926	9924
5	4.28	5137	0.79	942	1.32	1585	643	4.14	4962	4020
10	3.76	4516	0.74	883	0.77	919	36	1.54	1843	960
15	3.48	4175	0.71	849	0.45	536	-313	0.72	859	10
20	3.31	3972	0.69	828	0.27	320	-508	0.38	452	-376
25	3.20	3845	0.68	815	0.16	196	-619	0.21	256	-559

Underwater Scanning with SSPA-3 Detectors

Analysis of these tables indicate that adjustments may need to be made to the detector configuration and scan process depending on the actual background exposure rates encountered.

Using a $DCGL_{emc}$ of 100,000 DPM is actually a most conservative approach. An area factor of 10 is more likely which would set the $DCGL_{emc}$ at 180,000 DPM for a small area. For comparison, Tables 1 through 4 were recreated using a $DCGL_{emc}$ of 180,000 DPM and are listed below as Tables 5 through 8.

Table 5
Comparison of Background Exposure Rates for NORM-Containing Granite and MDC_{scan} for 180,000 DPM $DCGL_{emc}$

Water Shield (cm)	BKG (µR/hr)	BKG Countrate Equiv.	MDC_{scan} (net µR/hr)	MDC_{scan} Countrate Equiv.	DISC Edge (net µR/hr)	DISC Edge Countrate Equiv.	Net Countrate Difference DISC Edge vs. MDC_{scan}	DISC Center (net µR/hr)	DISC Center Countrate Equiv.	Net Countrate Difference DISC Center vs. MDC_{scan}
2	1.84	2210	0.52	618	3.24	3886	3268	16.39	19668	19050
5	1.28	1537	0.43	515	2.38	2854	2338	7.44	8933	8417
10	0.76	916	0.33	398	1.38	1655	1257	2.76	3317	2919
15	0.48	575	0.26	315	0.80	965	650	1.29	1547	1232
20	0.31	372	0.21	253	0.48	576	323	0.68	814	560
25	0.20	245	0.17	206	0.29	353	147	0.38	461	255

Table 6
Comparison of Background Exposure Rates for NORM-Containing Granite +1 µR/hr and MDC_{scan} for 180,000 DPM $DCGL_{emc}$

Water Shield (cm)	BKG (µR/hr)	BKG Countrate Equiv.	MDC_{scan} (net µR/hr)	MDC_{scan} Countrate Equiv.	DISC Edge (net µR/hr)	DISC Edge Countrate Equiv.	Net Countrate Difference DISC Edge vs. MDC_{scan}	DISC Center (net µR/hr)	DISC Center Countrate Equiv.	Net Countrate Difference DISC Center vs. MDC_{scan}
2	2.84	3410	0.64	768	3.24	3886	3118	16.39	19668	18900
5	2.28	2737	0.57	688	2.38	2854	2166	7.44	8933	8245
10	1.76	2116	0.50	605	1.38	1655	1050	2.76	3317	2712
15	1.48	1775	0.46	554	0.80	965	412	1.29	1547	993
20	1.31	1572	0.43	521	0.48	576	55	0.68	814	293
25	1.20	1445	0.42	500	0.29	353	-147	0.38	461	-39

Table 7
Comparison of Background Exposure Rates for NORM-Containing Granite + 2 µR/hr and MDC_{scan} for 180,000 DPM $DCGL_{emc}$

Water Shield (cm)	BKG (µR/hr)	BKG Countrate Equiv.	MDC_{scan} (net µR/hr)	MDC_{scan} Countrate Equiv.	DISC Edge (net µR/hr)	DISC Edge Countrate Equiv.	Net Countrate Difference DISC Edge vs. MDC_{scan}	DISC Center (net µR/hr)	DISC Center Countrate Equiv.	Net Countrate Difference DISC Center vs. MDC_{scan}
2	3.84	4610	0.74	893	3.24	3886	2993	16.39	19668	18775
5	3.28	3937	0.69	825	2.38	2854	2029	7.44	8933	8108
10	2.76	3316	0.63	757	1.38	1655	898	2.76	3317	2560
15	2.48	2975	0.60	717	0.80	965	248	1.29	1547	830
20	2.31	2772	0.58	692	0.48	576	-116	0.68	814	122
25	2.20	2645	0.56	676	0.29	353	-323	0.38	461	-215

Table 8
Comparison of Background Exposure Rates for NORM-Containing Granite + 3 µR/hr and MDC_{scan} for 180,000 DPM $DCGL_{emc}$

Water Shield (cm)	BKG (µR/hr)	BKG Countrate Equiv.	MDC_{scan} (net µR/hr)	MDC_{scan} Countrate Equiv.	DISC Edge (net µR/hr)	DISC Edge Countrate Equiv.	Net Countrate Difference DISC Edge vs. MDC_{scan}	DISC Center (net µR/hr)	DISC Center Countrate Equiv.	Net Countrate Difference DISC Center vs. MDC_{scan}
2	4.84	5810	0.84	1002	3.24	3886	2884	16.39	19668	18666
5	4.28	5137	0.79	942	2.38	2854	1911	7.44	8933	7991
10	3.76	4516	0.74	883	1.38	1655	771	2.76	3317	2433
15	3.48	4175	0.71	849	0.80	965	116	1.29	1547	697
20	3.31	3972	0.69	828	0.48	576	-252	0.68	814	-15
25	3.20	3845	0.68	815	0.29	353	-462	0.38	461	-354

5. Scan Process

Detector Setup

Scans will be conducted by a pole-mounted SPA-3 detector in its waterproof housing positioned at a distance of approximately 8-cm from the forebay bottom. This results in a maximum distance to a source of 16-cm within the 12.5-cm detection radius and is calculated as:

$$\sqrt{12.5^2 + 10^2} = 16cm$$

Each detector will be connected via a 30 foot cable to its' associated E-600. Each instrument/detector combination will need to be calibrated with the 30' length of cable to ensure the effect of voltage loss over the cable length is minimized.

The pole-mounted waterproof housing is moved along the floor surface. The bottom of the detector housing will be set at approximately 8-cm from the floor surface.

Underwater Scanning with SSPA-3 Detectors

Scan Performance

The basic procedure for performing a scan will be functionally identical to that used for soil scans with an SSPA-3. All existing operational checks will be performed without a need for modification. Other scan performance procedures (e.g. alarm setpoints, alarm verification, etc.) will be performed as normal. The major difference in the scan procedure is the scan speed. Soil scans are typically done at a scan rate of 0.25-m (25-cm) per second. Underwater scan rates will be 0.08-m (8-cm) per second. Also, the detectors will be moved in a straight line along the edge of the barge rather than in a zigzag pattern within the scan grid.

To perform the scan:

1. Position the barge at the desired scan area and secure from drift
2. Slowly lower the detector array until the pole contacts the floor of the Forebay
3. Record the starting grid location.
4. Reset the E-600 and begin to advance the detector array along the barge rail at a rate of 8-cm per second.
5. Verify alarms as necessary by reversing the travel of the detector array and scanning in the opposite direction
6. At the end of the guide rail (approximately 3-m), release the barge from the drift stop device and advance 0.25-meter
7. Repeat the scan process along the rail until a 3-m wide path has been scanned. Log the E-600 data and record the grid location.
8. Repeat from step 1

Note: The most elevated net peak hold value of the two instruments for a scan grid will be utilized as the scan result for that grid.

Alarm Setpoint

Calculation of the alarm setpoint for underwater scanning must attempt to account for variations in distance to the potential source. Keeping this in mind, the recommendation is to set the alarm at twice the background value for a 5-cm water shield. In this fashion, the alarm would sound for values greater than 100,000 DPM for water shield distances of up to 15-cm. For distances between 15- and 20-cm, the alarm would sound for values indicative of activity up to the true $DCGL_{emc}$ value of 180,000 DPM.

The following is the procedure that will be used to calculate the E-600 alarm setpoint for underwater SSPA-3 scans.

1. Affix a 5-cm standoff to the bottom of the single SSPA-3 detector housing
2. Lower the detector until the standoff contacts the floor in the designated background area
3. Obtain a 1-minute scaler measurement of the floor and log the result

4. Add 4,000 c/m (the detector response for 100.000 DPM) to the background count rate to derive the alarm setpoint.

Table 1. Co-60 Source Response in Water

Source #59436A-60, 0.65 uCi
uR/h = 5.237 in water-filled drum

Ambient Bkg	10500 c/m
Drum Bkg	4880 c/m

Source Counts c/m

10610
11150
10980
10460
11170
11240
11220
11580
11240
11120
11077 ave
325.0 std dev

Net c/m =	6197
c/m per uR/h =	1183

FORM 1

BACKGROUND ASSESSMENT DATA SHEET

Location: Forebay Floor	Instruments/Type: E-600
Material Type: ledge, rocks, sediment	Probe Type: SPA-3
Prepared By: G. Pillsbury	Date: 11/12/03
Survey Instructions: See attached description	
Approved By: [signature]	Date: 11/12/03
Remarks on survey results: This assessment is a special situation and background has been determined using two different techniques.	
Survey Data Attached (Yes) No	Other Supporting Data Attached (Yes) No
Surveyed By: L. Reid	Date: 11/11/03
Background Criteria: n_b = N/A Sat: ✓ Unsat:	
Reevaluated Background Criteria: n_b = N/A Sat: Unsat:	
The background area ~~is~~ / is not significantly affected by plant-derived radionuclides.	
Background = 16000 cpm for Survey Package FR-0400 3U4,5 Floor	
Prepared by: (FSS Engineer) T. Braunstein G. Pillsbury	Date: 11/12/03
Reviewed by: (Independent Reviewer) [signature]	Date: 11/12/03

Tech. File #19.200.40.7

Forebay Scan Background

11/12/03

In order to establish the alarm setpoint for the E-600 used for scanning, the underwater background of the forebay must be known. Due to the varied materials of composition and topography of the bottom of the forebay, background can only be approximated. Two approaches were used to estimate background as described below.

The first approach was to compile volumetric sample data from several types of forebay samples and determine the average activity of the various nuclides present. Once the nuclide activities were known, the values were entered into a Microshield Infinite Slab model to determine the exposure rate. The Microshield results were 12.3 uR/h at a distance of 5 cm through water. Multiplying the exposure rate by the c/m per uR/h value provided in the Forebay Technical Basis document of 1183 c/m per uR/h results in an estimated forebay bottom background of 14,500 c/m with a SPA-3 detector. The accuracy of this value is assumed to be $\pm$ 10 per cent so the true background could be as high as 16,000 c/m.

Actual forebay scan data were also evaluated. The first row of scan grid results taken with two different SPA-3 detectors were reviewed. The data showed a significant hot spot in the center of the row (count rates in the 30,000 to 50,000 c/m range). These results were excluded and the average of all grid peak hold values below 18,000 c/m were averaged. The average background value was between 15,000 and 16,000 c/m depending on which SPA-3 data were considered. These results showed good agreement with the Microshield model results.

The generic value for forebay background is considered to be 16,000 c/m for the north end. Adding 4000 c/m (100,000 dpm/100 cm2 equivalent) to the background value provides an alarm setpoint of 20,000 c/m.

FR0400 SCANS

#2056	#726557		Est. Bkg	Est. Bkg
13500	17500		13500	17500
17100	11800		17100	11800
25500	19700		17900	14800
19500	22600		15700	15800
17900	23700		17500	16000
19600	23500		17200	13900
26700	**45700**		17200	13600
42300	**49900**		13600	17600
32700	**31200**		14400	13700
27500	**32700**		16400	16000
15700	21300		16200	
17500	14800		15000	
17200	15800	ave	15975	15070
17200	16000			
13600	13900		Call Bkg 16000 c/m	
14400	13600		Add 4000	
16400	17600		Alarm = 20000	
16200	13700			
15000	16000			
ave 20289	22158			

Sample ID	Date	K-40	Rh-106	Co-60	Cs-137	Tl-208	Bi-212	Pb-212	Bi-214	Pb-214	Ra-226	Ac-228	Pa-234m	Th-234	U-235	Am-243	Pu-243
Forebay divers sample of clay	09/04/03	2.2919E+01	0.0000E+00	0.0000E+00	1.1204E+00	3.9559E-01	9.6386E-01	1.1610E+00	1.4162E+00	1.5112E+00	3.6561E+00	1.2807E+00	0.0000E+00	1.1809E+00	2.2207E-01	#########	#########
Forebay divers sample of sandgravel/curtain	09/04/03	1.8812E+01	0.0000E+00	3.7380E-01	7.6204E-01	2.7181E-01	4.9724E-01	6.2447E-01	6.4024E-01	7.7484E-01	0.0000E+00	8.7427E-01	0.0000E+00	9.0648E-01	1.0650E-01	1.0362E-02	#########
Forebay southend of cannal post cleaning	09/04/03	2.5100E+01	0.0000E+00	1.7887E+00	9.8785E-01	2.9492E-01	4.9839E-01	6.2347E-01	1.5210E+00	1.5116E+00	0.0000E+00	8.1168E-01	0.0000E+00	1.0759E+00	2.2218E-01	#########	#########
Forebay grit	06/23/03	1.1845E+01	0.0000E+00	8.0479E-01	4.4244E-01	1.7005E-01	3.5279E-01	5.7201E-01	6.2364E-01	6.3541E-01	1.7432E+00	6.3668E-01	0.0000E+00	0.0000E+00	1.0588E-01	#########	#########
Forebay deredged area center sediment dried	07/03/03	1.3717E+01	0.0000E+00	1.0089E-01	2.3783E-01	2.1098E-01	5.3379E-01	5.2441E-01	6.8844E-01	6.6410E-01	0.0000E+00	7.1918E-01	0.0000E+00	6.8682E-01	9.4319E-02	#########	#########
forebay divers bottom	09/15/03	1.5334E+01	0.0000E+00	7.0503E-02	2.9042E-01	2.2357E-01	3.9591E-01	6.0291E-01	5.9512E-01	6.9747E-01	1.5424E+00	7.1712E-01	0.0000E+00	6.9084E-01	9.3687E-02	#########	#########
forebay #101 dried	10/01/03	2.1997E+01	1.0100E-01	0.0000E+00	9.2579E-01	4.4133E-01	7.4244E-01	1.2409E+00	1.7913E+00	1.9505E+00	0.0000E+00	1.2455E+00	0.0000E+00	1.7323E+00	2.4030E-01	#########	3.5015E-01
forebay #102	10/01/03	2.2561E+01	0.0000E+00	1.3651E-01	1.4727E+00	4.1084E-01	8.2281E-01	1.0144E+00	1.0260E+00	1.1230E+00	0.0000E+00	1.2110E+00	0.0000E+00	1.0405E+00	1.6185E-01	6.6726E-02	#########
forebay #103	10/01/03	2.0554E+01	0.0000E+00	1.4578E+00	4.7300E-01	2.3754E-01	4.6926E-01	6.4327E-01	6.2790E-01	6.1512E-01	0.0000E+00	7.4116E-01	5.1227E+00	5.2650E-01	7.0939E-02	#########	#########
forebay #104	10/03/03	2.3844E+01	0.0000E+00	3.0168E-02	4.3647E-01	3.7742E-01	7.9037E-01	1.1427E+00	9.2770E-01	1.0483E+00	0.0000E+00	1.2162E+00	0.0000E+00	1.3830E+00	1.7777E-01	#########	5.1594E-01
forebay #105	10/01/03	1.7792E+01	0.0000E+00	5.4191E-01	8.9710E-02	2.4133E-01	5.6930E-01	6.1617E-01	7.3204E-01	7.1359E-01	1.6654E+00	7.2517E-01	0.0000E+00	5.3174E-01	1.0116E-01	#########	#########
forebay #106	10/01/03	2.0627E+01	0.0000E+00	0.0000E+00	2.1310E+00	3.2021E-01	6.9627E-01	1.0274E+00	8.9691E-01	1.1480E+00	2.3264E+00	1.1581E+00	0.0000E+00	0.0000E+00	1.4131E-01	#########	#########
Average pCi/g		1.9592E+01	8.4168E-03	4.4208E-01	7.8080E-01	3.0039E-01	6.1104E-01	8.1610E-01	9.5721E-01	1.0411E+00	9.1113E-01	9.4474E-01	4.2689E-01	8.1292E-01	1.4483E-01	8.9245E-03	7.2174E-02
Average uCi/cm^3:		5.0939E-05	2.1884E-08	1.1494E-06	2.0301E-06	7.8102E-07	1.5887E-06	2.1218E-06	2.4888E-06	2.7068E-06	2.3689E-06	2.4563E-06	1.1099E-06	2.1136E-06	3.7656E-07	2.3204E-08	1.8765E-07

g/cm^3: 2.6000E+00

µR/hr: 12.32
cpm/mR/hr: 1183
BKG cpm: 14574.56

age : 1
DS File: BKG-CPM.MS5
in Date: November 12, 2003
in Time: 9:25:41 AM
uration: 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Case 1
Description: Case 1
Geometry: 16 - Infinite Slab

Source Dimensions

Thickness 1.0e+3 cm 32 ft 9.7 in

Dose Points

	X	Y	Z
# 1	1005.8 cm	0 cm	0 cm
	32 ft 12.0 in	0.0 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Source	Infinite	Granite	2.6
Shield 1	5.0 cm	Water	1
Shield 2	.7 cm	PVC Sch 80	1.35
Air Gap		Air	0.00122

Source Input
Grouping Method : Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Excluded
Library : Grove

Nuclide	μCi/cm³	Bq/cm³
Ac-228	2.4563e-006	9.0883e-002
Am-243	3.7656e-007	1.3933e-002
Ba-137m	1.9205e-006	7.1058e-002
Bi-212	1.5887e-006	5.8782e-002
Bi-214	2.4888e-006	9.2086e-002
Co-60	1.1494e-006	4.2528e-002
Cs-137	2.0301e-006	7.5114e-002
K-40	5.0939e-005	1.8847e+000
Pa-234m	1.1099e-006	4.1066e-002
Pb-212	2.1218e-006	7.8507e-002
Pb-214	2.7068e-006	1.0015e-001
Pu-243	1.8765e-007	6.9430e-003
Ra-226	2.3689e-006	8.7649e-002
Rh-106	2.1884e-008	8.0971e-004
Th-234	2.1136e-006	7.8203e-002
Tl-208	7.8102e-007	2.8898e-002
U-235	3.7656e-007	1.3933e-002

Buildup
The material reference is : Shield 2

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.03	4.185e-03	6.486e-08	1.537e-05	6.428e-10	1.523e-07

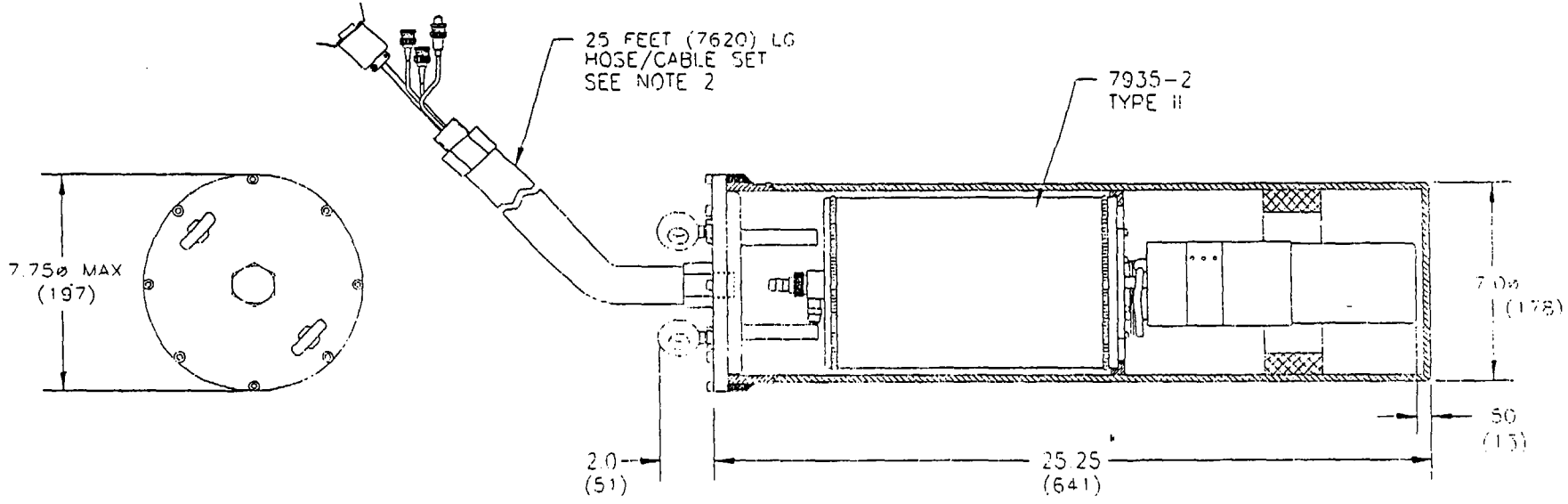
ıge : 2
:S File: BKG-CPM.MS5
ın Date: November 12, 2003
ın Time: 9:25:41 AM
ıration: 00:00:00

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.04	2.414e-03	8.030e-07	2.418e-04	3.552e-09	1.070e-06
0.05	1.130e-03	1.650e-06	5.505e-04	4.396e-09	1.467e-06
0.06	3.452e-03	1.196e-05	4.026e-03	2.376e-08	7.996e-06
0.08	6.720e-02	6.177e-04	1.672e-01	9.775e-07	2.646e-04
0.1	1.224e-02	1.971e-04	4.680e-02	3.015e-07	7.160e-05
0.15	5.743e-03	2.109e-04	2.664e-02	3.472e-07	4.386e-05
0.2	5.899e-02	3.674e-03	3.332e-01	6.484e-06	5.880e-04
0.3	4.350e-02	5.608e-03	2.925e-01	1.064e-05	5.548e-04
0.4	4.041e-02	8.755e-03	2.673e-01	1.706e-05	5.208e-04
0.5	1.342e-02	4.358e-03	9.121e-02	8.554e-06	1.790e-04
0.6	1.342e-01	6.075e-02	9.241e-01	1.186e-04	1.804e-03
0.8	3.268e-02	2.507e-02	2.462e-01	4.768e-05	4.683e-04
1.0	1.243e-01	1.438e-01	9.531e-01	2.651e-04	1.757e-03
1.5	2.723e-01	6.672e-01	2.841e+00	1.123e-03	4.779e-03
2.0	2.486e-02	1.028e-01	3.272e-01	1.590e-04	5.060e-04
3.0	2.884e-02	2.435e-01	5.686e-01	3.304e-04	7.715e-04
OTALS:	8.698e-01	1.267e+00	7.090e+00	2.088e-03	1.232e-02

Attachment 4

Submarine Drawing

REV.	CHANGE	ECN	BY	DATE	APPD



NOTES:
*1. LENGTH WILL INCREASE FOR LARGER DETECTORS.
2. OPTIONAL HOSE & CABLE LENGTHS UP TO 100' (30480)

Calc No. 003-04
Rev. 0
Att. 4, Page 2 of 2

UNLESS OTHERWISE SPECIFIED
TOLERANCES
DECIMAL
ONE PLACE ----
TWO PLACE ----
THREE PLACE ----
ANGULAR ----
HOLES
.250 & UNDER +.003 -.001
OVER .250 +.005 -.001
FLATNESS .010 MAX PER LINEAR FOOT
REMOVE BURRS, BREAK SHARP EDGES & CORNERS
MATERIAL Aluminum
FINISH ----------

79813
USED ON

DRAWN DS	DATE 10/11/02
CHKD	
APPD MECH	
APPD ELEC	
NEXT ASSY	

OUTLINE DRAWING
MODEL 7411S
SUBMARINE

SCALE ~ | DO NOT TEMPLATE DRAWING

[redacted]
MERIDEN, CONNECTICUT

DRAWING NO. 79813 REV
SHT 1 OF 1

Attachment 5

Training Records

Maine Yankee Decommissioning Project

Initial and Continuing Training Programs for Decommissioning

Maine Yankee Decommissioning Project

TRAINING ATTENDANCE REPORT

COURSE TITLE: Isocs ProCount + Geometry Development

COURSE/LESSON PLAN NUMBER: Canberra SU-472-3 | REVISION: 0 | TECH FILE #

LOCATION: Old PORC Rm.

DATE: 3/31/03 - 4/5/03 | START TIME: 0800 | STOP TIME: 16:30 | INSTRUCTOR: G. Constantin

SOCIAL SECURITY NUMBER	PRINT NAME LAST	FIRST	MI	COMPANY	SIGNATURE
000-44-5973	Pillsbury	George			
173-62-6443	Brautigam	Todd	S	Everon Services	
086-46-6137	Vanags	Uldis	-	Maine Yankee	
004-60-5441	Burnham	William	S	Bartlett	
007-62-6311	Randall	Dale	B	NTS	
0459	Carville	John	S	MY	

Course Description:

Data Entered By: _____ Date: _____

Maine Yankee Decommissioning Project

Initial and Continuing Training Programs
for Decommissioning

Maine Yankee Decommissioning Project TRAINING ATTENDANCE REPORT	COURSE TITLE: CANBERRA ISOCS Training		
	COURSE/LESSON PLAN NUMBER: SU-474-5	REVISION: 0	TECH FILE #
	LOCATION: Rm 206		

DATE: 3/17/03-3/20/03 START TIME: 0800 STOP TIME: 16:30 INSTRUCTOR: Glenn Centola

SOCIAL SECURITY NUMBER	PRINT NAME LAST	FIRST	MI	COMPANY	SIGNATURE
006-44-5973	Pillsbury	George		MY	[signature]
0459	Carville	John	S	MY	[signature]
[illegible]-3137	[illegible]	[illegible]	---	MY	[signature]
173-62-6443	Brautigam	Todd	S.	Exelon Services, Inc.	[signature]
0399	[illegible]	Dale	[illegible]	NTS	[signature]
0092	Burnham	William	S	Bartlett	[signature]

Course Description:

Data Entered By: ______________ Date: ______

Attachment 6

Operation and Calibration Procedure
DI- 6-163

Procedure Title	Proc No. DI 6-163
OPERATION & CALIBRATION OF THE ISOCS PORTABLE GAMMA SPECTROSCOPY SYSTEM	Class NISR (NRR) Rev. No. B Issue Date: 6-24-03 Page 1 of 16
APPROVED BY: J M Arnold	DATE: 6/23/03

1.0 PURPOSE

This DI implements requirements outlined in PMP 6.0 and 6.4 and provides instructions to perform isotopic analysis, to energy and efficiency calibrate the portable gamma spectroscopy systems, and to perform quality control checks.

2.0 SCOPE

This DI is applicable to all remediation and FSS surveys using in situ portable gamma spectroscopy at Maine Yankee.

3.0 REFERENCES

3.1 Canberra Genie 2000 SPECTROSCOPY SYSTEM User's Manual

4.0 DEFINITIONS

A portable gamma ray spectroscopy system consists of a germanium detector (in a liquid nitrogen cooled dipstick cryostat with preamplifier) in conjunction with the Inspector interface and laptop computer. Gamma rays interact with the detector to produce pulses which are analyzed and counted by the supportive electronics system.

5.0 RESPONSIBILITIES

Technicians provided with passwords may use the system and perform daily QC checks. The responsibility for calibration lies with the Lead Technician, Engineer, or FSS Superintendent.

6.0 PROCEDURE

6.1 PROCEDURAL QUALIFICATIONS

Procedural Qualifications see Attachment A, for precautions, prerequisites, exclusions, commitments, and final conditions.

6.2 CALIBRATION AND SETUP OF CART MOUNT ISOCS DETECTOR

6.2.1 Add or Verify MCA

a. Go to the MCA Input Definition Editor (MID) and select Edit, add MCA, click on USB MCAs.

b. Choose the required MCA, select Add, then select Done.

c. Select Devices, then MCA, setup or verify the MCA settings for memory (e.g., 8K), enter Inspector S/N in Device Serial Number box, then select OK.

d. Go to Settings, then High Voltage. Set the HV to the bias voltage listed on the detector and select OK.

e. Save the settings by selecting File/Save As. Use the detector number for the file name, 7607, and select Save.

f. Under settings, select Input. Enter the detector number for the Input name. Select OK.

g. Add the MCA to the VDM by going to "Database", then select "Load To", highlight the detector in the File list box, click on "Load", then "Done." Verify by selecting Database/View. Close the MID.

6.2.2 Gain and Pole Zero Adjust

a. Go to GAA and maximize window.

b. Select File, then Open Data source.

c. Highlight the Detector to be used (7607 from the Inputs list), and click OK.

d Select MCA, Acquire Setup, and set Live Time to the pre-determined count time 1000 sec. for calibration. Click OK.

e. Select MCA, then Adjust.

f. Select HVPS, verify proper voltage is set (detector bias voltage), then click ON. "Wait" appears under the word Adjust while the High Voltage ramps up. When HV has ramped up, "Wait" disappears.

g. Obtain a multienergy calibration source and position it 55 to 60 cm from the face of the detector. Acquire a long count of the source to obtain good peaks (500 to 1,000 counts) in a peak calibration channel.

h. Select Filter, then click Next, and verify Pole Zero on initial calibration using the oscilloscope. Adjust as necessary, then choose Exit.

i. Select MCA, click Acquire Start, or click Start on the Control Panel to the left of the display, to begin collecting a spectrum with the source in place.

j. Determine the kev/ch by dividing the desired maximum energy (e.g., 2500 kev) by the number of channels set in the MCA Input Definition Editor.

NOTE

8k equals 8192 channels.

k. In the MCA Adjust screen, choose Gain to adjust the gain controls. Pick the higher energy Co-60 peak (1332.5kev). Determine a channel location by dividing kev/ch into peak energy and place the cursor at that channel. Use the gain adjustments to bring peak centroid to the proper channel position. Once the high end is set, verify a low energy peak (Am-241, 59.5 kev) the same way.

l. When the pole zero and the gain have been properly adjusted, do a File Save and click Exit on the adjust screen. Clear the display.

6.2.3 Energy Cal/Efficiency Calibration

a. In GAA, open the Detector Data Source.

b Select Calibrate, Setup. Verify parameters, modify if necessary, then click OK.

c. Click Start to acquire a count of the calibration source.

d. Upon completion of the count, select Calibrate, Energy Full, By Certificate File. Select the certificate file to be used. Click Open.

e. Move the display cursor to the peak centroid for the first peak listed in the Certificate File list box (AM-241). Click the cursor button. Move to the last peak listed and repeat.

f. Click on Show and review Energy Cal curve. Verify the slope of the energy curve is within an acceptable tolerance of the previously calculated kev/ch value. Click OK and return to Energy Cal-Full, click on Auto to obtain coefficients. Click show to see curves and coefficients and if satisfied, click OK. Then click OK on the Energy Calibration Full Table.

g. Select File, then Save.

h. Select Calibrate, Efficiency, By Certificate File. Select file of choice, open and click Auto. Click Show. Click List Peaks. Adjust curve, scale, and order of polynomial to obtain best efficiency calibration curve. Click OK, then OK, then OK again to close all boxes. File Save.

i. Select Calibrate, Store, enter the file name, and then click Store.

j. Transfer the calibration information to ProCount by opening ProCount. Log in, then choose Calibration, Approve External Efficiency Calibration, then highlight the calibration file and choose Approve.

NOTE

If the detector is recalibrated, any external efficiencies must be reapproved (i.e., ISOCS geometry efficiencies).

6.2.4 QCC Daily Checks using ProCount

a. Log on using the User Name and password provided.

b Turn on High Voltage by selecting Detector Management, choose Detector and click Hardware Control, High Voltage-On/Off/Reset, choose On, and click OK. Then return to the main menu.

NOTE

Allow the high voltage to stabilize for at least 5 minutes before initiating a count.

c Click on Quality Control and choose Calibration QC Count.

d. Place the source 55 to 60 cm from the face of the detector.

e Select the geometry and click OK.

f Enter the count time 300 sec. and click OK.

g. Verify the detector numbers, and enter Sample ID as QCC_Date. Put the same information in for the description. Click OK.

h When the count is complete, remove the source and review the results by selecting Last Measurement Report from the Quality Control menu. Then choose the appropriate geometry. Screen shown on Form 1:

i Return to the Quality Control menu if there were flagged parameters. Select QC Plot/Report, then select Calibration QC file, choose Results then Show Chart. Highlight a parameter that was flagged. Click Show. Review the plot to verify the daily check value was within the acceptable range. Repeat for each parameter flagged. If the QC check is not acceptable, contact the FSS Engineer or Supervisor for direction on performing a recalibration.

j. If the QC check is acceptable, then return to the main Procount menu and select Sample Counting to begin data collection.

k. If background subtraction will be applied, then collect a background count.

1) From the Main Menu select Background Counts. Specify the proper detector (7607 Cartmount).

2) Answer the "Counting Geometry?" query by clicking on the Empty Shield box.

3) If queried for a time preset, enter 3600 sec unless directed otherwise by the Engineer.

4) Upon completion of the count, the new background count will replace any previous background count for the specified detector.

6.3 CALIBRATION AND SETUP OF SUBMARINE ISOCS DETECTOR

6.3.1 Add or Verify MCA

a. Go to the MCA Input Definition Editor (MID) and select Edit, add MCA, click on USB MCAs.

b. Choose the required MCA, select Add, then select Done.

c. Select Devices, then MCA, setup or verify the MCA settings for memory (e.g., 8K), enter Inspector S/N in Device Serial Number box, then select OK.

d. Go to Settings, then High Voltage. Set the HV to the bias voltage listed on the detector and select OK.

e Save the settings by selecting File/Save As. Use the detector number for the file name (7605) and select Save.

f Under settings, select Input. Enter the detector number for the Input name. Select OK.

g Add the MCA to the VDM by going to "Database", then select "Load To", highlight the detector in the File list box, click on "Load", then "Done." Verify by selecting Database/View. Close the MID.

6.3.2 Place the detector in the submarine IAW Attachment D.

6.3.3 Gain and Pole Zero Adjust

a. Go to GAA and maximize window.

b. Select File, then Open Data source.

c. Highlight the Detector to be used (7605 from the Inputs list), and click OK.

d. Select MCA, Acquire Setup, and set Live Time to the pre-determined count time 1000 sec. for calibration. Click OK.

e. Select MCA, then Adjust.

f. Select HVPS, verify proper voltage is set (detector bias voltage), then click ON. "Wait" appears under the word Adjust while the High Voltage ramps up. When HV has ramped up, "Wait" disappears.

g. Obtain a multienergy calibration source and position it on the surface of the submarine housing at the face of the detector. Acquire a long count of the source to obtain good peaks (5000 to 10,000 counts) in a peak calibration channel.

h. Select Filter, then click Next, and verify Pole Zero on initial calibration using the oscilloscope. Adjust as necessary, then choose Exit.

i. Select MCA, click Acquire Start, or click Start on the Control Panel to the left of the display, to begin collecting a spectrum with the source in place

j. Determine the kev/ch by dividing the desired maximum energy (e.g., 2500 kev) by the number of channels set in the MCA Input Definition Editor.

NOTE

8k equals 8192 channels.

k. In the MCA Adjust screen, choose Gain to adjust the gain controls. Pick the higher energy Co-60 peak (1332.5kev). Determine a channel location by dividing kev/ch into peak energy and place the cursor at that channel. Use the gain adjustments to bring peak centroid to the proper channel position. Once the high end is set, verify a low energy peak (Am-241, 59.5 kev) the same way.

l. When the pole zero and the gain have been properly adjusted, do a File Save and click Exit on the adjust screen. Clear the display.

6.3.4 Energy Cal/Efficiency Calibration

a. In GAA, open the Detector Data Source.

b. Select Calibrate, Setup. Verify parameters, modify if necessary, then click OK.

c. Click Start to acquire a count of the calibration source.

d. Upon completion of the count, select Calibrate, Energy Full, By Certificate File. Select the certificate file to be used. Click Open.

e. Move the display cursor to the peak centroid for the first peak listed in the Certificate File list box (AM-241). Click the cursor button. Move to the last peak listed and repeat.

f. Click on Show and review Energy Cal curve. Verify the slope of the energy curve is within an acceptable tolerance of the previously calculated kev/ch value. Click OK and return to Energy Cal-Full, click on Auto to obtain coefficients. Click show to see curves and coefficients and if satisfied, click OK. Then click OK on the Energy Calibration Full Table.

g. Select File, then Save.

h. Select Calibrate, Efficiency, By Certificate File. Select file of choice, open and click Auto. Click Show Click List Peaks. Adjust curve, scale, and order of polynomial to obtain best efficiency calibration curve. Click OK, then OK, then OK again to close all boxes. File Save.

i. Select Calibrate, Store, enter the file name, and then click Store.

j. Transfer the calibration information to ProCount by opening ProCount. Log in, then choose Calibration, Approve External Efficiency Calibration, then highlight the calibration file and choose Approve.

NOTE

If the detector is recalibrated, any external efficiencies must be reapproved (i.e., ISOCS geometry efficiencies).

6.3.5 QCC Daily Checks using ProCount

a. Log on using the User Name and password provided.

b. Turn on High Voltage by selecting Detector Management, choose Detector and click Hardware Control, High Voltage-On/Off/Reset, choose On, and click OK. Then return to the main menu.

NOTE

Allow the high voltage to stabilize for at least 5 minutes before initiating a count.

c. Click on Quality Control and choose Calibration QC Count.

d. Place the source on the surface of the submarine housing at the face of the detector.

e. Select the geometry "SUB" and click OK.

f. Enter the count time 120 sec. and click OK.

g. Verify the detector numbers, and enter Sample ID as QCC_Date. Put the same information in for the description. Click OK.

h. When the count is complete, remove the source and review the results by selecting Last Measurement Report from the Quality Control menu. Then choose the appropriate geometry. Screen shown on Form 1.

i. Return to the Quality Control menu if there were flagged parameters. Select QC Plot/Report, then select Calibration QC file, choose Results then Show Chart Highlight a parameter that was flagged. Click Show. Review the plot to verify the daily check value was within the acceptable range. Repeat for each parameter flagged. If the QC check is not acceptable, contact the FSS Engineer or Supervisor for direction on performing a recalibration.

j. If the QC check is acceptable, then return to the main Procount menu and select Sample Counting to begin data collection.

k. If background subtraction will be applied, then collect a background count.

1) From the Main Menu select Background Counts. Specify the proper detector (7605 Underwater).

2) Answer the "Counting Geometry?" query by clicking on the Empty Shield box.

3) If queried for a time preset, enter 3600 sec unless directed otherwise by the Engineer.

4) Upon completion of the count, the new background count will replace any previous background count for the specified detector.

6.4 COUNTING A SAMPLE

6.4.1 In the main menu select Sample Counting. Verify or enter the Sample Type, Sample Live Count Time or Count to MDA Min./Max times, and Detector, then click OK

6.4.2 Enter the sample ID information using the Sample Parameters screen, then click OK.

6.4.3 View the completed spectrum at the end of count time by selecting the View Last Report option on the Detector Management window to verify the spectrum makes sense qualitatively before beginning the next count.

6.4.4 At least daily, transfer the collected data to a disk or other storage media and deliver it to the FSS Engineer for analysis.

6.5 SHUTTING DOWN THE SYSTEM IN GENIE

6.5.1 Complete all analyses and store all files.

6.5.2 Select MCA, Adjust, and High Voltage.

6.5.3 Change the status to OFF. Wait for the high voltage to drop to zero as indicated by the Inspector HV LED.

6.5.4 Shut down the computer and turn off all power to the system. Disconnect the detector, the Inspector, and computer, and place in storage. (Once the high voltage has been removed, the detector can be allowed to warm up.) During periods of continuous operation, the detector should be kept cold using the auto fill system.

6.6 SHUTTING DOWN THE SYSTEM IN PROCOUNT

6.6.1 Go into Detector Management, choose Detector, and click on Hardware Control.

6.6.2 Select High Voltage-On/Off/Reset. Enter Off in the choice box and click OK.

6.6.3 Return to the main menu and exit the program.

6.6.4 Shut down the computer and turn off all power to the system. Disconnect the detector, the Inspector, and computer, and place in storage. (Once the high voltage has been removed, the detector can be allowed to warm up.) During periods of continuous operation, the detector should be kept cold using the auto fill system.

7.0 ATTACHMENTS

7.1 Attachment A, Procedural Qualifications

7.2 Attachment B, Gamma Spec Checklist

7.3 Attachment C, QC Analysis Sequence and Definition Parameters

7.4 Attachment D, Proper Closure of the ISOCS Submarine

8.0 FORMS

Form 1, Portable Gamma Spec QA/QC Check

ATTACHMENT A

PROCEDURAL QUALIFICATIONS

1. PRECAUTIONS

Germanium detectors will be irreparably damaged if allowed to warm up with the High Voltage on. ALWAYS keep them cooled with liquid nitrogen when in use. The portable units require filling much more frequently (twice a day for the small detector) or provide them with a constant refill from a large nitrogen source.

Germanium detectors are kept at liquid nitrogen temperature for proper operation. They will not be damaged if allowed to warm up, PROVIDED the high voltage is turned off.

When a germanium detector warm-up cycle has begun, it should be allowed to warm up fully before being cooled down again. Remove the dipstick from the Dewar for two days, keeping vertically upright or horizontal at all times. NEVER invert a dipstick cryostat. Return to Dewar, but do not turn the high voltage back on until it has cooled down for at least six hours.

Avoid contaminating detectors, shields, or sample holders.

Ensure the Inspector battery has been fully charged in order to get a full days counting from it.

The Inspector MCA has a temperature range of 32-100°F and the laptop computer has a range of 40-95°F

2. PREREQUISITES

Cool the FSS portable germanium detectors for at least six hours prior to applying high voltage. Ensure the Inspector battery is charged.

Connect the Inspector to the detector and the laptop to the Inspector prior to applying high voltage to the detector.

Verify there are no blinking fault LEDs on the Inspector prior to beginning counting.

3. EXCLUSIONS

None

4. COMMITMENTS

None

5. FINAL CONDITIONS

The high voltage has been removed from the detector, the Inspector has been turned off and disconnected. The detector has been allowed to warm up and placed in storage.

ATTACHMENT B

GAMMA SPEC CHECKLIST

CHECKLIST REVIEW

A. Gamma Spectrum Analysis Report Review

(1) Parameters listed within the Header Report for a gamma spectral analysis are defined either by the User or the Software. The Engineer/reviewer shall re-check and correct all significant typographical errors of input.

B. Nuclide Identification Report

(1) Most of the energy lines listed should be found in the spectrum. Loose pre-amp wiring, low LN2 levels, changes in room temperature and humidity may cause detector drift. If detector drifts occurs, a large number of these peaks on the higher end of the energy spectrum will not be identified. Make an investigation of its cause and initiate the appropriate corrective action.

(2) Flags appearing alongside the nuclide peaks are used to tell whether the peak was found, and if it was used for further calculations.

C. Interference Corrected Report

(1) Identified nuclides are listed in an order of increasing mass number. Confidence values range from 0.1000 through 1.0000. Nuclide libraries stored with energy line(s), half live(s) and relative % abundance(s) are used in this identification Nuclides with confidence values less than 0.1000 are not identified. A maximum confidence value of 1.0000 indicates an exact fit.

(2) Appearing next to the individually decay corrected nuclide activities are the calculated errors associated with these measurements. Smaller identified peaks will have a larger error.

(3) Energy lines not used for quantification will be listed under unidentified peaks. Detector drift can occur, however, increasing the number of these "non-identifiable" lines. If detector drift is occurring, initiate the appropriate corrective action.

ATTACHMENT C

QC ANALYSIS SEQUENCE AND DEFINITION PARAMETERS

QA ANALYSIS SEQUENCE PARAMETERS

Peak Locate – Unidentified 2nd Difference
- Start Channel: 50
- Stop Channel: 8192
- Significance Threshold: 3.00
- Tolerance Energy: 2.00 kev

Peak Area – Sum/Non-linear LSQ Fit
- Peak Area Region
  - Start Channel: 50
  - Stop Channel: 8192
- Continuum
  - Continuum: 4 channels
  - Continuum Function: Step
- Check Boxes
  - 95% Critical Level Test: Checked
  - Use Fixed FWHM: Unchecked
  - Use Fixed Tail Parameter: Unchecked
  - Fit Singlets: Checked
  - Display ROIs: Checked
  - Reject Zero Area Peaks: Checked
- Residual Search
  - Perform Search: Unchecked
- ROI Limits Determination
  - Max Num FWHMs between Peaks: 5.00
  - Max Num FWHMs for Left Limit: 2.00
  - Max Num FWHMs for Right Limit: 2.00

QA DEFINITION PARAMETERS

Peak Centroid Boundary Test ± 5 Channels for:
- 59.53 kev
- 661.65 kev
- 1332.48 kev

Peak Centroid FWHM N-Sigma Test Investigate 2.00 Action 3.00 for:
- 59.53 kev
- 661.65 kev
- 1332.48 kev

Peak Counts/Second N-Sigma Test Investigate 2.00 Action 3.00 for:
- 59.53 kev
- 661.65 kev
- 1332.48 kev

ATTACHMENT D

PROPER CLOSURE OF THE ISOCS SUBMARINE

1. Remove the small ISOCS detector from the holder.
2. Place the submarine unit (SUB) on the floor with the opening up.
3. Ensure there are no obstructions in the SUB.
4. Carefully place the detector end of the ISOCS unit into the SUB.
5. Route the ISOCS cables between the foam stand-offs along the side of the SUB.
6. The ISOCS is completely within the enclosure when the top is approximately 3.25 inches from the top edge of the SUB.
7. Inspect the O-ring located in the lid of the SUB for damage – DO NOT USE if there are cracks, gouges, or breaks in the O-ring until it has been replaced.
8. If necessary, place a small amount of grease on the O-ring located in the lid of the SUB.
9. Attach the unshielded aircraft cable from the top of the detector to the knurled nut on the underside of the lid of the SUB.
10. Appropriately make all cable connections, ensuring to isolate each connector from directly contacting another by use of the plastic webbed shrouds or electrical tape
11. Place the lid on the open end of the SUB.
12. Insert a hex bolt into each hole and hand-tighten.
13. Using an appropriate working torque wrench, tighten each hex bolt in numerical order (1 through 8) to approximately 40 inch-pounds.
14. Once tightened, verify the torque of each hex bolt is within the tolerance range of 36 to 48 inch-pounds.
15. Visually inspect the interface of the lid to the SUB main body to ensure no gap is present – a gap may indicate a damaged hex bolt and/or threaded hole.
16. DO NOT USE the SUB if any hex bolt is missing until the hex bolt has been replaced or if the interface of the lid to the SUB body appears inadequate to prevent in-leakage of water.

FORM 1

PORTABLE GAMMA SPEC QA/QC CHECK

Last Measurement Q.A. Report 4/15/2003 9:25:37 AM Page 1

***** G E N I E Q U A L I T Y A S S U R A N C E *****

Last Results Report
4/15/2003 9:25:37 AM

QA File: C:\PCNT2K\QAFILES\G01D02C.QAF
Sample ID: QC0421503_4
Sample Quantity: 1.0000E+000
Sample Date: 4/15/2003 9:20:00 AM
Measurement Date: 4/15/2003 9:20:34 AM
Elapsed Live Time: 300.0 seconds
Elapsed Real Time: 301.1 seconds
Geometry: ptsrs

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Peak centroid 59.53 kev [0.00+/-0.00]	1.9577E+002	0.00 < : : : >
Peak centroid 661.65 kev [0.00+/-0.00]	2.1667E+003	0.00 < : : : >
Peak centroid 1332.48 ke [0.00+/-0.00]	4.3652E+003	0.00 < : : : >
Peak FWHM 59.53 kev [0.00+/-0.00]	1.0066E+000	0.00 < : : : >
Peak FWHM 661.65 kev [0.00+/-0.00]	1.4413E+000	0.00 < : : : >
Peak FWHM 1332.48 kev [0.00+/-0.00]	1.8665E+000	0.00 < : : : >
Peak counts/second 59.53 [0.00+/-0.00]	2.4815E+000	0.00 < : : : >
Peak counts/second 661.6 [0.00+/-0.00]	3.5591E+000	0.00 < : : : >
Peak counts/second 1332. [0.00+/-0.00]	4.5274E+000	0.00 < : : : >

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Attachment 7

Forbay Soil Boring Project

[This is an Initial Assesment, the report was not updated as final]

MAINE YANKEE ATOMIC POWER COMPANY

FOREBAY REMEDIATION
SOIL BORINGS FOR RADIOLOGICAL SCREENING
PROGRAM REQUIREMENTS

JULY 11, 2002

Prepared by:

Herbert C. Scribner
Project Manager

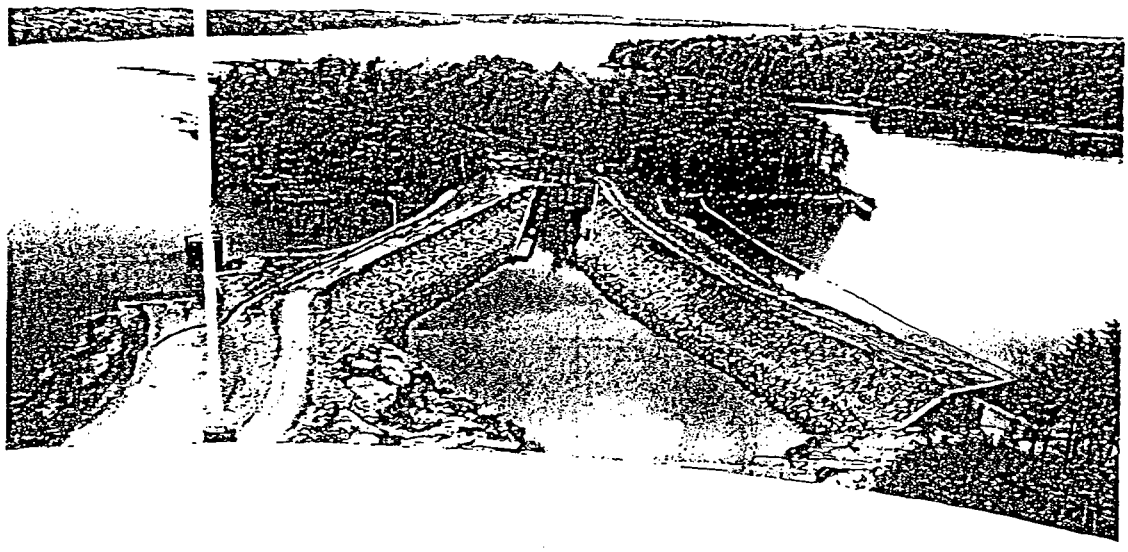


TABLE OF CONTENTS

A. OVERVIEW

A test boring program is proposed to improve Maine Yankee's (MY) understanding of the spatial distribution of nuclide contamination in the Forebay dike structures. In the spring of 2001, preliminary sampling of sediment and soil in the Forebay and behind the coarse slope protection (rip-rap) along the interior dike walls indicated elevated levels of Co-60 contamination. Based on this assessment and the release criteria set forth in the MY License Termination Plan (LTP)[1], it is clear that the bulk of contaminated sediment on the Forebay/seal floor will require removal. The limited sampling of soil under the rip-rap covering indicated the penetration of some level of plant derived contamination as deep as 24" into the dike walls (under the rip-rap).

Maine Yankee seeks more extensive soil sampling and analysis in areas behind the coarse slope protection to assess the need for remediation (based on dose contributions and the latest dose assessment currently being developed for the LTP).

The proposed core boring program detailed below may be expanded based on the findings of each boring. For example, if elevated radiation levels are identified at one boring location, one or more additional borings may be installed to better define the extent of the contamination. Maine Yankee personnel will direct the scope of the program based, in part, on data provided by the field exploration team.

B. BORING LOCATIONS AND RATIONALE

Proposed locations of test borings are shown on Figure 1. The attached table (Table 1) details the rationale for each boring. Several boring locations are also shown on the generalized geologic profiles (Figure 2). The initial phase of borings includes seven drilled vertically, and twelve drilled at an angle. The vertical borings are designed to collect fill materials from the central portions of the Forebay dikes (east and west). The vertical borings probe pervious and impervious fill and will be advanced to the top of bedrock.

The angled borings probe pervious fill behind the coarse rip-rap. The borings are angled in order to penetrate specific fill layers that were constructed with a defined slope (*e.g.*, 1.75 horizontal to 1 vertical). With the exception of borings FB16a and FB17a, the angled borings will be drilled into a 2-foot thick layer of "fine slope protection." The fine slope protection underlies the outer coarse slope protection and reportedly consists of ~6-inch gravel. Angled borings FB16a and FB17a will be drilled into a 2-foot thick "pervious layer", reportedly consisting of ~4-inch gravel. This pervious layer underlies the fine slope protection. It is anticipated that the angle of drilling will be on the order of 30 degrees from horizontal. Refer to Figure 3 for details on forebay dike construction.

[1] The LTP remains in active review by the NRC. LTP approval is expected in fall 2002.

Angled borings FB16/FB16a and FB17/FB17a are located adjacent to an area where sediments with relatively high Co-60 counts were identified. The boring couplets FB16/FB16a and FB17/FB17a will allow evaluation of whether radiation has penetrated into the two gravel fill layers (-6-inch layer and -4-inch layer) behind the rip-rap (coarse slope protection).

C. FIELD MARKING OF BORING LOCATIONS

Maine Yankee, and Jacques Whitford Company, Inc. (JWC) will mark each boring location in the field using grade stakes and flagging. The locations will be identified by measuring distances from mapped site features, such as the seal pit weir or intake structure. Target fill layers for the angled borings will be identified by observations of exposed soils following initial "cut-down" of the two Forebay dikes.

D. SURVEY CONTROL

The survey team will complete a survey of existing Forebay features, including the slope of the outer coarse slope protection (rip-rap). The survey data will be used to generate profiles showing boring locations and the adjacent rip-rap slope at each boring location.

Following field marking, the surveyors will survey the locations of each test boring. Maine Yankee anticipates that boring stakes will be removed in order to construct a 6-inch gravel road surface. The survey data will be used to accurately relocate the boring locations once the road surface is in place.

The survey team will provide control for the angled borings. They will assist the driller with positioning of the drill rig at the required angle both in the horizontal and vertical planes. Upon completion of the angled borings, the surveyors will check the rig orientation to quantify any deviations from the original position. The angle of each boring will be provided by Maine Yankee based on plans showing the slope of fill layers within each of the Forebay dikes.

E. DRILLING PROTOCOL

The primary objective of the drilling program is to collect discrete samples of fill material from known locations within the Forebay dike structure. The protocol detailed below incorporates drilling methods and survey control techniques that optimize sample recovery, minimize the use of drilling fluids, and provides control of boring locations and drilling angles.

1. The borings will be advanced using a Rotasonic drill rig. The Rotasonic uses harmonic wave energy to advance an outer 8-inch (OD) casing and inner 6.5-inch (OD) corebarrel (sampler) for the angled borings, and an outer 5.5-inch (OD) casing and inner 4.5-inch (OD) corebarrel for the vertical borings.

2. Fill material will be collected in a 10 foot long, 6.5-inch (OD) corebarrel. The driller will extrude the fill sample into an approximately 7-inch diameter clear plastic bag. The driller will record sample recovery as the ratio of length of sample retrieved to the length of the core run. To comply with standard Final Status Survey (FSS) protocol, soil samples (in general) must be collected from borings of no larger than one (1) meter in depth. To comply with this requirement, sample fill material from the corebarrel must be retrieved and bagged such that the material can be effectively correlated to a given (approximate) one meter of corebarrel length.

3. To help maintain the integrity of the Forebay dike surface, truck traffic will be minimized. It is anticipated that traffic on the dikes will be minimized by completing the proposed borings in the following order:

   FB7, FB6, FB5, FB1, FB2, FB3, FB4, FB17, FB17a, FB16, FB16a, FB15, FB14, FB13, FB8, FB9, FB10, FB11, FB12

4. The core barrel will be cleaned between successive runs with a potable water rinse. A scrub brush will be used to remove cohesive materials that may cling to the inside or outside of the corebarrel. Wash water will be collected in a plastic container (*e.g.*, clean trash container).

5. The outer 8-inch (OD) casing will be steam-cleaned between boring locations. Steam cleaning will be conducted on an impervious steam-cleaning pad constructed by the driller at a location specified by Maine Yankee. The pad will be designed to collect soil and water generated by the cleaning operation.

6. The drill rig shall arrive at the site free of any contaminants that might impact the samples and site environment, and will be subject to inspection prior to entry to the Maine Yankee site. Hydraulic lines and other possible sources of potential spills will be leak tight and in good condition.

7. Maine Yankee will provide Radiation Protection (RP) support for the two-person drill crew. RP will conduct radiation screening of drill equipment prior to clearance for removal off-site. RP will provide screening of any waste materials (*e.g.*, soil and water) that is generated. Maine Yankee will be responsible for containment and disposal of such wastes.

8. Boreholes will be backfilled upon completion with Volclay or an equivalent grout using tremie-pipe procedures. At some boring locations it will be necessary to place grout in boreholes below the water table. The viscosity of the grout will be adjusted to minimize loss of grout into the surrounding formation.

9. Prior to job start-up, the drilling team will review Forebay construction details to provide an understanding of anticipated subsurface conditions.

F. SAMPLE MANAGEMENT

1. A JWC geologist will photograph and screen each soil sample for volatile organic compounds (VOCs) with a photo ionization detector (PID). JWC will document geologic characteristics on a soil boring log.

2. In conjunction with Maine Yankee RP support, the JWC geologist will provide sample material for contamination measurements by Maine Yankee. One sample per every 3 feet of sample recovered will be provided for radiation testing.

3. Samples will be relinquished by the JWC geologist to Maine Yankee RP representatives under chain-of-custody protocol per MY procedures. Maine Yankee will invoke procedure DI-6-157 "Chain of Custody" for the collection of these samples.

4. Surplus sample material will be collected in labeled heavy-duty plastic bags or plastic buckets. The labels will identify the boring number, depth and date of collection. It is anticipated that 3 to 5 cubic yards or more of excess sample material may be collected over the course of the coring program. The surplus sample material will be stored at a location identified by Maine Yankee.

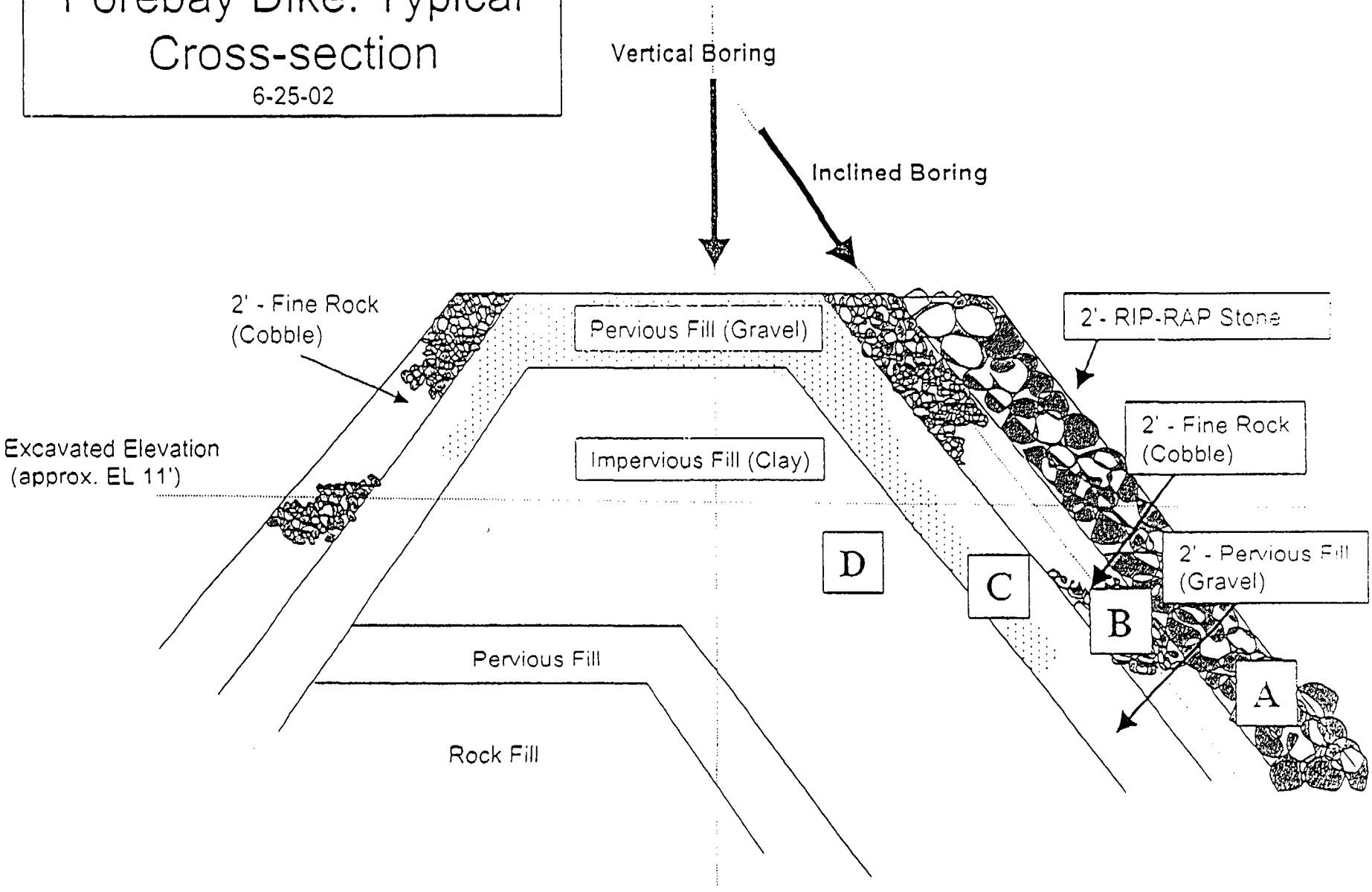
Table 1
Summary of Proposed Forebay Borings

Boring	Orientation	Estimated Depth to Bedrock[1] (ft)	Estimated Core Run Based on 30° Drilling Angle	Rationale
FB1	Vertical	22	N/A	Evaluate interior of dike adjacent to relatively high Co-60 readings in sediment along west dike
FB2	Vertical	60+	N/A	Evaluate interior of dike in deep fill zone along west dike
FB3	Vertical	28	N/A	Evaluate interior of dike adjacent to seeps along west dike
FB4	Vertical	17	N/A	Evaluate interior of dike adjacent to relatively high Co-60 readings in sediment along west dike
FB5	Vertical	26	N/A	Evaluate interior of dike adjacent to relatively high Co-60 readings in sediment along east dike
FB6	Vertical	17	N/A	Evaluate interior of dike adjacent to relatively high Co-60 readings in sediment along east dike
FB7	Vertical	8	N/A	Evaluate interior of dike in pervious materials along east dike
FB8	Angled	18	36	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along east dike
FB9	Angled	18	36	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along east dike
FB10	Angled	16	32	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along east dike
FB11	Angled	20	40	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along east dike
FB12	Angled	14	28	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along east dike
FB13	Angled	25	50	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along west dike
FB14	Angled	35	71	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along west dike; deep fill zone
FB15	Angled	35	71	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along west dike; deep fill zone
FB16	Angled	27	54	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along west dike
FB16a	Angled	23	46	Evaluate fill materials in –4-inch layer; adjacent to relatively high Co-60 readings in sediment along west dike
FB17	Angled	10	20	Evaluate fill material behind rip-rap; adjacent to relatively high Co-60 readings in sediment along west dike
FB17a	Angled	10	20	Evaluate fill materials in –4-inch layer; adjacent to relatively high Co-60 readings in sediment along west dike

1. Depths based on estimated depth to bedrock from top of dike after initial soil removal.

Forebay Dike: Typical Cross-section

6-25-02



Forebay Remediation
Soil Borings for Radiological Screening
Data Summary and Initial Assessment
December 12, 2002

During the period from August 8, 2002 to September 17, 2002, Maine Yankee conducted a soil coring campaign to further characterize the radiological contaminant distribution within the dikes of the forebay and to support remediation planning. The following represents a summary of the resulting data from the sample analyses.[1]

Samples of dike soil material were taken from nineteen discrete dike locations at a sample frequency of about one sample per meter of depth. Seven of these locations were vertically drilled in the approximate center of the dike. The exact placement of the seven vertical corings were reviewed and adjusted per discussions with the project hyrdrogeologist. This consultation was made to provide some assurance that the vertical locations and resulting samples could be informative regarding potential flow paths interior to the dike walls considering dike construction and bedrock contours. Ten locations were drilled inclined at an angle directly behind (i.e., parallel to) the forebay interior coarse rip-rap which forms the dikes' outermost layer. Two locations were drilled at an angle into a 2-foot thick "pervious layer", which was designed to consist of "four inch minus" material (primarily gravel). These two locations were drilled behind the two inclined locations which were expected to have the highest contamination potential based upon previous sampling of accessible forebay sediment.[2] Thus, this "couplet" arrangement, i.e., two inclined corings with one just below the rip-rap layer and one displaced approximately 2' interior to the dike, was intended to give some sense of the profile, if any, of contamination penetration into the dike interior.

In general, both the vertical and inclined corings were made down to the bedrock layer beneath the dikes. This, therefore, meant that the corings varied in depth of penetration from 11.5 feet and as deep as 78.0 feet, with the average depth of about 40 feet. An important point here is that this system of deeply penetrating corings, widely distributed in the dike centers and close to the rip-rap, were expected to provide a very representative picture of contamination, if any, both interior and below the dike structures.

The equipment used for the coring utilized a special sonic technique that allowed for effective capture of materials at specific axial locations with a relatively high degree of spatial precision. Further, the sonic technology allowed the minimal use of drilling lubricants that can otherwise add uncertainty to constituent concentrations. Lastly, it

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[1] This information was summarized and provided to the NRC, along with associated updates to the Maine Yankee License Termination Plan (Attachment 2H) by Maine Yankee's letter, MN-02-063, dated December 12, 2002.

[2] For additional detail on the two high activity sediment samples, previously obtained and analyzed, see LTP Attachment 2H, Section 2.1. The samples were taken on the northern portion of the west dike at the high tide level. See LTP Figure 2H-1 for the general sample location.

should be noted that an extensive photographic record was maintained of the coring samples to support correlation of sample results with the material coloring, if such a correlation could be made.

Each approximately one meter coring depth was representatively sampled. These samples were weighed and subjected to gamma spectroscopy using a HPGe detector for a 10 minute count. The results were aggregate corrected to account for the removal of rocks. This produced a data set of 274 (two-hundred-seventy-four) measurements for gamma emitting nuclides of potential concern, namely cobalt, cesium and antimony (274 data points for each nuclide). Out of the 274 measurements, 67 (sixty-seven) were from the vertical drilled coring locations and 207 (two-hundred-seven) were from the inclined coring locations.

Most of the results were less than minimum detectable activity. There were 6 (six) instances of positively detected cobalt (Co-60) and 38 (thirty-eight) instances of positively detected cesium (Cs-137). There were no instances of positively detected antimony. All of the positively detected instances of cobalt were from the inclined corings. Thus, there were no positive detections of the plant derived cobalt in the vertical corings. And in the vertical corings, there were only two positively detected instances of cesium.

The highest detectable cobalt measurement was 0.094 pCi/g, which was in an inclined coring location. The highest detectable cesium measurement was 0.170 pCi/g, which was also in an inclined coring location. The averages for all positively detected Co-60 and Cs-137 results were 0.071 pCi/g and 0.082 pCi/g, respectively. This compares with the Maine Yankee License Termination Plan surface soil[3] DCGL's for Co-60 and Cs-137 of 1.1 pCi/g and 3.2 pCi/g, respectively.

Overall, the forebay dike soil coring campaign has shown that radiological contamination has not penetrated into the forebay dikes beyond the rip-rap to any dose significant extent. The sample results from the vertically drilled coring locations identified no instances of detectable plant derived radiation with levels of cesium contamination consistent with background (fallout) levels. The sample results from the inclined drilled locations identified some positively detected levels of cesium and cobalt just above the minimum detectable activity. These detections were probably associated with instances where the coring rig crossed over the gravel/rip-rap interface.[4] Even the highest levels of positively detected cesium and cobalt measurements, were not only significantly below the Maine Yankee License Termination Plan surface soil DCGL's but

[3] The listed DCGLs apply to the industrial area.

[4] Previous forebay sediment sampling clearly indicated that the organic marine sediment (dark in color) around the rip-rap contains higher activity levels. This is true for underwater sediment as well. The above reference to the gravel/rip-rap interface refers to those apparent instances when the drilling column skimmed very close to the rip-rap, picking up some of the actual marine sediment deposited around the rip-rap. Thus, these samples would contain the dike material from the fine rock/cobble below the rip-rap along with some marine sediment deposited around the rip-rap. Such a mixture would be expected to contain slightly higher activity due to the presence of the consistently more highly contaminated marine sediment.

also well below the levels assumed in the LTP's dose modeling for the forebay (LTP Section 6.6.9).

As noted in LTP Attachment 2H (Section 2.3 and Table 2H-5), marine sediment around the rip-rap will be remediated. However, given that the dike coring sampling results revealed very low levels of dike soil contamination, well below that assumed in the LTP's conservative dose assessment, it is concluded that remediation of the dike soil is not warranted.

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB4	8/8/02	FB4-08-08-02-0-5	2	5.0	90	1.524	0.000	1.524	< 1.58E-01	1.59E-01	< 3.80E-01	1854	2.24E+00
bearing):NA	8/8/02	FB4-08-08-02-5-8	1	8.0	90	2.438	0.000	2.438	< 7.50E-02	7.52E-02	< 1.80E-01	1847	9.94
	8/8/02	FB4-08-08-02-8-16	2	16.0	90	4.877	0.000	4.877	< 1.41E-01	< 1.41E-01	< 3.38E-01	1655	2.00E+00
	8/8/02	FB4-08-08-02-16-19	1	19.0	90	5.791	0.000	5.791	< 7.05E-02	< 7.07E-02	< 1.69E-01	1691	1.00E+00
	8/8/02	FB4-08-08-02-19-22	1	22.0	90	5.705	0.000	5.706	< 7.50E-02	< 7.52E-02	< 1.80E-01	1753	1.40E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB2	8/13/02	FB2-08-13-02-0-4	1	4.0	90	1.219	0.000	1.219	< 6.57E-02	< 6.51E-02	< 1.78E-01	2293	7.40E-01
bearing):NA	8/13/02	FB2-08-13-02-4-6	1	6.0	90	1.829	0.000	1.829	< 7.48E-02	< 7.42E-02	< 2.03E-01	2609	6.50E-01
	8/13/02	FB2-08-13-02-6-8.5	1	8.5	90	2.591	0.000	2.591	< 6.00E-02	< 5.95E-02	< 1.63E-01	2089	8.10E-01
	8/13/02	FB2-08-13-02-8.5-11	1	11.0	90	3.353	0.000	3.353	< 6.00E-02	< 5.95E-02	< 1.63E-01	2070	8.10E-01
	8/13/02	FB2-08-13-02-11-16	1	16.0	90	4.877	0.000	4.877	< 5.72E-02	< 5.67E-02	< 1.55E-01	2046	8.50E-01
	8/13/02	FB2-08-13-02-16-18.5	1	18.5	90	5.639	0.000	5.639	< 5.46E-02	< 5.42E-02	< 1.48E-01	1940	8.90E-01
	8/13/02	FB2-08-13-02-18.5-21	1	21.0	90	6.401	0.000	6.401	< 5.72E-02	< 5.67E-02	< 1.55E-01	1971	8.50E-01
	8/13/02	FB2-08-13-02-21-23.5	1	23.5	90	7.163	0.000	7.163	< 6.31E-02	< 6.26E-02	< 1.71E-01	2189	7.70E-01
	8/13/02	FB2-08-13-02-23.5-26	1	26.0	90	7.925	0.000	7.925	< 6.00E-02	< 5.95E-02	< 1.63E-01	2120	8.10E-01
	8/13/02	FB2-08-13-02-26-28.5	1	28.5	90	8.687	0.000	8.687	< 6.00E-02	< 5.95E-02	< 1.63E-01	2083	8.10E-01
	8/13/02	FB2-08-13-02-28.5-31	1	31.0	90	9.449	0.000	9.449	< 6.57E-02	< 6.51E-02	< 1.78E-01	2350	7.40E-01
	8/13/02	FB2-08-13-02-31-33.5	1	33.5	90	10.211	0.000	10.211	< 6.31E-02	< 6.26E-02	< 1.71E-01	2184	7.70E-01
	8/13/02	FB2-08-13-02-33.5-36	1	36.0	90	10.973	0.000	10.973	< 5.72E-02	< 5.67E-02	< 1.55E-01	2006	8.50E-01
	8/14/02	FB2-08-14-02-36-38.5	1	38.5	90	11.735	0.000	11.735	< 5.17E-02	< 5.13E-02	< 1.40E-01	1832	9.40E-01
	8/14/02	FB2-08-14-02-38.5-41	1	41.0	90	12.497	0.000	12.497	< 5.17E-02	< 5.13E-02	< 1.40E-01	1831	9.40E-01
	8/14/02	FB2-08-14-02-41-43.5	1	43.5	90	13.259	0.000	13.259	< 5.46E-02	< 5.42E-02	< 1.48E-01	1939	8.90E-01
	8/14/02	FB2-08-14-02-43.5-46	1	46.0	90	14.021	0.000	14.021	< 5.17E-02	< 5.13E-02	< 1.40E-01	1776	9.40E-01
	8/14/02	FB2-08-14-02-46-49	1	49.0	90	14.935	0.000	14.935	< 5.17E-02	< 5.13E-02	< 1.40E-01	1776	9.40E-01
	8/14/02	FB2-08-14-02-49-50	1	50.0	90	15.240	0.000	15.240	< 4.86E-02	< 4.82E-02	< 1.32E-01	1533	1.00E+00

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)		Cobalt-60 (pCi/g)		Cesium (pCi/g)		Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB3	8/12/02	FB3-08-12-02-0-1	1	1.0	90	0.305	0.000	0.305	<	6.33E-02	<	5.25E-02	<	1.45E-01	1730	1.00E+00
bearing:NA	8/12/02	FB3-08-12-02-3-5	1	3.5	90	1.067	0.000	1.057	<	6.73E-02	<	5.65E-02	<	1.54E-01	1755	3.40E-01
	8/12/02	FB3-08-12-02-5-7.5	1	7.5	90	2.286	0.000	2.286	<	6.73E-02	<	5.65E-02	<	1.54E-01	1841	3.40E-01
	8/12/02	FB3-08-12-02-7.5-10	1	10.0	90	3.048	0.000	3.048	<	6.73E-02		6.65E-02	<	1.54E-01	1761	3.40E-01
	8/12/02	FB3-08-12-02-10-12.5	1	12.5	90	3.810	0.000	3.810	<	8.22E-02	<	8.12E-02	<	1.88E-01	2196	7.70E-01
	8/12/02	FB3-08-12-02-12.5-15	1	15.0	90	4.572	0.000	4.572	<	8.92E-02	<	8.80E-02	<	2.04E-01	2427	7.10E-01
	8/12/02	FB3-08-12-02-15-20	2	20.0	90	6.096	0.000	6.096	<	2.69E-02	<	1.47E-01	<	6.16E-02	2012	2.35E+00
	8/12/02	FB3-08-12-02-20-25	2	25.0	90	7.620	0.000	7.620	<	2.34E-02	<	1.69E-01	<	5.37E-02	2330	2.70E+00
	8/13/02	FB3-08-13-02-25-27.5	1	27.5	90	8.382	0.000	8.382	<	9.31E-02	<	9.19E-02	<	2.13E-01	2507	6.80E-01
	8/13/02	FB3-08-13-02-27.5-30	1	30.0	90	9.144	0.000	9.144	<	9.31E-02	<	9.19E-02	<	2.13E-01	2459	6.80E-01
	8/13/02	FB3-08-13-02-30-32.5	1	32.5	90	9.906	0.000	9.906	<	8.92E-02	<	8.80E-02	<	2.04E-01	2370	7.10E-01
	8/13/02	FB3-08-13-02-32.5-35	1	35.0	90	10.668	0.000	10.668	<	9.74E-02	<	9.62E-02	<	2.23E-01	2609	6.50E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)		Cobalt-60 (pCi/g)		Cesium (pCi/g)		Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB1	8/14/02	FB1-08-14-02-0-2	1	2.0	90	0.610	0.000	0.610	<	7.14E-02	<	7.31E-02	<	1.46E-01	2339	7.40E-01
bearing:NA	8/14/02	FB1-08-14-02-2-6	1	6.0	90	1.829	0.000	1.829	<	5.93E-02	<	6.08E-02	<	1.21E-01	1873	8.90E-01
	8/14/02	FB1-08-14-02-6-8	1	8.0	90	2.438	0.000	2.438	<	6.21E-02	<	6.36E-02	<	1.27E-01	2012	8.50E-01
	8/14/02	FB1-08-14-02-8-10	1	10.0	90	3.048	0.000	3.048	<	6.52E-02	<	6.68E-02	<	1.33E-01	2105	8.10E-01
	8/14/02	FB1-08-14-02-10-13	1	13.0	90	3.962	0.000	3.962	<	6.21E-02	<	6.36E-02	<	1.27E-01	1978	8.50E-01
	8/14/02	FB1-08-14-02-13-16	1	16.0	90	4.877	0.000	4.877	<	6.21E-02	<	6.36E-02	<	1.27E-01	1983	8.50E-01
	8/14/02	FB1-08-14-02-16-18.5	1	18.5	90	5.639	0.000	5.639	<	6.86E-02	<	7.03E-02	<	1.40E-01	2203	7.70E-01
	8/14/02	FB1-08-14-02-18.5-21	1	21.0	90	6.401	0.000	6.401	<	6.52E-02	<	6.68E-02	<	1.33E-01	2100	8.10E-01
	8/14/02	FB1-08-14-02-21-23.5	1	23.5	90	7.163	0.000	7.163	<	6.21E-02	<	6.36E-02	<	1.27E-01	2039	8.50E-01
	8/14/02	FB1-08-14-02-23.5-26	1	26.0	90	7.925	0.000	7.925	<	6.21E-02	<	6.36E-02	<	1.27E-01	2203	8.50E-01
	8/14/02	FB1-08-14-02-26-29	1	29.0	90	8.839	0.000	8.839	<	6.52E-02	<	6.68E-02	<	1.33E-01	2054	8.10E-01
	8/14/02	FB1-08-14-02-29-32.5	1	32.5	90	9.906	0.000	9.906	<	6.86E-02	<	7.03E-02	<	1.40E-01	2138	7.70E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB5	8/15/02	FB5-08-15-02-0-3	1	3.0	90	0.914	0.000	0.914	< 6.51E-02	< 6.46E-02	< 1.32E-01	2085	8.10E-01
bearing:NA	8/15/02	FB5-08-15-02-3-6	1	6.0	90	1.829	0.000	1.829	< 5.84E-02	< 5.79E-02	< 1.39E-01	2181	7.70E-01
	8/15/02	FB5-08-15-02-6-10	1	10.0	90	3.048	0.000	3.048	< 5.92E-02	< 5.88E-02	< 1.20E-01	1891	8.90E-01
	8/15/02	FB5-08-15-02-10-13	1	13.0	90	3.962	0.000	3.962	< 6.51E-02	< 6.46E-02	< 1.32E-01	2070	8.10E-01
	8/15/02	FB5-08-15-02-13-16	1	16.0	90	4.877	0.000	4.877	< 6.20E-02	< 6.15E-02	< 1.26E-01	1955	8.50E-01
	8/15/02	FB5-08-15-02-16-19	1	19.0	90	5.791	0.000	5.791	< 6.51E-02	< 6.46E-02	< 1.32E-01	2062	8.10E-01
	8/15/02	FB5-08-15-02-19-22	1	22.0	90	6.706	0.000	6.706	< 7.12E-02	< 7.07E-02	< 1.45E-01	2258	7.40E-01
	8/15/02	FB5-08-15-02-22-25	1	25.0	90	7.620	0.000	7.620	< 5.92E-02	< 5.88E-02	< 1.20E-01	1889	8.90E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB6	8/15/02	FB6-08-15-02-0-3	1	3.0	90	0.914	0.000	0.914	< 6.82E-02	< 7.04E-02	< 1.60E-01	1572	1.00E+00
bearing:NA	8/15/02	FB6-08-15-02-3-6	1	6.0	90	1.829	0.000	1.829	< 7.26E-02	< 7.49E-02	< 1.70E-01	1762	9.40E-01
	8/15/02	FB6-08-15-02-6-8.5	1	8.5	90	2.591	0.000	2.591	< 7.66E-02	< 7.91E-02	< 1.80E-01	1868	8.90E-01
	8/15/02	FB6-08-15-02-8.5-11	1	11.0	90	3.353	0.000	3.353	< 7.26E-02	< 7.49E-02	< 1.70E-01	1753	9.40E-01
	8/15/02	FB6-08-15-02-11-14	1	14.0	90	4.267	0.000	4.267	< 6.82E-02	< 7.04E-02	< 1.60E-01	1693	1.00E+00
	8/15/02	FB6-08-15-02-14-17	1	17.0	90	5.182	0.000	5.182	< 7.66E-02	< 7.91E-02	< 1.80E-01	1869	8.90E-01
	8/15/02	FB6-08-15-02-17-20	1	20.0	90	6.096	0.000	6.096	< 6.82E-02	< 7.04E-02	< 1.60E-01	1651	1.00E+00
	8/15/02												

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB7	8/15/02	FB7-08-15-02-0-3	1	3.0	90	0.914	0.000	0.914	< 7.28E-02	< 6.23E-02	< 1.74E-01	1605	1.00E+00
bearing:NA	8/15/02	FB7-08-15-02-3-6	1	6.0	90	1.829	0.000	1.829	< 8.56E-02	< 7.33E-02	< 2.05E-01	2013	8.50E-01
	8/15/02	FB7-08-15-02-6-8.5	1	8.5	90	2.591	0.000	2.591	< 7.74E-02	< 6.63E-02	< 1.85E-01	1827	9.40E-01
	8/15/02	FB7-08-15-02-8.5-11.5	1	11.5	90	3.505	0.000	3.505	< 7.74E-02	< 6.63E-02	< 1.85E-01	1820	9.40E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB17	8/19/02	FB17-08-19-02-0-3	1	3.0	32.7	0.914	0.769	0.494	< 7.24E-02	< 7.54E-02	< 1.69E-01	1873	8.90E-01
bearing:	8/19/02	FB17-08-19-02-3-6	1	6.0	32.7	1.829	1.539	0.988	< 7.24E-02	< 7.54E-02	< 1.69E-01	1920	8.90E-01
S89-47-00-E	8/19/02	FB17-08-19-02-6-8.5	1	8.5	32.7	2.591	2.180	1.400	< 6.44E-02	< 6.71E-02	< 1.50E-01	1707	1.00E+00
	8/19/02	FB17-08-19-02-8.5-11	1	11.0	32.7	3.353	2.821	1.811	< 7.58E-02	< 7.89E-02	< 1.76E-01	1979	8.50E-01
	8/19/02	FB17-08-19-02-11-13.5	1	13.5	32.7	4.115	3.463	2.223	< 6.85E-02	7.14E-02	< 1.60E-01	1751	9.40E-01
	8/19/02	FB17-08-19-02-13.5-16	1	16.0	32.7	4.877	4.104	2.635	7.58E-02	< 7.89E-02	< 1.76E-01	2033	8.50E-01
	8/19/02	FB17-08-19-02-16-19	1	19.0	32.7	5.791	4.873	3.129	< 6.85E-02	7.14E-02	< 1.60E-01	1826	9.40E-01
	8/19/02	FB17-08-19-02-19-22	1	22.0	32.7	6.706	5.643	3.623	< 7.24E-02	< 7.54E-02	< 1.69E-01	1868	8.90E-01
	8/19/02	FB17-08-19-02-22-26	1	26.0	32.7	7.925	6.669	4.281	< 6.44E-02	< 6.71E-02	< 1.50E-01	1519	1.00E+00
	8/19/02	FB17-08-19-02-26-27.5	1	27.5	32.7	8.382	7.054	4.528	< 8.36E-02	< 8.71E-02	< 1.95E-01	2244	7.70E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB17A	8/20/02	FB17A-08-20-02-0-3	1	3.0	32.5	0.914	0.771	0.491	< 5.78E-02	< 6.24E-02	< 1.47E-01	1977	9.50E-01
bearing:	8/20/02	FB17A-08-20-02-3-7	1	7.0	32.5	2.134	1.799	1.146	< 6.38E-02	< 6.88E-02	< 1.62E-01	2244	7.70E-01
S89-47-00-E	8/20/02	FB17A-08-20-02-7-11	1	11.0	32.5	3.353	2.828	1.801	< 5.78E-02	< 6.24E-02	< 1.47E-01	2017	8.50E-01
	8/20/02	FB17A-08-20-02-11-16	1	16.0	32.5	4.877	4.113	2.620	< 6.06E-02	< 6.54E-02	< 1.54E-01	2105	8.10E-01
	8/20/02	FB17A-08-20-02-16-18.5	1	18.5	32.5	5.639	4.756	3.030	< 6.38E-02	< 6.88E-02	< 1.62E-01	2169	7.70E-01
	8/20/02	FB17A-08-20-02-18.5-21	1	21.0	32.5	6.401	5.398	3.439	< 5.78E-02	< 6.24E-02	< 1.47E-01	2046	8.50E-01
	8/20/02	FB17A-08-20-02-21-24	1	24.0	32.5	7.315	6.170	3.930	< 6.06E-02	< 6.54E-02	< 1.54E-01	2066	8.10E-01
	8/20/02	FB17A-08-20-02-24-27.5	1	27.5	32.5	8.382	7.069	4.504	< 5.78E-02	< 6.24E-02	< 1.47E-01	1969	8.50E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB16	8/21/02	FB16-08-21-02-0-3	1	3.0	32.5	0.914	0.771	0.491	< 6.58E-02	< 7.21E-02	< 1.50E-01	2114	8.10E-01
bearing:	8/21/02	FB16-08-21-02-3-7	1	7.0	32.5	2.134	1.799	1.146	< 6.58E-02	7.21E-02	< 1.50E-01	2072	8.10E-01
N-88-19-15-E	8/21/02	FB16-08-21-02-7-11	1	11.0	32.5	3.353	2.828	1.801	5.99E-02	6.56E-02	< 1.46E-01	1949	8.50E-01
	8/21/02	FB16-08-21-02-11-13.5	1	13.5	32.5	4.115	3.470	2.211	5.67E-02	6.21E-02	< 1.38E-01	1819	9.40E-01
	8/21/02	FB16-08-21-02-13.5-16	1	16.0	32.5	4.877	4.113	2.620	6.58E-02	7.21E-02	< 1.60E-01	2070	8.10E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)		Cobalt-60 (pCi/g)		Cesium (pCi/g)		Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB16B	8/21/02	FB16B-08-21-02-16-18.5	1	18.5	32.5	5.639	4.756	3.030	<	6.40E-02	<	6.88E-02	<	1.53E-01	2023	8.50E-01
bearing:	8/21/02	FB16B-08-21-02-18.5-21	1	21.0	32.5	6.401	5.398	3.439	<	6.40E-02	<	6.88E-02	<	1.53E-01	1958	8.50E-01
N-88-19-15-E	8/21/02	FB16B-08-21-02-21-23.5	1	23.5	32.5	7.163	6.041	3.849	<	6.40E-02	<	6.88E-02	<	1.53E-01	1972	8.50E-01
	8/21/02	FB16B-08-21-02-23.5-26	1	26.0	32.5	7.925	6.684	4.258	<	5.44E-02		5.85E-02	<	1.30E-01	1671	1.00E+00
	8/21/02	FB16B-08-21-02-26-29	1	29.0	32.5	8.839	7.455	4.749	<	5.44E-02	<	5.85E-02	<	1.30E-01	1694	1.00E+00
	8/21/02	FB16B-08-21-02-29-32	1	32.0	32.5	9.754	8.226	5.241	<	5.44E-02	<	5.85E-02	<	1.30E-01	1574	1.00E+00
	8/21/02	FB16B-08-21-02-32-36	1	36.0	32.5	10.973	9.254	5.896	<	5.44E-02	<	5.85E-02	<	1.30E-01	1547	1.00E+00
	8/21/02	FB16B-08-21-02-36-39	1	39.0	32.5	11.887	10.026	6.387	<	5.44E-02	<	5.85E-02	<	1.30E-01	1737	1.00E+00
	8/21/02	FB16B-08-21-02-39-42	1	42.0	32.5	12.802	10.797	6.878	<	5.44E-02	<	5.85E-02	<	1.30E-01	1825	1.00E+00
	8/21/02	FB16B-08-21-02-42-46	1	46.0	32.5	14.021	11.825	7.533	<	5.44E-02	<	5.85E-02	<	1.30E-01	1637	1.00E+00
	8/21/02	FB16B-08-21-02-46-49	1	49.0	32.5	14.935	12.596	8.025	<	6.40E-02		6.88E-02	<	1.53E-01	2007	8.50E-01
	8/21/02	FB16B-08-21-02-49-52	1	52.0	32.5	15.850	13.367	8.516	<	6.72E-02		7.22E-02	<	1.60E-01	2073	8.50E-01
	8/21/02	FB16B-08-21-02-52-56	1	56.0	32.5	17.069	14.396	9.171	<	6.40E-02	<	6.88E-02	<	1.53E-01	2039	8.50E-01
	8/21/02	FB16B-08-21-02-56-60	1	60.0	32.5	18.288	15.424	9.826	<	6.40E-02	<	6.88E-02	<	1.53E-01	2041	8.50E-01
	8/21/02	FB16B-08-21-02-60-63	1	63.0	32.5	19.202	16.195	10.317	<	6.72E-02	<	7.22E-02	<	1.60E-01	2058	8.50E-01
	8/21/02	FB16B-08-21-02-63-66	1	66.0	32.5	20.117	16.966	10.809	<	6.40E-02	<	6.88E-02	<	1.53E-01	2032	8.50E-01
	8/21/02	FB16B-08-21-02-66-69	1	69.0	32.5	21.031	17.738	11.300	<	6.40E-02	<	6.88E-02	<	1.53E-01	2021	8.50E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)		Cobalt-60 (pCi/g)		Cesium (pCi/g)		Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB16A	8/22/02	FB16A-08-22-02-0-3	1	3.0	32.5	0.914	0.771	0.491	<	7.00E-02	<	5.86E-02	<	1.40E-01	2120	8.10E-01
bearing:	8/22/02	FB16A-08-22-02-3-6	1	6.0	32.5	1.829	1.542	0.983	<	6.67E-02	<	5.59E-02	<	1.33E-01	2024	8.50E-01
N-88-19-15-E	8/22/02	FB16A-08-22-02-6-8.5	1	8.5	32.5	2.591	2.185	1.392	<	7.00E-02	<	5.86E-02	<	1.40E-01	2060	8.10E-01
	8/22/02	FB16A-08-22-02-8.5-11	1	11.0	32.5	3.353	2.828	1.801	<	7.00E-02		5.86E-02	<	1.40E-01	2124	8.10E-01
	8/22/02	FB16A-08-22-02-11-13.5	1	13.5	32.5	4.115	3.470	2.211	<	7.00E-02	<	5.86E-02	<	1.40E-01	2059	8.10E-01
	8/22/02	FB16A-08-22-02-13.5-16	1	16.0	32.5	4.877	4.113	2.620		7.36E-02	<	6.17E-02	<	1.47E-01	2157	7.70E-01
	8/22/02	FB16A-08-22-02-16-18.5	1	18.5	32.5	5.639	4.756	3.030	<	7.00E-02	<	5.86E-02	<	1.40E-01	2146	8.10E-01
	8/22/02	FB16A-08-22-02-18.5-21	1	21.0	32.5	6.401	5.398	3.439	<	7.36E-02	<	6.17E-02	<	1.47E-01	2198	7.70E-01
	8/22/02	FB16A-08-22-02-21-23.5	1	23.5	32.5	7.163	6.041	3.849	<	7.36E-02	<	6.17E-02	<	1.47E-01	2186	7.70E-01
	8/22/02	FB16A-08-22-02-23.5-26	1	26.0	32.5	7.925	6.684	4.258	<	7.36E-02	<	6.17E-02	<	1.47E-01	2165	7.70E-01
	8/22/02	FB16A-08-22-02-26-28.5	1	28.5	32.5	8.687	7.326	4.667	<	7.00E-02	<	5.86E-02	<	1.40E-01	2134	8.10E-01
	8/22/02	FB16A-08-22-02-28.5-31	1	31.0	32.5	9.449	7.969	5.077	<	6.03E-02	<	5.05E-02	<	1.20E-01	1787	9.40E-01
	8/22/02	FB16A-08-22-02-31-33.5	1	33.5	32.5	10.211	8.612	5.486	<	6.37E-02	<	5.34E-02	<	1.27E-01	1937	8.90E-01
	8/22/02	FB16A-08-22-02-33.5-36	1	36.0	32.5	10.973	9.254	5.896	<	6.37E-02		5.34E-02	<	1.27E-01	1907	8.90E-01
	8/22/02	FB16A-08-22-02-36-38.5	1	38.5	32.5	11.735	9.897	6.305	<	6.03E-02	<	5.05E-02	<	1.20E-01	1753	9.40E-01
	8/22/02	FB16A-08-22-02-38.5-41	1	41.0	32.5	12.497	10.540	6.715	<	6.03E-02	<	5.05E-02	<	1.20E-01	1762	9.40E-01
	8/26/02	FB16A-08-26-02-41-43.5	1	43.5	32.5	13.259	11.182	7.124	<	5.67E-02		4.75E-02	<	1.13E-01	1700	1.00E+00
	8/26/02	FB16A-08-26-02-43.5-46	1	46.0	32.5	14.021	11.825	7.533	<	5.67E-02	<	4.75E-02	<	1.13E-01	1602	1.00E+00
	8/26/02	FB16A-08-26-02-46-48.5	1	48.5	32.5	14.783	12.468	7.943	<	7.00E-02		5.86E-02	<	1.40E-01	2097	8.10E-01
	8/26/02	FB16A-08-26-02-48.5-51	1	51.0	32.5	15.545	13.110	8.352	<	6.67E-02	<	5.59E-02	<	1.33E-01	1986	8.50E-01
	8/26/02	FB16A-08-26-02-51-53.5	1	53.5	32.5	16.307	13.753	8.762	<	7.36E-02		6.17E-02	<	1.47E-01	2186	7.70E-01
	8/26/02	FB16A-08-26-02-53.5-56	1	56.0	32.5	17.069	14.396	9.171	<	7.00E-02	<	5.86E-02	<	1.40E-01	2077	8.10E-01
	8/26/02	FB16A-08-26-02-56-60	1	60.0	32.5	18.288	15.424	9.826	<	7.00E-02	<	5.86E-02	<	1.40E-01	2080	8.10E-01
	8/26/02	FB16A-08-26-02-60-63	1	63.0	32.5	19.202	16.195	10.317	<	7.00E-02	<	5.86E-02	<	1.40E-01	2073	8.10E-01
	8/26/02	FB16A-08-26-02-63-66	1	66.0	32.5	20.117	16.966	10.809	<	6.37E-02	<	5.34E-02	<	1.27E-01	1929	8.90E-01
	8/26/02	FB16A-08-26-02-66-70	1	70.0	32.5	21.336	17.995	11.464	<	7.00E-02	<	5.86E-02	<	1.40E-01	2075	8.10E-01
	8/26/02	FB16A-08-26-02-70-73	1	73.0	32.5	22.250	18.766	11.955	<	6.67E-02	<	5.59E-02	<	1.33E-01	2015	8.50E-01
	8/26/02	FB16A-08-26-02-73-76	1	76.0	32.5	23.165	19.537	12.446	<	7.00E-02	<	5.86E-02	<	1.40E-01	2088	8.10E-01
	8/26/02	FB16A-08-26-02-76-78	1	78.0	32.5	23.774	20.051	12.774	<	7.00E-02	<	5.86E-02	<	1.40E-01	2147	8.10E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)		Cobalt-60 (pCi/g)		Cesium (pCi/g)		Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB15	8/26/02	FB15-08-26-02-0-3	1	3.0	37.0	0.914	0.730	0.550	<	6.27E-02	<	7.09E-02	<	1.48E-01	1984	8.50E-01
bearing:	8/26/02	FB15-08-26-02-3-6	1	6.0	37.0	1.829	1.461	1.101	<	5.33E-02		6.03E-02	<	1.26E-01	1711	1.00E+00
N-88-36-25-E	8/26/02	FB15-08-26-02-6-8.5	1	8.5	37.0	2.591	2.069	1.559	<	5.99E-02		6.78E-02	<	1.42E-01	1872	8.90E-01
	8/26/02	FB15-08-26-02-8.5-11	1	11.0	37.0	3.353	2.678	2.018	<	6.27E-02	<	7.09E-02	<	1.48E-01	2006	8.50E-01
	8/26/02	FB15-08-26-02-11-13.5	1	13.5	37.0	4.115	3.286	2.476	<	6.27E-02	<	7.09E-02	<	1.48E-01	1973	8.50E-01
	8/26/02	FB15-08-26-02-13.5-16	1	16.0	37.0	4.877	3.895	2.935	<	5.67E-02	<	6.41E-02	<	1.34E-01	1844	9.40E-01
	8/27/02	FB15-08-27-02-16-18.5	1	18.5	37.0	5.639	4.503	3.394	<	6.92E-02	<	7.83E-02	<	1.64E-01	2185	7.70E-01
	8/27/02	FB15-08-27-02-18.5-21	1	21.0	37.0	6.401	5.112	3.852	<	6.58E-02	<	7.44E-02	<	1.56E-01	2093	8.10E-01
	8/27/02	FB15-08-27-02-21-23.5	1	23.5	37.0	7.163	5.720	4.311	<	6.27E-02	<	7.09E-02	<	1.48E-01	1968	8.50E-01
	8/27/02	FB15-08-27-02-23.5-26	1	26.0	37.0	7.925	6.329	4.769	<	6.58E-02	<	7.44E-02	<	1.56E-01	2083	8.10E-01
	8/27/02	FB15-08-27-02-26-30	1	30.0	37.0	9.144	7.303	5.503	<	5.67E-02	<	6.41E-02	<	1.34E-01	1818	9.40E-01
	8/27/02	FB15-08-27-02-30-33	1	33.0	37.0	10.058	8.033	6.053	<	5.33E-02	<	6.03E-02	<	1.26E-01	1578	1.00E+00
	8/27/02	FB15-08-27-02-33-36	1	36.0	37.0	10.973	8.763	6.604	<	5.33E-02	<	6.03E-02	<	1.26E-01	1511	1.00E+00
	8/27/02	FB15-08-27-02-36-40	1	40.0	37.0	12.192	9.737	7.337	<	5.67E-02		6.41E-02	<	1.34E-01	1838	9.40E-01
	8/27/02	FB15-08-27-02-40-43	1	43.0	37.0	13.106	10.467	7.888	<	5.67E-02	<	6.41E-02	<	1.34E-01	1759	9.40E-01
	8/27/02	FB15-08-27-02-43-46	1	45.0	37.0	14.021	11.198	8.438	<	5.33E-02	<	6.03E-02	<	1.26E-01	1706	1.00E+00
	8/27/02	FB15-08-27-02-46-48.5	1	48.5	37.0	14.783	11.806	8.897	<	6.27E-02	<	7.09E-02	<	1.48E-01	1950	8.50E-01
	8/27/02	FB15-08-27-02-48.5-51	1	51.0	37.0	15.545	12.415	9.355	<	6.27E-02	<	7.09E-02	<	1.48E-01	2022	8.50E-01
	8/27/02	FB15-08-27-02-51-54	1	54.0	37.0	16.459	13.145	9.905	<	6.58E-02	<	7.44E-02	<	1.56E-01	2118	8.10E-01
	8/27/02	FB15-08-27-02-54-58	1	58.0	37.0	17.678	14.119	10.639	<	5.99E-02	<	6.78E-02	<	1.42E-01	1945	8.90E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)		Cobalt-60 (pCi/g)	Cesium (pCi/g)		Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB14	8/28/02	FB14-08-28-02-0-3	1	3.0	38.0	0.914	0.721	0.563	<	7.68E-02	1.01E-01	<	1.68E-01	1.76E+03	9.40E-01
bearing:	8/28/02	FB14-08-28-02-3-6	1	6.0	38.0	1.829	1.441	1.126	<	6.79E-02	1.22E-01	<	1.52E-01	1.76E+03	9.40E-01
S-85-07-06-E	8/28/02	FB14-08-28-02-6-8.5	1	8.5	38.0	2.591	2.042	1.595	<	7.15E-02	1.17E-01	<	1.45E-01	1.72E+03	1.00E+00
	8/28/02	FB14-08-28-02-8.5-11	1	11.0	38.0	3.353	2.642	2.064	<	6.96E-02	1.70E-01	<	1.38E-01	1.94E+03	9.00E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)		Cobalt-60 (pCi/g)	Cesium (pCi/g)		Antimony (pCi/	Sample Mass (grams)	Correction Factor
FB14B	8/28/02	FB14B-08-28-02-0-4	1	4.0	38.0	1.219	0.961	0.751	<	6.76E-02	7.91E-02	<	1.31E-01	2014	8.50E-01
Bearing	8/28/02	FB14B-08-28-02-4-7	1	7.0	38.0	2.134	1.681	1.314	<	7.01E-02	1.12E-01	<	1.44E-01	1700	1.00E+00
bearing:	8/28/02	FB14B-08-28-02-7-10	1	10.0	38.0	3.048	2.402	1.877	<	5.74E-02	1.04E-01	<	1.52E-01	1591	9.30E-01
S-85-07-06-E															

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/g)	Sample Mass (grams)	Correction Factor
FB14C	8/28/02	FB14C-08-28-02-0-3	1	3.0	38.0	0.914	0.721	0.563	< 6.47E-02	< 5.68E-02	< 1.22E-01	1953	8.50E-01
bearing:	8/28/02	FB14C-08-28-02-3-6	1	6.0	38.0	1.829	1.441	1.126	< 6.86E-02	< 7.36E-02	< 1.67E-01	1956	8.50E-01
S-85-07-06-E	8/28/02	FB14C-08-28-02-6-8.5	1	8.5	38.0	2.591	2.042	1.595	< 7.11E-02	6.73E-02	< 1.51E-01	1847	8.90E-01
	8/28/02	FB14C-08-28-02-8.5-11	1	11.0	38.0	3.353	2.642	2.064	< 5.85E-02	< 6.98E-02	< 1.54E-01	1705	1.00E+00
	8/28/02	FB14C-08-28-02-11-13.5	1	13.5	38.0	4.115	3.243	2.533	< 7.19E-02	< 4.34E-02	< 1.26E-01	1877	9.00E-01
	8/28/02	FB14C-08-28-02-13.5-16	1	16.0	38.0	4.877	3.843	3.002	< 6.56E-02	< 6.61E-02	< 1.57E-01	1782	9.40E-01
	8/29/02	FB14C-08-29-02-16-18.5	1	18.5	38.0	5.639	4.443	3.472	< 6.17E-02	< 5.81E-02	< 1.13E-01	1886	8.90E-01
	8/29/02	FB14C-08-29-02-18.5-21	1	21.0	38.0	6.401	5.044	3.941	< 5.52E-02	< 5.11E-02	< 1.14E-01	1664	1.00E+00
	8/29/02	FB14C-08-29-02-21-23.5	1	23.5	38.0	7.163	5.644	4.410	< 5.71E-02	< 5.70E-02	< 1.21E-01	1772	9.40E-01
	8/29/02	FB14C-08-29-02-23.5-26	1	26.0	38.0	7.925	6.245	4.879	< 5.81E-02	< 5.97E-02	< 1.16E-01	1760	9.40E-01
	8/29/02	FB14C-08-29-02-26-28.5	1	28.5	38.0	8.687	6.845	5.348	< 5.81E-02	< 6.00E-02	< 1.26E-01	1873	8.90E-01
	8/29/02	FB14C-08-29-02-28.5-31	1	31.0	38.0	9.449	7.446	5.817	< 6.64E-02	< 1.08E-01	< 1.10E-01	1956	8.50E-01
	8/29/02	FB14C-08-29-02-31-33.5	1	33.5	38.0	10.211	8.046	6.286	< 5.15E-02	< 5.16E-02	< 1.09E-01	1549	1.00E+00
	8/29/02	FB14C-08-29-02-33.5-36	1	36.0	38.0	10.973	8.647	6.756	< 5.06E-02	< 5.26E-02	< 1.21E-01	1806	9.40E-01
	8/29/02	FB14C-08-29-02-36-40	1	40.0	38.0	12.192	9.607	7.505	< 7.35E-02	5.06E-02	< 1.57E-01	1688	1.00E+00
	8/29/02	FB14C-08-29-02-40-43	1	43.0	38.0	13.106	10.328	8.069	< 5.97E-02	< 6.47E-02	< 1.56E-01	1639	1.00E+00
	8/29/02	FB14C-08-29-02-43-46	1	46.0	38.0	14.021	11.049	8.632	< 6.78E-02	9.65E-02	< 1.65E-01	1782	9.40E-01
	8/29/02	FB14C-08-29-02-46-49.5	1	49.5	38.0	15.088	11.889	9.289	< 6.20E-02	4.08E-02	< 1.35E-01	1957	8.50E-01
	8/29/05	FB14C-08-29-02-49.5-52.5	1	52.5	38.0	16.002	12.610	9.852	< 7.52E-02	< 6.67E-02	< 1.56E-01	1925	8.90E-01
	8/29/02	FB14C-08-29-02-52.5-55.5	1	55.5	38.0	16.916	13.330	10.415	< 7.77E-02	< 7.49E-02	< 1.73E-01	1377	1.00E+00

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/g)	Sample Mass (grams)	Correction Factor
FB13	9/9/02	FB13-09-09-02-0-3	1	3.0	34.5	0.914	0.754	0.518	< 5.33E-02	< 4.78E-02	< 1.14E-01	1973	8.50E-01
bearing:	9/9/02	FB13-09-09-02-3-6	1	6.0	34.5	1.829	1.507	1.036	< 6.32E-02	< 5.39E-02	< 1.13E-01	1832	9.40E-01
S-79-43-10-E	9/9/02	FB13-09-09-02-6-8.5	1	8.5	34.5	2.591	2.135	1.467	< 5.43E-02	7.17E-02	< 1.13E-01	1891	8.90E-01
	9/9/02	FB13-09-09-02-8.5-11	1	11.0	34.5	3.353	2.763	1.899	< 5.64E-02	< 5.72E-02	< 1.07E-01	1843	9.40E-01
	9/9/02	FB13-09-09-02-11-13.5	1	13.5	34.5	4.115	3.391	2.331	< 6.77E-02	< 6.05E-02	< 1.14E-01	1779	9.40E-01
	9/9/02	FB13-09-09-02-13.5-16	1	16.0	34.5	4.877	4.019	2.762	< 5.99E-02	< 5.78E-02	< 1.17E-01	1657	8.90E-01
	9/9/02	FB13-09-09-02-16-18.5	1	18.5	34.5	5.639	4.647	3.194	< 6.25E-02	< 5.79E-02	< 1.13E-01	1920	8.90E-01
	9/9/02	FB13-09-09-02-18.5-21	1	21.0	34.5	6.401	5.275	3.625	< 5.82E-02	< 6.04E-02	< 1.11E-01	1820	9.40E-01
	9/9/02	FB13-09-09-02-21-23.5	1	23.5	34.5	7.163	5.903	4.057	< 7.09E-02	< 5.59E-02	< 1.23E-01	2051	9.10E-01
	9/9/02	FB13-09-09-02-23.5-26	1	26.0	34.5	7.925	6.531	4.489	< 7.41E-02	< 5.95E-02	< 1.26E-01	2079	9.10E-01
	9/9/02	FB13-09-09-02-26-30	1	30.0	34.5	9.144	7.536	5.179	< 5.82E-02	< 6.44E-02	< 1.24E-01	1940	8.90E-01
	9/9/02	FB13-09-09-02-30-33	1	33.0	34.5	10.058	8.289	5.697	< 5.56E-02	< 5.15E-02	< 1.15E-01	1596	1.00E+00
	9/9/02	FB13-09-09-02-33-36	1	36.0	34.5	10.973	9.043	6.215	< 5.63E-02	< 5.56E-02	< 1.10E-01	1838	9.40E-01
	9/9/02	FB13-09-09-02-36-40	1	40.0	34.5	12.192	10.048	6.906	< 5.34E-02	< 5.13E-02	< 1.01E-01	1791	9.40E-01
	9/9/02	FB13-09-09-02-40-43	1	43.0	34.5	13.106	10.801	7.424	< 5.48E-02	< 5.10E-02	< 1.13E-01	1610	1.00E+00
	9/9/02	FB13-09-09-02-43-46	1	46.0	34.5	14.021	11.555	7.941	< 5.81E-02	< 5.69E-02	< 1.13E-01	1823	9.40E-01
	9/9/02	FB13-09-09-02-46-50	1	50.0	34.5	15.240	12.560	8.632	< 6.64E-02	< 5.93E-02	< 1.24E-01	2042	9.50E-01
	9/9/02	FB13-09-09-02-50-53	1	53.0	34.5	16.154	13.313	9.150	< 5.51E-02	< 5.35E-02	< 1.09E-01	1665	1.00E+00
	9/9/02	FB13-09-09-02-53-56	1	56.0	34.5	17.069	14.067	9.668	< 5.08E-02	< 5.10E-02	< 1.07E-01	1675	1.00E+00
	9/9/02	FB13-09-09-02-56-60	1	60.0	34.5	18.288	15.072	10.358	< 4.75E-02	< 5.22E-02	< 1.07E-01	1734	1.00E+00
	9/9/02	FB13-09-09-02-60-63	1	63.0	34.5	19.202	15.825	10.876	< 5.70E-02	< 5.73E-02	< 1.15E-01	1778	9.40E-01
	9/9/02	FB13-09-09-02-63-66	1	66.0	34.5	20.117	16.579	11.394	< 5.28E-02	< 4.79E-02	< 1.03E-01	1669	1.00E+00

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)		Cobalt-60 (pCi/g)		Cesium (pCi/g)		Antimony (pCi/g)	Sample Mass (grams)	Correction Factor
FB08	9/10/02	FB8-09-10-02-0-3	1	3.0	34.5	0.914	0.754	0.518	<	6.33E-02	<	7.07E-02	<	1.76E-01	1780	9.40E-01
bearing:	9/10/02	FB8-09-10-02-3-6	1	6.0	34.5	1.829	1.507	1.036	<	6.39E-02	<	4.81E-02	<	1.36E-01	2028	8.50E-01
N-57-35-06W	9/10/2002	FB8-09-10-02-6-8.5	1	8.5	34.5	2.591	2.135	1.467	<	7.78E-02	<	7.21E-02	<	1.63E-01	2086	8.10E-01
	9/10/2002	FB8-09-10-02-8.5-11	1	11.0	34.5	3.353	2.763	1.899	<	7.45E-02	<	5.29E-02	<	1.32E-01	1985	8.50E-01
	9/10/2002	FB8-09-10-02-11-13.5	1	13.5	34.5	4.115	3.391	2.331	<	6.85E-02		6.17E-02	<	1.65E-01	2083	8.10E-01
	9/10/2002	FB8-09-10-02-13.5-16	1	16.0	34.5	4.877	4.019	2.762	<	5.51E-02	<	6.09E-02	<	1.39E-01	2158	7.70E-01
	9/10/2002	FB8-09-10-02-16-18.5	1	18.5	34.5	5.639	4.647	3.194	<	6.72E-02	<	6.44E-02	<	1.48E-01	1975	8.50E-01
	9/10/2002	FB8-09-10-02-18.5-21	1	21.0	34.5	6.401	5.275	3.625	<	5.72E-02	<	5.60E-02	<	1.35E-01	1937	8.90E-01
	9/10/2002	FB8-09-10-02-21-23.5	1	23.5	34.5	7.163	5.903	4.057	<	6.61E-02	<	6.84E-02	<	1.61E-01	2009	8.50E-01
	9/10/2002	FB8-09-10-02-23.5-26	1	26.0	34.5	7.925	6.531	4.489	<	5.37E-02	<	5.75E-02	<	1.37E-01	1896	8.90E-01
	9/10/2002	FB8-09-10-02-26-28.5	1	28.5	34.5	8.687	7.159	4.920	<	5.78E-02	<	6.54E-02	<	1.64E-01	1943	8.90E-01
	9/10/2002	FB8-09-10-02-28.5-32	1	32.0	34.5	9.754	8.038	5.524	<	6.64E-02	<	5.64E-02	<	1.33E-01	1821	9.40E-01
	9/10/2002	FB8-09-10-02-32-35.5	1	35.5	34.5	10.820	8.917	6.129	<	6.24E-02	<	6.26E-02	<	1.50E-01	1805	9.40E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/g)	Sample Mass (grams)	Correction Factor
FB09	9/12/00	FB9-09-12-02-0-3	1	3.0	36.0	0.914	0.740	0.537	< 6.25E-02	1.01E-01	< 1.53E-01	1936	8.90E-01
bearing:	9/12/02	FB9-09-12-02-3-6	1	6.0	36.0	1.829	1.480	1.075	< 7.22E-02	9.00E-02	< 1.62E-01	1757	9.40E-01
N-46-39-59-W	9/12/02	FB9-09-12-02-6-8.5	1	8.5	36.0	2.591	2.096	1.523	< 6.74E-02	< 7.22E-02	< 1.64E-01	2039	8.50E-01
	9/12/02	FB9-09-12-02-8.5-11	1	11.0	36.0	3.353	2.712	1.971	< 7.12E-02	< 6.27E-02	< 1.29E-01	1898	9.00E-01
	9/12/02	FB9-09-12-02-11-13.5	1	13.5	36.0	4.115	3.329	2.419	< 6.97E-02	< 6.71E-02	< 1.37E-01	1925	8.90E-01
	9/12/02	FB9-09-12-02-13.5-16	1	16.0	36.0	4.877	3.945	2.867	< 6.43E-02	< 6.67E-02	< 1.61E-01	1925	8.90E-01
	9/12/02	FB9-09-12-02-16-18.5	1	18.5	36.0	5.639	4.562	3.314	< 6.34E-02	< 5.01E-02	< 1.30E-01	1717	1.00E+00
	9/12/02	FB9-09-12-02-18.5-21	1	21.0	36.0	6.401	5.178	3.762	< 5.56E-02	< 5.37E-02	< 1.30E-01	1749	1.00E+00
	9/12/02	FB9-09-12-02-21-23.5	1	23.5	36.0	7.163	5.795	4.210	< 6.32E-02	< 5.65E-02	< 1.53E-01	1720	1.00E+00
	9/12/02	FB9-09-12-02-23.5-26	1	26.0	36.0	7.925	6.411	4.658	< 7.33E-02	< 6.24E-02	< 1.65E-01	1851	8.90E-01
	9/12/02	FB9-09-12-02-26-28.5	1	28.0	36.0	8.534	6.904	5.016	< 6.91E-02	< 6.15E-02	< 1.65E-01	1880	8.90E-01
	9/12/02	FB9-09-12-02-28.5-31	1	31.0	36.0	9.449	7.644	5.554	< 5.63E-02	< 5.33E-02	< 1.33E-01	1810	9.40E-01
	9/12/02	FB9-09-12-02-31-33.5	1	33.5	36.0	10.211	8.261	6.002	< 6.15E-02	< 6.11E-02	< 1.58E-01	1650	1.00E+00
	9/12/02	FB9-09-12-02-33.5-36	1	36.0	36.0	10.973	8.877	6.450	< 6.38E-02	< 6.56E-02	< 1.39E-01	1852	8.90E-01
	9/12/02	FB9-09-12-02-36-38.5	1	38.5	36.0	11.735	9.494	6.898	< 7.58E-02	< 7.18E-02	< 1.72E-01	2306	7.40E-01
	9/12/02	FB9-09-12-02-38.5-41	1	41.0	36.0	12.497	10.110	7.345	< 7.15E-02	< 6.70E-02	< 1.33E-01	2117	8.10E-01
	9/12/02	FB9-09-12-02-41-43.5	1	43.5	36.0	13.259	10.727	7.793	< 6.72E-02	< 6.57E-02	< 1.62E-01	1935	8.90E-01
	9/12/02	FB9-09-12-02-43.5-46	1	46.0	36.0	14.021	11.343	8.241	< 7.31E-02	< 6.32E-02	< 1.54E-01	1992	8.50E-01
	9/12/02	FB9-09-12-02-46-50	1	50.0	36.0	15.240	12.329	8.958	< 7.26E-02	< 6.98E-02	< 1.79E-01	1789	9.40E-01
	9/12/02	FB9-09-12-02-50-53	1	53.0	36.0	16.154	13.069	9.495	< 7.07E-02	< 6.65E-02	< 1.41E-01	1657	1.00E+00
	9/12/02	FB9-09-12-02-53-56	1	56.0	36.0	17.069	13.809	10.033	< 7.51E-02	< 7.00E-02	< 1.74E-01	1764	9.40E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/g)	Sample Mass (grams)	Correction Factor
FB10	9/16/00	FB10-09-16-02-0-3	1	3.0	34.0	0.914	0.758	0.511	< 7.62E-02	7.81E-02	< 1.97E-01	2181	7.70E-01
bearing:	9/16/02	FB10-09-16-02-3-6	1	6.0	34.0	1.829	1.516	1.023	< 6.70E-02	< 5.88E-02	< 1.58E-01	2059	9.10E-01
N-54-23-49-W	9/16/02	FB10-09-16-02-6-11	2	11.0	34.0	3.353	2.780	1.875	< 7.84E-02	< 5.56E-02	< 2.02E-01	2216	1.54E+00
	9/16/02	FB10-09-16-02-11-13.5	1	13.5	34.0	4.115	3.411	2.301	< 8.44E-02	< 7.77E-02	< 1.70E-01	2158	7.70E-01
	9/16/02	FB10-09-16-02-13.5-16	1	16.0	34.0	4.877	4.043	2.727	< 7.71E-02	< 6.89E-02	< 1.38E-01	1979	9.50E-01
	9/16/02	FB10-09-16-02-16-20	1	20.0	34.0	6.096	5.054	3.409	< 6.96E-02	< 6.36E-02	< 1.56E-01	1785	9.40E-01
	9/16/02	FB10-09-16-02-20-23	1	23.0	34.0	7.010	5.812	3.920	< 6.32E-02	< 7.07E-02	< 1.46E-01	2148	8.10E-01
	9/16/02	FB10-09-16-02-23-26	1	26.0	34.0	7.925	6.570	4.431	< 6.18E-02	< 5.72E-02	< 1.54E-01	1712	1.00E+00
	9/16/02	FB10-09-16-02-26-30	1	30.0	34.0	9.144	7.581	5.113	< 5.64E-02	< 6.04E-02	< 1.54E-01	1713	1.00E+00
	9/16/02	FB10-09-16-02-30-33	1	33.0	34.0	10.059	8.339	5.625	< 6.57E-02	< 6.19E-02	< 1.51E-01	1671	1.00E+00
	9/16/02	FB10-09-16-02-33-36	1	36.0	34.0	10.973	9.097	6.136	< 5.45E-02	< 6.01E-02	< 1.46E-01	1742	1.00E+00
	9/16/02	FB10-09-16-02-36-38.5	1	38.5	34.0	11.735	9.729	6.562	< 7.35E-02	< 5.95E-02	< 1.29E-01	1651	1.00E+00
	9/16/02	FB10-09-16-02-38.5-41	1	41.0	34.0	12.497	10.360	6.988	< 6.90E-02	< 6.30E-02	< 1.61E-01	1758	9.40E-01

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/g)	Sample Mass (grams)	Correction Factor
FB11	9/17/00	FB11-09-17-02-0-2	1	2.0	31.0	0.610	0.523	0.314	< 7.15E-02	7.83E-02	< 1.79E-01	2105	8.10E-01
bearing:	9/17/02	FB11-09-17-02-2-5	1	5.0	31.0	1.524	1.306	0.785	< 6.93E-02	1.06E-01	< 1.33E-01	1703	1.00E+00
N-54-54-42-W	9/17/02	FB11-09-17-02-5-8	1	8.0	31.0	2.438	2.090	1.256	< 7.43E-02	1.13E-01	< 1.67E-01	2125	8.10E-01
	9/17/02	FB11-09-17-02-8-12	1	12.0	31.0	3.658	3.135	1.884	< 7.44E-02	7.02E-02	< 1.39E-01	1703	1.00E+00
	9/17/02	FB11-09-17-02-12-15	1	15.0	31.0	4.572	3.919	2.355	9.42E-02	9.26E-02	< 1.17E-01	2056	8.10E-01
	9/17/02	FB11-09-17-02-15-17.5	1	17.5	31.0	5.334	4.572	2.747	< 6.83E-02	< 8.04E-02	< 1.65E-01	2107	8.10E-01
	9/17/02	FB11-09-17-02-17.5-20	1	20.0	31.0	6.096	5.225	3.140	< 6.49E-02	< 7.19E-02	< 1.49E-01	2266	7.40E-01
	9/17/02	FB11-09-17-02-20-22.5	1	22.5	31.0	6.858	5.878	3.532	< 9.00E-02	< 7.33E-02	< 1.60E-01	2079	8.10E-01
	9/17/02	FB11-09-17-02-22.5-25	1	25.0	31.0	7.620	6.532	3.925	< 7.61E-02	< 7.24E-02	< 1.40E-01	1885	8.90E-01
	9/17/02	FB11-09-17-02-25-27.5	1	27.5	31.0	8.382	7.185	4.317	< 8.16E-02	< 7.03E-02	< 1.56E-01	2166	7.70E-01
	9/17/02	FB11-09-17-02-27.5-30	1	30.0	31.0	9.144	7.838	4.710	< 6.62E-02	< 6.52E-02	< 1.35E-01	2038	8.50E-01
	9/17/02	FB11-09-17-02-30-32.5	1	32.5	31.0	9.906	8.491	5.102	< 6.67E-02	< 6.73E-02	< 1.61E-01	1899	8.90E-01
	9/17/02	FB11-09-17-02-32.5-35	1	35.0	31.0	10.668	9.144	5.494	< 7.84E-02	< 6.60E-02	< 1.46E-01	1858	8.90E-01
	9/17/02	FB11-09-17-02-35-37.5	1	37.5	31.0	11.430	9.797	5.887	< 7.66E-02	< 6.81E-02	< 1.42E-01	1987	8.50E-01
	9/17/02	FB11-09-17-02-37.5-40	1	40.0	31.0	12.192	10.451	6.279	< 6.94E-02	< 6.71E-02	< 1.52E-01	1602	1.00E+00

Boring Location	Date	Sample No.	Number of Samples from Core Run	Feet down hole	Angle degrees	Down Hole (meters)	Horizontal Distance from Point of Entry (meters)	Vertical Depth from Surface (meters)	Cobalt-60 (pCi/g)	Cesium (pCi/g)	Antimony (pCi/g)	Sample Mass (grams)	Correction Factor
FB12	9/17/00	FB12-09-17-02-0-2	1	2.0	30.0	0.610	0.528	0.305	< 7.09E-02	< 8.04E-02	< 1.81E-01	2023	8.50E-01
bearing:	9/17/02	FB12-09-17-02-2-4	1	4.0	30.0	1.219	1.056	0.610	< 7.04E-02	8.99E-02	< 1.52E-01	1942	9.40E-01
N-78-48-23-W	9/17/02	FB12-09-17-02-4-6.5	1	6.5	30.0	1.981	1.716	0.991	< 7.48E-02	< 8.66E-02	< 1.71E-01	1995	8.50E-01
	9/17/02	FB12-09-17-02-6.5-9	1	9.0	30.0	2.743	2.376	1.372	< 7.41E-02	< 7.14E-02	< 1.54E-01	1787	9.40E-01
	9/17/02	FB12-09-17-02-9-11.5	1	11.5	30.0	3.505	3.036	1.753	< 7.28E-02	7.58E-02	< 1.84E-01	2129	8.10E-01
	9/17/02	FB12-09-17-02-11.5-14	1	14.0	30.0	4.267	3.696	2.134	< 8.62E-02	< 7.14E-02	< 1.57E-01	2182	7.70E-01
	9/17/02	FB12-09-17-02-14-15	1	15.0	30.0	4.572	3.959	2.286	< 7.82E-02	< 6.37E-02	< 1.72E-01	1889	8.90E-01

Attachment 8

ISOCS output reports for $DCGL_{EMC}$ Evaluation

[Note : Small bolded line at the top of each page references specific analysis report, data in table is found under the "Inteference Corrected Report" header. E. g. for Spectrum EXC00135 using the $28m^2$ geometry, the values are located on page 5 of 6 for the first analysis report in this attachment.

****
***** GAMMA SPECTRUM ANALYSIS *****
****

ISOCS Report Generator : ISOCSAN.TPL 2/26/96
Report Generated On : 9/13/04 2:25:12 PM

Spectrum File Name : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title : Excavations
Sample Identification : FR0111-05-1-S048
Sample Type : EXC
Desc. 1 : FR0111-05-1-S048-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8190
Peak Area Range (in channels) : 50 - 8190
Identification Energy Tolerance : 1.500 keV

Sample Size : 1.000E+000 gm

Note: For Point Source, report UNIT = none.

Sample Taken On : 8/17/04 11:36:09 AM
Acquisition Started : 8/17/04 11:36:09 AM

Live Time : 1000.0 seconds
Real Time : 1000.8 seconds

Energy Calibration Used Done On : 6/30/04
Efficiency / Geometry ID : Soil 3m 90d
Efficiency Calibration Used Done On : 2/18/04

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:11 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	774	793	781.64	238.69	2.69E+002	28.74%	3.66E+002
	2	962	975	967.68	295.48	8.33E+001	55.55%	1.71E+002
	3	1143	1159	1152.57	351.92	1.66E+002	29.78%	1.51E+002
	4	1662	1685	1672.98	510.79	1.44E+002	35.18%	1.32E+002
	5	1903	1918	1909.73	583.06	1.08E+002	33.40%	7.56E+001
	6	1988	2006	1995.71	609.30	1.94E+002	22.35%	8.72E+001
	7	2160	2171	2165.34	661.09	2.74E+001	88.06%	4.96E+001
	8	2375	2386	2380.60	726.80	1.90E+001	123.16%	4.90E+001
M	9	2955	2993	2961.02	903.99	2.40E+001	54.98%	2.54E+001
m	10	2955	2993	2983.65	910.89	1.28E+002	19.54%	5.55E+001
	11	3165	3179	3172.21	968.45	4.70E+001	54.51%	4.30E+001
	12	3663	3676	3669.08	1120.13	3.75E+001	64.23%	4.05E+001
	13	3834	3849	3842.26	1173.00	6.20E+001	38.98%	3.00E+001
	14	4357	4371	4364.18	1332.33	6.07E+001	34.00%	1.73E+001
	15	4773	4796	4785.01	1460.79	6.82E+002	8.08%	2.70E+001
	16	5772	5789	5779.75	1764.45	6.35E+001	27.31%	4.50E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.997	511.00*	100.00	5.372E-001	37.31%
K-40	1.000	1460.81*	10.67	2.617E+001	11.44%
CO-60	0.997	1173.22*	100.00	2.450E-001	39.76%
		1332.49*	100.00	2.483E-001	34.90%
CS-137	0.978	661.65*	85.12	1.099E-001	88.84%
TL-208	0.745	277.35	6.80		
		510.84*	21.60	2.487E+000	38.20%
		583.14*	84.20	4.585E-001	35.67%
		763.13	1.64		
		860.37	12.46		
BI-212	0.552	727.17*	11.80	5.621E-001	123.75%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.308	74.81	10.70		
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.893E+000	32.53%
		300.09	3.41		
BI-214	0.346	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	2.001E+000	27.03%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	1.303E+000	65.44%
		1133.66	0.28		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.346	1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		
		1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	2.231E+000	29.95%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.511	53.23	1.11		
		74.82	6.21		
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	1.940E+000	57.60%
		351.92*	37.20	1.884E+000	33.18%

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.997	4.3817E-001	46.44%
K-40	1.000	2.6167E+001	11.44%
CO-60	0.997	2.4685E-001	26.23%
CS-137	0.978	1.0994E-001	88.84%
TL-208	0.745	4.5847E-001	35.52%
BI-212	0.552	5.6213E-001	123.75%
PB-212	0.308	2.8932E+000	32.53%
BI-214	0.346	1.9478E+000	20.60%
PB-214	0.511	1.8973E+000	28.76%

=> 0.025 / 0.11

DR 9-29-04

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:25:11 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	9	903.99	2.4012E-002	54.98
m	10	910.89	1.2830E-001	19.54
	11	968.45	4.6989E-002	54.51

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.55E-001	1.23E-001
		1332.49*	100.00	1.23E-001	
+	CS-137	661.65*	85.12	1.82E-001	1.82E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:23:40 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavations
Sample Identification           : FR0111-05-1-S048
Sample Type                     : EXC
Desc. 1 : FR0111-05-1-S048-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/17/04  11:36:09 AM
Acquisition Started             : 8/17/04  11:36:09 AM

Live Time                       :     1000.0 seconds
Real Time                       :     1000.8 seconds


        Energy Calibration Used Done On      : 6/30/04
        Efficiency / Geometry ID             : 1M2_AREA_AT_EDGE
        Efficiency Calibration Used Done On  : 9/1/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:23:38 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	774-	793	781.64	238.69	2.69E+002	28.74%	3.66E+002
	2	962-	975	967.68	295.48	8.33E+001	55.55%	1.71E+002
	3	1143-	1159	1152.57	351.92	1.66E+002	29.78%	1.51E+002
	4	1662-	1685	1672.98	510.79	1.44E+002	35.18%	1.32E+002
	5	1903-	1918	1909.73	583.06	1.08E+002	33.40%	7.56E+001
	6	1988-	2006	1995.71	609.30	1.94E+002	22.35%	8.72E+001
	7	2160-	2171	2165.34	661.09	2.74E+001	88.06%	4.96E+001
	8	2375-	2386	2380.60	726.80	1.90E+001	123.16%	4.90E+001
M	9	2955-	2993	2961.02	903.99	2.40E+001	54.98%	2.54E+001
m	10	2955-	2993	2983.65	910.89	1.28E+002	19.54%	5.55E+001
	11	3165-	3179	3172.21	968.45	4.70E+001	54.51%	4.30E+001
	12	3663-	3676	3669.08	1120.13	3.75E+001	64.23%	4.05E+001
	13	3834-	3849	3842.26	1173.00	6.20E+001	38.98%	3.00E+001
	14	4357-	4371	4364.18	1332.33	6.07E+001	34.00%	1.73E+001
	15	4773-	4796	4785.01	1460.79	6.82E+002	8.08%	2.70E+001
	16	5772-	5789	5779.75	1764.45	6.35E+001	27.31%	4.50E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.997	511.00*	100.00	1.169E+001	37.31%
K-40	1.000	1460.81*	10.67	5.491E+002	11.44%
CO-60	0.997	1173.22*	100.00	5.321E+000	39.76%
		1332.49*	100.00	5.210E+000	34.90%
CS-137	0.978	661.65*	85.12	2.489E+000	88.84%
TL-208	0.742	277.35	6.80		
		510.84*	21.60	5.413E+001	38.20%
		583.14*	84.20	1.018E+001	35.67%
		763.13	1.64		
		860.37	12.46		
BI-212	0.545	727.17*	11.80	1.264E+001	123.75%
		785.46	1.97		
		1620.62	2.75		
BI-214	0.340	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	4.473E+001	27.03%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	2.840E+001	65.44%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		
		1280.96	1.44		
		1303.76	0.11		

Interference Corrected Activity Report 9/13/04 2:23:40 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.340	1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	4.682E+001	29.95%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.481	53.23	1.11		
		74.82	6.21		
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	3.885E+001	57.60%
		351.92*	37.20	3.875E+001	33.18%

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.997	9.4932E+000	46.69%
K-40	1.000	5.4905E+002	11.44%
CO-60	0.997	5.2572E+000	26.23%
CS-137	0.978	2.4885E+000	88.84%
TL-208	0.742	1.0182E+001	35.52%
BI-212	0.545	1.2639E+001	123.75%
BI-214	0.340	4.2487E+001	20.58%
PB-214	0.481	3.8775E+001	28.75%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:23:38 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
	1	238.69	2.6862E-001	28.74
M	9	903.99	2.4012E-002	54.98
m	10	910.89	1.2830E-001	19.54
	11	968.45	4.6989E-002	54.51

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	3.37E+000	2.59E+000
		1332.49*	100.00	2.59E+000	
+	CS-137	661.65*	85.12	4.13E+000	4.13E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

****
***** GAMMA SPECTRUM ANALYSIS *****
****

ISOCS Report Generator ISOCSAN.TPL 2/26/96
Report Generated On : 9/13/04 2:25:16 PM

Spectrum File Name : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title : Excavations
Sample Identification : S042
Sample Type : EXC
Desc. 1 : FR0111-05-1-S042-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8190
Peak Area Range (in channels) : 50 - 8190
Identification Energy Tolerance : 1.500 keV

Sample Size : 1.000E+000 gm

Note: For Point Source, report UNIT = none.

Sample Taken On : 8/17/04 12:28:34 PM
Acquisition Started : 8/17/04 12:28:34 PM

Live Time : 1000.0 seconds
Real Time : 1000.9 seconds

Energy Calibration Used Done On : 6/30/04
Efficiency / Geometry ID : Soil 3m 90d
Efficiency Calibration Used Done On : 2/18/04

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:15 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	242-	257	246.54	75.34	2.10E+002	60.63%	1.32E+003
	2	274-	283	278.29	85.03	8.01E+001	102.30%	7.23E+002
M	3	776-	800	782.28	238.88	1.98E+002	21.75%	3.75E+002
m	4	776-	800	793.79	242.40	9.27E+001	38.44%	3.60E+002
	5	959-	978	967.22	295.34	1.76E+002	39.33%	3.05E+002
	6	1103-	1118	1108.90	338.59	5.53E+001	93.66%	2.13E+002
	7	1144-	1161	1152.72	351.97	2.72E+002	23.18%	2.33E+002
	8	1665-	1681	1672.99	510.79	1.31E+002	34.73%	1.28E+002
	9	1903-	1921	1909.69	583.05	1.48E+002	28.75%	9.45E+001
	10	1987-	2005	1995.18	609.15	3.14E+002	15.52%	9.07E+001
	11	2161-	2174	2166.49	661.44	3.15E+001	96.79%	7.65E+001
	12	2509-	2520	2514.21	767.59	3.67E+001	67.65%	4.93E+001
	13	2977-	2992	2984.04	911.01	4.02E+001	79.16%	7.38E+001
	14	3167-	3179	3173.17	968.75	5.24E+001	48.36%	4.36E+001
	15	3661-	3677	3668.63	1120.00	1.11E+002	27.66%	4.28E+001
	16	3833-	3849	3841.89	1172.89	5.83E+001	48.65%	4.67E+001
	17	4356-	4373	4364.85	1332.53	5.81E+001	42.46%	3.09E+001
	18	4506-	4519	4512.19	1377.51	3.24E+001	57.11%	2.06E+001
	19	4771-	4796	4784.88	1460.75	8.78E+002	6.91%	1.92E+001
	20	5770-	5789	5780.09	1764.56	9.46E+001	22.76%	7.38E+000
	21	7215-	7228	7221.41	2204.55	2.30E+001	47.75%	3.04E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.997	511.00*	100.00	4.861E-001	36.89%
K-40	1.000	1460.81*	10.67	3.368E+001	10.65%
CO-60	0.996	1173.22*	100.00	2.302E-001	49.27%
		1332.49*	100.00	2.380E-001	43.17%
CS-137	0.997	661.65*	85.12	1.264E-001	97.51%
TL-208	0.745	277.35	6.80		
		510.84*	21.60	2.251E+000	37.78%
		583.14*	84.20	6.238E-001	31.35%
		763.13	1.64		
		860.37	12.46		
PB-212	0.482	74.81*	10.70	1.386E+001	64.09%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.135E+000	26.56%
		300.09	3.41		
BI-214	0.510	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	3.245E+000	21.73%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36*	4.80	3.570E+000	69.14%
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	3.868E+000	30.35%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Interference Corrected Activity Report 9/13/04 2:25:16 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.510	1280.96	1.44		
		1303.76	0.11		
		1377.67*	3.92	4.462E+000	58.50%
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	3.325E+000	25.88%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	2.550E+000	49.38%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.745	53.23	1.11		
		74.82*	6.21	2.387E+001	63.84%
		77.11	10.50		
		87.30	4.67		
		241.98*	7.49	5.917E+000	41.47%
		295.21*	19.20	4.098E+000	42.18%
		351.92*	37.20	3.078E+000	27.42%
AC-228	0.333	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	2.072E+000	102.56%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	5.377E-001	80.03%
		964.60	5.20		
		969.11*	16.60	1.187E+000	53.58%
		1588.00	3.50		
TH-228	0.807	84.38*	1.22	4.458E+001	103.95%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.997	3.5137E-001	52.41%
K-40	1.000	3.3677E+001	10.65%
CO-60	0.996	2.3448E-001	32.48%
CS-137	0.997	1.2635E-001	97.51%
TL-208	0.745	6.2378E-001	31.18%
PB-212	0.482	2.1737E+000	25.68%
BI-214	0.510	3.3154E+000	15.54%
PB-214	0.745	3.5329E+000	20.09%
AC-228	0.333	7.7800E-001	45.18%
TH-228	0.807	4.4580E+001	103.95%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:25:15 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.97E-001	1.69E-001
		1332.49*	100.00	1.69E-001	
+	CS-137	661.65*	85.12	2.33E-001	2.33E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**********************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S        *****
**********************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:23:44 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavations
Sample Identification           : S042
Sample Type                     : EXC
Desc. 1 : FR0111-05-1-S042-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/17/04  12:28:34 PM
Acquisition Started             : 8/17/04  12:28:34 PM

Live Time                       :     1000.0 seconds
Real Time                       :     1000.9 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 9/1/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:23:43 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	242-	257	246.54	75.34	2.10E+002	60.63%	1.32E+003
	2	274-	283	278.29	85.03	8.01E+001	102.30%	7.23E+002
M	3	776-	800	782.28	238.88	1.98E+002	21.75%	3.75E+002
m	4	776-	800	793.79	242.40	9.27E+001	38.44%	3.60E+002
	5	959-	978	967.22	295.34	1.76E+002	39.33%	3.05E+002
	6	1103-	1118	1108.90	338.59	5.53E+001	93.66%	2.13E+002
	7	1144-	1161	1152.72	351.97	2.72E+002	23.18%	2.33E+002
	8	1665-	1681	1672.99	510.79	1.31E+002	34.73%	1.28E+002
	9	1903-	1921	1909.69	583.05	1.48E+002	28.75%	9.45E+001
	10	1987-	2005	1995.18	609.15	3.14E+002	15.52%	9.07E+001
	11	2161-	2174	2166.49	661.44	3.15E+001	96.79%	7.65E+001
	12	2509-	2520	2514.21	767.59	3.67E+001	67.65%	4.93E+001
	13	2977-	2992	2984.04	911.01	4.02E+001	79.16%	7.38E+001
	14	3167-	3179	3173.17	968.75	5.24E+001	48.36%	4.36E+001
	15	3661-	3677	3668.63	1120.00	1.11E+002	27.66%	4.28E+001
	16	3833-	3849	3841.89	1172.89	5.83E+001	48.65%	4.67E+001
	17	4356-	4373	4364.85	1332.53	5.81E+001	42.46%	3.09E+001
	18	4506-	4519	4512.19	1377.51	3.24E+001	57.11%	2.06E+001
	19	4771-	4796	4784.88	1460.75	8.78E+002	6.91%	1.92E+001
	20	5770-	5789	5780.09	1764.56	9.46E+001	22.76%	7.38E+000
	21	7215-	7228	7221.41	2204.55	2.30E+001	47.75%	3.04E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.997	511.00*	100.00	1.058E+001	36.89%
K-40	1.000	1460.81*	10.67	7.066E+002	10.65%
CO-60	0.996	1173.22*	100.00	5.000E+000	49.27%
		1332.49*	100.00	4.993E+000	43.17%
CS-137	0.997	661.65*	85.12	2.860E+000	97.51%
TL-208	0.742	277.35	6.80		
		510.84*	21.60	4.898E+001	37.78%
		583.14*	84.20	1.385E+001	31.35%
		763.13	1.64		
		860.37	12.46		
PB-212	0.463	74.81*	10.70	2.255E+002	64.09%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	4.140E+001	26.56%
		300.09	3.41		
BI-214	0.505	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	7.255E+001	21.73%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36*	4.80	7.995E+001	69.14%
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	8.429E+001	30.35%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.505	1280.96	1.44		
		1303.76	0.11		
		1377.67*	3.92	9.363E+001	58.50%
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	6.977E+001	25.88%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	5.351E+001	49.38%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.723	53.23	1.11		
		74.82*	6.21	3.885E+002	63.84%
		77.11	10.50		
		87.30	4.67		
		241.98*	7.49	1.150E+002	41.47%
		295.21*	19.20	8.207E+001	42.18%
		351.92*	37.20	6.331E+001	27.42%
AC-228	0.318	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	4.237E+001	102.56%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	1.189E+001	80.03%
		964.60	5.20		
		969.11*	16.60	2.614E+001	53.58%
		1588.00	3.50		
TH-228	0.812	84.38*	1.22	7.390E+002	103.95%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.997	7.5883E+000	52.88%
K-40	1.000	7.0663E+002	10.65%
CO-60	0.996	4.9961E+000	32.47%
CS-137	0.997	2.8603E+000	97.51%
TL-208	0.742	1.3853E+001	31.18%
PB-212	0.463	4.2210E+001	25.62%
BI-214	0.505	7.1847E+001	15.55%
PB-214	0.723	7.2345E+001	19.97%
AC-228	0.318	1.7220E+001	44.99%
TH-228	0.812	7.3897E+002	103.95%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:23:43 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	4.27E+000	3.54E+000
		1332.49*	100.00	3.54E+000	
+	CS-137	661.65*	85.12	5.28E+000	5.28E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

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*****************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S         *****
*****************************************************************************

ISOCS Report Generator            ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:25:20 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavations
Sample Identification           : FR0111-05-1-S049
Sample Type                     : EXC
Desc. 1 : FR0111-05-1-S049-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/17/04  12:50:19 PM
Acquisition Started             : 8/17/04  12:50:19 PM

Live Time                       :     1000.0 seconds
Real Time                       :     1000.9 seconds


     Energy Calibration Used Done On       : 6/30/04
     Efficiency / Geometry ID              : Soil 3m 90d
     Efficiency Calibration Used Done On   : 2/18/04
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:19 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	242-	251	246.40	75.30	9.15E+001	99.30%	9.08E+002
2	776-	787	781.84	238.75	1.37E+002	44.49%	3.31E+002
3	961-	974	967.33	295.37	1.32E+002	39.84%	2.14E+002
4	1146-	1161	1152.54	351.91	2.00E+002	28.01%	1.99E+002
5	1659-	1683	1672.76	510.72	1.43E+002	41.63%	1.88E+002
6	1902-	1917	1909.24	582.91	9.62E+001	42.11%	1.10E+002
7	1986-	2005	1994.80	609.03	2.70E+002	18.30%	1.05E+002
8	2159-	2171	2165.68	661.19	5.10E+001	61.46%	7.80E+001
9	2597-	2608	2602.98	794.69	2.27E+001	101.53%	4.63E+001
10	2974-	2990	2982.30	910.48	6.63E+001	46.75%	5.87E+001
11	3166-	3180	3172.59	968.57	5.36E+001	51.65%	5.04E+001
12	3661-	3675	3668.19	1119.86	6.98E+001	42.23%	5.42E+001
13	3833-	3850	3841.29	1172.70	5.84E+001	50.50%	5.16E+001
14	4046-	4060	4053.43	1237.46	2.87E+001	90.27%	5.03E+001
15	4357-	4371	4364.29	1332.36	4.95E+001	42.31%	2.25E+001
16	4506-	4519	4512.08	1377.48	1.75E+001	86.76%	1.45E+001
17	4772-	4795	4783.61	1460.37	9.08E+002	6.75%	1.74E+001
18	5769-	5788	5779.31	1764.32	8.41E+001	23.44%	4.88E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.994	511.00*	100.00	5.303E-001	43.44%
K-40	0.986	1460.81*	10.67	3.482E+001	10.54%
CO-60	0.990	1173.22*	100.00	2.307E-001	51.11%
		1332.49*	100.00	2.026E-001	43.03%
CS-137	0.985	661.65*	85.12	2.045E-001	62.58%
TL-208	0.742	277.35	6.80		
		510.84*	21.60	2.455E+000	44.20%
		583.14*	84.20	4.066E-001	43.93%
		763.13	1.64		
		860.37	12.46		
PB-212	0.484	74.81*	10.70	6.047E+000	101.45%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.474E+000	47.03%
		300.09	3.41		
BI-214	0.459	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	2.792E+000	23.80%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	2.428E+000	44.04%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	2.594E+000	91.11%

Interference Corrected Activity Report 9/13/04 2:25:21 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.459	1280.96	1.44		
		1303.76	0.11		
		1377.67*	3.92	2.414E+000	87.69%
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	2.956E+000	26.47%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.606	53.23	1.11		
		74.82*	6.21	1.042E+001	101.29%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	3.084E+000	42.66%
		351.92*	37.20	2.262E+000	31.61%

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.994	4.4251E-001	52.79%
K-40	0.986	3.4821E+001	10.54%
CO-60	0.990	2.1256E-001	32.98%
CS-137	0.985	2.0448E-001	62.58%
TL-208	0.742	4.0659E-001	43.81%
PB-212	0.484	1.5140E+000	45.31%
BI-214	0.459	2.7666E+000	17.54%
PB-214	0.606	2.4662E+000	25.04%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:25:19 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
9	794.69	2.2728E-002	101.53
10	910.48	6.6310E-002	46.75
11	968.57	5.3599E-002	51.65

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	2.07E-001	1.38E-001
		1332.49*	100.00	1.38E-001	
+	CS-137	661.65*	85.12	2.30E-001	2.30E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

****
***** G A M M A S P E C T R U M A N A L Y S I S *****
****

ISOCS Report Generator : ISOCSAN.TPL 2/26/96
Report Generated On : 9/13/04 2:23:47 PM

Spectrum File Name : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title : Excavations
Sample Identification : FR0111-05-1-S049
Sample Type : EXC
Desc. 1 : FR0111-05-1-S049-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8190
Peak Area Range (in channels) : 50 - 8190
Identification Energy Tolerance : 1.500 keV

Sample Size : 1.000E+000 gm

Note: For Point Source, report UNIT = none.

Sample Taken On : 8/17/04 12:50:19 PM
Acquisition Started : 8/17/04 12:50:19 PM

Live Time : 1000.0 seconds
Real Time : 1000.9 seconds

Energy Calibration Used Done On : 6/30/04
Efficiency / Geometry ID : 1M2_AREA_AT_EDGE
Efficiency Calibration Used Done On : 9/1/04

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:23:46 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	242-	251	246.40	75.30	9.15E+001	99.30%	9.08E+002
2	776-	787	781.84	238.75	1.37E+002	44.49%	3.31E+002
3	961-	974	967.33	295.37	1.32E+002	39.84%	2.14E+002
4	1146-	1161	1152.54	351.91	2.00E+002	28.01%	1.99E+002
5	1659-	1683	1672.76	510.72	1.43E+002	41.63%	1.88E+002
6	1902-	1917	1909.24	582.91	9.62E+001	42.11%	1.10E+002
7	1986-	2005	1994.80	609.03	2.70E+002	18.30%	1.05E+002
8	2159-	2171	2165.68	661.19	5.10E+001	61.46%	7.80E+001
9	2597-	2608	2602.98	794.69	2.27E+001	101.53%	4.63E+001
10	2974-	2990	2982.30	910.48	6.63E+001	46.75%	5.87E+001
11	3166-	3180	3172.59	968.57	5.36E+001	51.65%	5.04E+001
12	3661-	3675	3668.19	1119.86	6.98E+001	42.23%	5.42E+001
13	3833-	3850	3841.29	1172.70	5.84E+001	50.50%	5.16E+001
14	4046-	4060	4053.43	1237.46	2.87E+001	90.27%	5.03E+001
15	4357-	4371	4364.29	1332.36	4.95E+001	42.31%	2.25E+001
16	4506-	4519	4512.08	1377.48	1.75E+001	86.76%	1.45E+001
17	4772-	4795	4783.61	1460.37	9.08E+002	6.75%	1.74E+001
18	5769-	5788	5779.31	1764.32	8.41E+001	23.44%	4.88E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.994	511.00*	100.00	1.154E+001	43.44%
K-40	0.986	1460.81*	10.67	7.306E+002	10.54%
CO-60	0.990	1173.22*	100.00	5.010E+000	51.11%
		1332.49*	100.00	4.252E+000	43.03%
CS-137	0.985	661.65*	85.12	4.629E+000	62.58%
TL-208	0.739	277.35	6.80		
		510.84*	21.60	5.344E+001	44.20%
		583.14*	84.20	9.029E+000	43.93%
		763.13	1.64		
		860.37	12.46		
PB-212	0.465	74.81*	10.70	9.841E+001	101.45%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.859E+001	47.03%
		300.09	3.41		
BI-214	0.454	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	6.242E+001	23.80%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	5.291E+001	44.04%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	5.552E+001	91.11%

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.454	1280.96	1.44		
		1303.76	0.11		
		1377.67*	3.92	5.065E+001	87.69%
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	6.203E+001	26.47%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.585	53.23	1.11		
		74.82*	6.21	1.696E+002	101.29%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	6.177E+001	42.66%
		351.92*	37.20	4.653E+001	31.61%

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.994	9.5926E+000	53.03%
K-40	0.986	7.3065E+002	10.54%
CO-60	0.990	4.5083E+000	33.02%
CS-137	0.985	4.6286E+000	62.58%
TL-208	0.739	9.0290E+000	43.81%
PB-212	0.465	2.9311E+001	45.26%
BI-214	0.454	6.0099E+001	17.54%
PB-214	0.585	5.0486E+001	24.98%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:23:46 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
9	794.69	2.2728E-002	101.53
10	910.48	6.6310E-002	46.75
11	968.57	5.3599E-002	51.65

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	4.49E+000	2.90E+000
		1332.49*	100.00	2.90E+000	
+	CS-137	661.65*	85.12	5.21E+000	5.21E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

****
***** GAMMA SPECTRUM ANALYSIS *****
****

ISOCS Report Generator ISOCSAN.TPL 2/26/96
Report Generated On : 9/13/04 2:25:24 PM

Spectrum File Name : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title : Excavations
Sample Identification : FR0111-05-1-S055
Sample Type : EXC
Desc. 1 : FR0111-05-1-S055-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8190
Peak Area Range (in channels) : 50 - 8190
Identification Energy Tolerance : 1.500 keV

Sample Size : 1.000E+000 gm

Note: For Point Source, report UNIT = none.

Sample Taken On : 8/17/04 1:12:28 PM
Acquisition Started : 8/17/04 1:12:28 PM

Live Time : 1000.0 seconds
Real Time : 1000.7 seconds

Energy Calibration Used Done On : 6/30/04
Efficiency / Geometry ID : Soil 3m 90d
Efficiency Calibration Used Done On : 2/18/04

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:23 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	234-	257	246.00	75.17	4.93E+002	29.65%	1.27E+003
2	774-	788	781.56	238.66	1.77E+002	35.61%	2.98E+002
3	959-	974	966.93	295.25	8.07E+001	65.97%	2.18E+002
4	1142-	1160	1152.55	351.92	1.58E+002	36.35%	2.09E+002
5	1664-	1685	1672.74	510.71	1.67E+002	26.40%	9.08E+001
6	1900-	1917	1908.80	582.78	1.10E+002	37.00%	9.89E+001
7	1986-	2006	1994.73	609.01	1.72E+002	24.57%	8.10E+001
8	2161-	2174	2166.78	661.53	4.20E+001	69.55%	6.40E+001
9	2974-	2992	2982.47	910.53	9.45E+001	33.95%	5.05E+001
10	3167-	3180	3173.03	968.71	2.44E+001	102.19%	4.96E+001
11	3658-	3675	3667.50	1119.65	7.07E+001	36.41%	3.13E+001
12	3834-	3847	3840.55	1172.48	4.85E+001	50.38%	3.75E+001
13	4355-	4370	4363.03	1331.97	5.58E+001	37.99%	2.02E+001
14	4773-	4795	4783.56	1460.35	7.90E+002	7.45%	2.99E+001
15	5770-	5788	5778.59	1764.10	6.10E+001	30.63%	9.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.994	511.00*	100.00	6.221E-001	29.17%
K-40	0.985	1460.81*	10.67	3.031E+001	11.00%
CO-60	0.972	1173.22*	100.00	1.916E-001	50.99%
		1332.49*	100.00	2.285E-001	38.79%
CS-137	0.999	661.65*	85.12	1.685E-001	70.54%
TL-208	0.739	277.35	6.80		
		510.84*	21.60	2.880E+000	30.30%
		583.14*	84.20	4.654E-001	39.06%
		763.13	1.64		
		860.37	12.46		
PB-212	0.486	74.81*	10.70	3.260E+001	36.21%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.911E+000	38.74%
		300.09	3.41		
BI-214	0.339	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	1.776E+000	28.90%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	2.459E+000	38.50%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Interference Corrected Activity Report 9/13/04 2:25:24 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.339	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	2.143E+000	33.01%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.607	53.23	1.11		
		74.82*	6.21	5.617E+001	35.77%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	1.879E+000	67.71%
		351.92*	37.20	1.795E+000	39.18%

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.994	5.2159E-001	35.60%
K-40	0.985	3.0312E+001	11.00%
CO-60	0.972	2.1184E-001	30.99%
CS-137	0.999	1.6852E-001	70.54%
TL-208	0.739	4.6538E-001	38.92%
PB-212	0.486	2.0333E+000	36.10%
BI-214	0.339	1.9878E+000	20.44%
PB-214	0.607	1.8636E+000	32.71%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:25:23 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
9	910.53	9.4486E-002	33.95
10	968.71	2.4399E-002	102.19

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.68E-001	1.35E-001
		1332.49*	100.00	1.35E-001	
+	CS-137	661.65*	85.12	2.17E-001	2.17E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:23:51 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavations
Sample Identification            : FR0111-05-1-S055
Sample Type                      : EXC
Desc. 1 : FR0111-05-1-S055-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/17/04   1:12:28 PM
Acquisition Started              : 8/17/04   1:12:28 PM

Live Time                        :     1000.0 seconds
Real Time                        :     1000.7 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 9/1/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:23:50 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	234-	257	246.00	75.17	4.93E+002	29.65%	1.27E+003
2	774-	788	781.56	238.66	1.77E+002	35.61%	2.98E+002
3	959-	974	966.93	295.25	8.07E+001	65.97%	2.18E+002
4	1142-	1160	1152.55	351.92	1.58E+002	36.35%	2.09E+002
5	1664-	1685	1672.74	510.71	1.67E+002	26.40%	9.08E+001
6	1900-	1917	1908.80	582.78	1.10E+002	37.00%	9.89E+001
7	1986-	2006	1994.73	609.01	1.72E+002	24.57%	8.10E+001
8	2161-	2174	2166.78	661.53	4.20E+001	69.55%	6.40E+001
9	2974-	2992	2982.47	910.53	9.45E+001	33.95%	5.05E+001
10	3167-	3180	3173.03	968.71	2.44E+001	102.19%	4.96E+001
11	3658-	3675	3667.50	1119.65	7.07E+001	36.41%	3.13E+001
12	3834-	3847	3840.55	1172.48	4.85E+001	50.38%	3.75E+001
13	4355-	4370	4363.03	1331.97	5.58E+001	37.99%	2.02E+001
14	4773-	4795	4783.56	1460.35	7.90E+002	7.45%	2.99E+001
15	5770-	5788	5778.59	1764.10	6.10E+001	30.63%	9.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.994	511.00*	100.00	1.354E+001	29.17%
K-40	0.985	1460.81*	10.67	6.360E+002	11.00%
CO-60	0.972	1173.22*	100.00	4.162E+000	50.99%
		1332.49*	100.00	4.794E+000	38.79%
CS-137	0.999	661.65*	85.12	3.815E+000	70.54%
TL-208	0.736	277.35	6.80		
		510.84*	21.60	6.269E+001	30.30%
		583.14*	84.20	1.033E+001	39.06%
		763.13	1.64		
		860.37	12.46		
PB-212	0.467	74.81*	10.70	5.304E+002	36.21%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	3.705E+001	38.74%
		300.09	3.41		
BI-214	0.333	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	3.970E+001	28.90%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	5.358E+001	38.50%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Interference Corrected Activity Report 9/13/04 2:23:51 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.333	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	4.498E+001	33.01%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.586	53.23	1.11		
		74.82*	6.21	9.139E+002	35.77%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	3.764E+001	67.71%
		351.92*	37.20	3.693E+001	39.18%

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.994	1.1308E+001	35.77%
K-40	0.985	6.3603E+002	11.00%
CO-60	0.972	4.5195E+000	30.95%
CS-137	0.999	3.8148E+000	70.54%
TL-208	0.736	1.0334E+001	38.92%
PB-212	0.467	3.9813E+001	35.72%
BI-214	0.333	4.3517E+001	20.41%
PB-214	0.586	3.8321E+001	32.50%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:23:50 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
9	910.53	9.4486E-002	33.95
10	968.71	2.4399E-002	102.19

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	3.64E+000	2.83E+000
		1332.49*	100.00	2.83E+000	
+	CS-137	661.65*	85.12	4.91E+000	4.91E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S         *****
**************************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:25:28 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavations
Sample Identification            : FR0111-05-1-S056
Sample Type                      : EXC
Desc. 1 : FR0111-05-1-S056-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/17/04   1:54:04 PM
Acquisition Started              : 8/17/04   1:54:04 PM

Live Time                        :     1000.0 seconds
Real Time                        :     1000.8 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : Soil 3m 90d
          Efficiency Calibration Used Done On   : 2/18/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:27 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	241-	257	246.05	75.19	2.38E+002	51.46%	1.17E+003
2	272-	283	277.96	84.93	8.48E+001	104.48%	7.79E+002
3	770-	788	781.63	238.69	1.46E+002	55.58%	4.62E+002
4	959-	974	966.83	295.22	7.16E+001	78.58%	2.49E+002
5	1101-	1113	1107.96	338.30	5.92E+001	67.32%	1.35E+002
6	1145-	1162	1151.87	351.71	2.02E+002	26.39%	1.63E+002
7	1662-	1682	1672.68	510.69	1.44E+002	35.96%	1.52E+002
8	1901-	1917	1908.86	582.79	1.18E+002	34.93%	1.04E+002
9	1985-	2001	1994.87	609.05	1.49E+002	28.65%	1.04E+002
10	2156-	2174	2165.94	661.27	8.80E+001	40.19%	6.90E+001
11	2509-	2520	2514.51	767.68	2.16E+001	112.08%	5.24E+001
12	2975-	2991	2982.88	910.66	1.10E+002	28.85%	4.81E+001
13	3163-	3180	3171.29	968.17	6.21E+001	54.11%	7.09E+001
14	3661-	3675	3667.64	1119.69	6.07E+001	44.95%	4.63E+001
15	3834-	3848	3841.00	1172.61	4.09E+001	63.40%	4.61E+001
16	4356-	4370	4363.11	1332.00	3.09E+001	71.23%	3.21E+001
17	4773-	4794	4783.49	1460.33	8.65E+002	7.22%	4.02E+001
18	5769-	5788	5777.98	1763.91	7.97E+001	22.99%	2.30E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.993	511.00*	100.00	5.350E-001	38.05%
K-40	0.984	1460.81*	10.67	3.318E+001	10.84%
CO-60	0.979	1173.22*	100.00	1.615E-001	63.88%
		1332.49*	100.00	1.267E-001	71.66%
CS-137	0.990	661.65*	85.12	3.529E-001	41.88%
TL-208	0.739	277.35	6.80		
		510.84*	21.60	2.477E+000	38.92%
		583.14*	84.20	4.996E-001	37.10%
		763.13	1.64		
		860.37	12.46		
PB-212	0.486	74.81*	10.70	1.576E+001	55.50%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.570E+000	57.63%
		300.09	3.41		
BI-214	0.400	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	1.538E+000	32.44%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36*	4.80	2.106E+000	112.98%
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	2.113E+000	46.66%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Interference Corrected Activity Report 9/13/04 2:25:28 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.400	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	2.801E+000	26.07%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.606	53.23	1.11		
		74.82*	6.21	2.715E+001	55.22%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	1.667E+000	80.05%
		351.92*	37.20	2.286E+000	30.18%
AC-228	0.322	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	2.218E+000	79.24%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	1.469E+000	31.15%
		964.60	5.20		
		969.11*	16.60	1.407E+000	58.82%
		1588.00	3.50		
TH-228	0.815	84.38*	1.22	4.721E+001	106.10%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.993	4.2709E-001	48.57%
K-40	0.984	3.3180E+001	10.84%
CO-60	0.979	1.4187E-001	48.04%
CS-137	0.990	3.5293E-001	41.88%
TL-208	0.739	4.9959E-001	36.96%
PB-212	0.486	1.7102E+000	52.48%
BI-214	0.400	1.9792E+000	20.32%
PB-214	0.606	2.1948E+000	27.47%
AC-228	0.322	1.4922E+000	26.17%
TH-228	0.815	4.7210E+001	106.10%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:25:27 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.86E-001	1.65E-001
		1332.49*	100.00	1.65E-001	
+	CS-137	661.65*	85.12	2.47E-001	2.47E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

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*****************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S         *****
*****************************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:23:55 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavations
Sample Identification           : FR0111-05-1-S056
Sample Type                     : EXC
Desc. 1 : FR0111-05-1-S056-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/17/04   1:54:04 PM
Acquisition Started             : 8/17/04   1:54:04 PM

Live Time                       :     1000.0 seconds
Real Time                       :     1000.8 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 9/1/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:23:54 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	241-	257	246.05	75.19	2.38E+002	51.46%	1.17E+003
2	272-	283	277.96	84.93	8.48E+001	104.48%	7.79E+002
3	770-	788	781.63	238.69	1.46E+002	55.58%	4.62E+002
4	959-	974	966.83	295.22	7.16E+001	78.58%	2.49E+002
5	1101-	1113	1107.96	338.30	5.92E+001	67.32%	1.35E+002
6	1145-	1162	1151.87	351.71	2.02E+002	26.39%	1.63E+002
7	1662-	1682	1672.68	510.69	1.44E+002	35.96%	1.52E+002
8	1901-	1917	1908.86	582.79	1.18E+002	34.93%	1.04E+002
9	1985-	2001	1994.87	609.05	1.49E+002	28.65%	1.04E+002
10	2156-	2174	2165.94	661.27	8.80E+001	40.19%	6.90E+001
11	2509-	2520	2514.51	767.68	2.16E+001	112.08%	5.24E+001
12	2975-	2991	2982.88	910.66	1.10E+002	28.85%	4.81E+001
13	3163-	3180	3171.29	968.17	6.21E+001	54.11%	7.09E+001
14	3661-	3675	3667.64	1119.69	6.07E+001	44.95%	4.63E+001
15	3834-	3848	3841.00	1172.61	4.09E+001	63.40%	4.61E+001
16	4356-	4370	4363.11	1332.00	3.09E+001	71.23%	3.21E+001
17	4773-	4794	4783.49	1460.33	8.65E+002	7.22%	4.02E+001
18	5769-	5788	5777.98	1763.91	7.97E+001	22.99%	2.30E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.993	511.00*	100.00	1.164E+001	38.05%
K-40	0.984	1460.81*	10.67	6.962E+002	10.84%
CO-60	0.979	1173.22*	100.00	3.508E+000	63.88%
		1332.49*	100.00	2.658E+000	71.66%
CS-137	0.990	661.65*	85.12	7.989E+000	41.88%
TL-208	0.736	277.35	6.80		
		510.84*	21.60	5.391E+001	38.92%
		583.14*	84.20	1.109E+001	37.10%
		763.13	1.64		
		860.37	12.46		
PB-212	0.467	74.81*	10.70	2.564E+002	55.50%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	3.045E+001	57.63%
		300.09	3.41		
BI-214	0.392	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	3.439E+001	32.44%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36*	4.80	4.717E+001	112.98%
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	4.604E+001	46.66%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.392	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	5.877E+001	26.07%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.584	53.23	1.11		
		74.82*	6.21	4.418E+002	55.22%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	3.339E+001	80.05%
		351.92*	37.20	4.701E+001	30.18%
AC-228	0.307	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	4.536E+001	79.24%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	3.249E+001	31.15%
		964.60	5.20		
		969.11*	16.60	3.098E+001	58.82%
		1588.00	3.50		
TH-228	0.820	84.38*	1.22	7.824E+002	106.10%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.993	9.2479E+000	48.86%
K-40	0.984	6.9620E+002	10.84%
CO-60	0.979	3.0145E+000	48.14%
CS-137	0.990	7.9890E+000	41.88%
TL-208	0.736	1.1094E+001	36.96%
PB-212	0.467	3.3508E+001	51.82%
BI-214	0.392	4.3605E+001	20.21%
PB-214	0.584	4.4970E+001	27.40%
AC-228	0.307	3.2893E+001	26.12%
TH-228	0.820	7.8242E+002	106.10%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:23:54 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	4.04E+000	3.46E+000
		1332.49*	100.00	3.46E+000	
+	CS-137	661.65*	85.12	5.59E+000	5.59E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator            ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:25:32 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavations
Sample Identification           : FR0111-05-1-S060
Sample Type                     : EXC
Desc. 1 : FR0111-05-1-S060-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/17/04   2:26:54 PM
Acquisition Started             : 8/17/04   2:43:37 PM

Live Time                       :     1664.0 seconds
Real Time                       :     1665.3 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : Soil 3m 90d
          Efficiency Calibration Used Done On   : 2/18/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:31 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	232-	257	239.10	73.07	2.62E+002	27.86%	1.49E+003
m	2	232-	257	246.37	75.29	5.37E+002	15.05%	1.69E+003
	3	769-	789	781.57	238.67	1.99E+002	52.92%	7.36E+002
M	4	954-	988	966.68	295.17	2.16E+002	19.11%	4.04E+002
m	5	954-	988	982.51	300.01	6.21E+001	55.56%	3.50E+002
	6	1088-	1113	1107.12	338.05	8.69E+001	101.46%	4.55E+002
	7	1143-	1159	1152.13	351.79	3.27E+002	21.02%	2.89E+002
	8	1663-	1684	1671.11	510.22	1.90E+002	32.73%	2.15E+002
	9	1900-	1917	1909.09	582.86	1.74E+002	29.01%	1.50E+002
	10	1984-	2005	1994.47	608.93	3.45E+002	17.84%	1.71E+002
	11	2157-	2172	2166.01	661.29	6.58E+001	59.86%	1.12E+002
	12	2375-	2389	2381.68	727.13	3.81E+001	93.33%	1.01E+002
	13	2509-	2521	2515.45	767.97	3.53E+001	90.66%	8.78E+001
	14	2973-	2992	2982.58	910.57	1.46E+002	28.77%	8.92E+001
	15	3165-	3180	3171.82	968.34	9.05E+001	37.87%	7.15E+001
	16	3658-	3676	3667.99	1119.80	1.02E+002	34.33%	6.41E+001
	17	3834-	3850	3840.66	1172.51	5.55E+001	63.30%	8.45E+001
	18	4047-	4062	4053.77	1237.57	4.76E+001	70.53%	7.94E+001
	19	4354-	4370	4362.32	1331.76	5.27E+001	53.75%	4.93E+001
	20	4770-	4795	4783.31	1460.27	1.43E+003	5.45%	3.58E+001
	21	5657-	5670	5663.63	1729.01	2.57E+001	45.14%	3.31E+000
	22	5768-	5789	5778.57	1764.09	1.18E+002	21.36%	1.28E+001
	23	7212-	7225	7218.99	2203.81	3.02E+001	48.12%	8.85E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.957	511.00*	100.00	4.240E-001	35.01%
K-40	0.980	1460.81*	10.67	3.295E+001	9.76%
CO-60	0.964	1173.22*	100.00	1.318E-001	63.79%
		1332.49*	100.00	1.297E-001	54.32%
CS-137	0.991	661.65*	85.12	1.585E-001	61.01%
TL-208	0.737	277.35	6.80		
		510.84*	21.60	1.963E+000	35.95%
		583.14*	84.20	4.432E-001	31.59%
		763.13	1.64		
		860.37	12.46		
BI-212	0.559	727.17*	11.80	6.776E-001	94.11%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.557	74.81*	10.70	2.132E+001	25.65%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.286E+000	55.07%
		300.09*	3.41	4.868E+000	57.28%
BI-214	0.561	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	4.539E+000	23.94%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36*	4.80	4.370E+000	91.91%
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	4.512E+000	36.85%
		1133.66	0.28		

Interference Corrected Activity Report 9/13/04 2:25:32 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.561	1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	5.466E+000	71.76%
		1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59*	2.88	6.130E+000	47.15%
		1764.49*	15.36	5.286E+000	25.12%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	4.264E+000	49.97%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.606	53.23	1.11		
		74.82*	6.21	3.673E+001	25.04%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	3.025E+000	24.44%
		351.92*	37.20	2.228E+000	25.62%
AC-228	0.323	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	1.958E+000	109.73%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	1.171E+000	31.07%
		964.60	5.20		
		969.11*	16.60	1.232E+000	44.34%
		1588.00	3.50		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30

Interference Corrected Activity Report 9/13/04 2:25:32 PM Page 5

Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.957	3.2825E-001	46.13%
K-40	0.980	3.2953E+001	9.76%
CO-60	0.964	1.3054E-001	41.36%
CS-137	0.991	1.5846E-001	61.01%
TL-208	0.737	4.4316E-001	31.43%
BI-212	0.559	6.7762E-001	94.11%
PB-212	0.557	1.8240E+000	37.18%
BI-214	0.561	4.8032E+000	16.54%
PB-214	0.606	2.6052E+000	16.83%
AC-228	0.323	1.2050E+000	24.89%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:25:31 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	73.07	1.5738E-001	27.86

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.54E-001	1.24E-001
		1332.49*	100.00	1.24E-001	
+	CS-137	661.65*	85.12	1.75E-001	1.75E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:23:59 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavations
Sample Identification            : FR0111-05-1-S060
Sample Type                      : EXC
Desc. 1 : FR0111-05-1-S060-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/17/04   2:26:54 PM
Acquisition Started              : 8/17/04   2:43:37 PM

Live Time                        :     1664.0 seconds
Real Time                        :     1665.3 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 9/1/04
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:23:59 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	232-	257	239.10	73.07	2.62E+002	27.86%	1.49E+003
m	2	232-	257	246.37	75.29	5.37E+002	15.05%	1.69E+003
	3	769-	789	781.57	238.67	1.99E+002	52.92%	7.36E+002
M	4	954-	988	966.68	295.17	2.16E+002	19.11%	4.04E+002
m	5	954-	988	982.51	300.01	6.21E+001	55.56%	3.50E+002
	6	1088-	1113	1107.12	338.05	8.69E+001	101.46%	4.55E+002
	7	1143-	1159	1152.13	351.79	3.27E+002	21.02%	2.89E+002
	8	1663-	1684	1671.11	510.22	1.90E+002	32.73%	2.15E+002
	9	1900-	1917	1909.09	582.86	1.74E+002	29.01%	1.50E+002
	10	1984-	2005	1994.47	608.93	3.45E+002	17.84%	1.71E+002
	11	2157-	2172	2166.01	661.29	6.58E+001	59.86%	1.12E+002
	12	2375-	2389	2381.68	727.13	3.81E+001	93.33%	1.01E+002
	13	2509-	2521	2515.45	767.97	3.53E+001	90.66%	8.78E+001
	14	2973-	2992	2982.58	910.57	1.46E+002	28.77%	8.92E+001
	15	3165-	3180	3171.82	968.34	9.05E+001	37.87%	7.15E+001
	16	3658-	3676	3667.99	1119.80	1.02E+002	34.33%	6.41E+001
	17	3834-	3850	3840.66	1172.51	5.55E+001	63.30%	8.45E+001
	18	4047-	4062	4053.77	1237.57	4.76E+001	70.53%	7.94E+001
	19	4354-	4370	4362.32	1331.76	5.27E+001	53.75%	4.93E+001
	20	4770-	4795	4783.31	1460.27	1.43E+003	5.45%	3.58E+001
	21	5657-	5670	5663.63	1729.01	2.57E+001	45.14%	3.31E+000
	22	5768-	5789	5778.57	1764.09	1.18E+002	21.36%	1.28E+001
	23	7212-	7225	7218.99	2203.81	3.02E+001	48.12%	8.85E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

Interference Corrected Activity Report 9/13/04 2:23:59 PM Page 3

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.957	511.00*	100.00	9.226E+000	35.01%
K-40	0.980	1460.81*	10.67	6.914E+002	9.76%
CO-60	0.964	1173.22*	100.00	2.861E+000	63.79%
		1332.49*	100.00	2.721E+000	54.32%
CS-137	0.991	661.65*	85.12	3.587E+000	61.01%
TL-208	0.734	277.35	6.80		
		510.84*	21.60	4.271E+001	35.95%
		583.14*	84.20	9.841E+000	31.59%
		763.13	1.64		
		860.37	12.46		
BI-212	0.552	727.17*	11.80	1.524E+001	94.11%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.535	74.81*	10.70	3.469E+002	25.65%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.493E+001	55.07%
		300.09*	3.41	9.773E+001	57.28%
BI-214	0.555	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	1.015E+002	23.94%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36*	4.80	9.787E+001	91.91%
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	9.832E+001	36.85%
		1133.66	0.28		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.555	1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	1.170E+002	71.76%
		1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59*	2.88	1.286E+002	47.15%
		1764.49*	15.36	1.109E+002	25.12%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	8.947E+001	49.97%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.585	53.23	1.11		
		74.82*	6.21	5.978E+002	25.04%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	6.058E+001	24.44%
		351.92*	37.20	4.583E+001	25.62%
AC-228	0.308	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	4.002E+001	109.73%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	2.591E+001	31.07%
		964.60	5.20		
		969.11*	16.60	2.713E+001	44.34%
		1588.00	3.50		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30

Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.957	7.1008E+000	46.45%
K-40	0.980	6.9145E+002	9.76%
CO-60	0.964	2.7769E+000	41.37%
CS-137	0.991	3.5870E+000	61.01%
TL-208	0.734	9.8410E+000	31.43%
BI-212	0.552	1.5236E+001	94.11%
PB-212	0.535	3.6188E+001	36.28%
BI-214	0.555	1.0424E+002	16.53%
PB-214	0.585	5.3442E+001	16.70%
AC-228	0.308	2.6599E+001	24.87%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:23:58 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	73.07	1.5738E-001	27.86

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	3.34E+000	2.61E+000
		1332.49*	100.00	2.61E+000	
+	CS-137	661.65*	85.12	3.96E+000	3.96E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**********************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S        *****
**********************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:25:36 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavations
Sample Identification            : FR0111-05-1-S045
Sample Type                      : EXC
Desc. 1 : FR0111-05-1-S045-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/18/04   7:45:20 AM
Acquisition Started              : 8/18/04   8:02:03 AM

Live Time                        :     1425.0 seconds
Real Time                        :     1426.0 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : Soil 3m 90d
          Efficiency Calibration Used Done On   : 2/18/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:35 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	235-	251	246.34	75.28	3.49E+002	39.27%	1.45E+003
2	775-	790	782.01	238.80	2.85E+002	27.83%	4.48E+002
3	961-	990	967.15	295.32	1.02E+002	96.30%	5.01E+002
4	1103-	1120	1108.55	338.48	1.12E+002	50.31%	2.16E+002
5	1143-	1162	1152.55	351.92	1.90E+002	35.71%	2.85E+002
6	1661-	1683	1673.02	510.80	1.98E+002	29.32%	1.76E+002
7	1901-	1921	1909.53	583.00	2.20E+002	23.95%	1.37E+002
8	1989-	2005	1995.50	609.24	1.69E+002	27.83%	1.29E+002
9	2161-	2174	2166.62	661.48	5.23E+001	57.30%	6.57E+001
10	2371-	2388	2379.64	726.51	3.90E+001	96.46%	9.80E+001
11	2597-	2609	2603.49	794.84	2.32E+001	116.35%	6.08E+001
12	2976-	2993	2984.01	911.00	1.24E+002	31.42%	8.31E+001
13	3167-	3180	3172.80	968.64	4.74E+001	63.14%	6.66E+001
14	3661-	3676	3669.09	1120.14	6.10E+001	48.70%	5.60E+001
15	3836-	3849	3842.30	1173.01	2.90E+001	81.74%	4.10E+001
16	4076-	4089	4082.93	1246.47	2.54E+001	70.18%	2.06E+001
17	4355-	4373	4364.40	1332.39	5.95E+001	41.12%	2.85E+001
18	4506-	4519	4512.68	1377.66	1.83E+001	96.46%	2.27E+001
19	4773-	4797	4784.99	1460.79	1.11E+003	6.24%	3.37E+001
20	5772-	5791	5781.16	1764.89	7.40E+001	25.36%	5.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.997	511.00*	100.00	5.181E-001	31.84%
K-40	1.000	1460.81*	10.67	2.984E+001	10.22%
CO-60	0.998	1173.22*	100.00	8.042E-002	82.12%
		1332.49*	100.00	1.709E-001	41.86%
CS-137	0.998	661.65*	85.12	1.471E-001	58.50%
TL-208	0.744	277.35	6.80		
		510.84*	21.60	2.398E+000	32.87%
		583.14*	84.20	6.514E-001	27.02%
		763.13	1.64		
		860.37	12.46		
BI-212	0.537	727.17*	11.80	8.104E-001	97.21%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.484	74.81*	10.70	1.620E+001	44.42%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.151E+000	31.73%
		300.09	3.41		
BI-214	0.390	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	2.442E+000	31.98%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	2.974E+000	50.44%
		1133.66	0.28		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.390	1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		
		1280.96	1.44		
		1303.76	0.11		
		1377.67*	3.92	3.525E+000	97.38%
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	3.644E+000	28.48%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.606	53.23	1.11		
		74.82*	6.21	2.791E+001	44.07%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	1.661E+000	97.49%
		351.92*	37.20	1.508E+000	38.59%
AC-228	0.412	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	2.935E+000	65.41%
		409.51	2.13		
		463.00	4.40		
		794.70*	4.60	1.263E+000	118.73%
		835.50	1.75		
		911.07*	27.70	1.162E+000	33.54%
		964.60	5.20		
		969.11*	16.60	7.547E-001	67.22%
		1588.00	3.50		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.997	3.7734E-001	44.85%
K-40	1.000	2.9841E+001	10.22%
CO-60	0.998	1.2205E-001	39.76%
CS-137	0.998	1.4710E-001	58.50%
TL-208	0.744	6.5145E-001	26.83%
BI-212	0.537	8.1042E-001	97.21%
PB-212	0.484	2.2708E+000	29.63%
BI-214	0.390	2.9128E+000	21.07%
PB-214	0.606	1.5695E+000	34.49%
AC-228	0.412	1.0677E+000	28.01%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:25:35 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
16	1246.47	1.7834E-002	70.18

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.23E-001	1.16E-001
		1332.49*	100.00	1.16E-001	
+	CS-137	661.65*	85.12	1.52E-001	1.52E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

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**********************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S        *****
**********************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:24:03 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavations
Sample Identification            : FR0111-05-1-S045
Sample Type                      : EXC
Desc. 1 : FR0111-05-1-S045-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/18/04   7:45:20 AM
Acquisition Started              : 8/18/04   8:02:03 AM

Live Time                        :     1425.0 seconds
Real Time                        :     1426.0 seconds


          Energy Calibration Used Done On      : 6/30/04
          Efficiency / Geometry ID             : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On  : 9/1/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:24:02 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	235-	251	246.34	75.28	3.49E+002	39.27%	1.45E+003
2	775-	790	782.01	238.80	2.85E+002	27.83%	4.48E+002
3	961-	990	967.15	295.32	1.02E+002	96.30%	5.01E+002
4	1103-	1120	1108.55	338.48	1.12E+002	50.31%	2.16E+002
5	1143-	1162	1152.55	351.92	1.90E+002	35.71%	2.85E+002
6	1661-	1683	1673.02	510.80	1.98E+002	29.32%	1.76E+002
7	1901-	1921	1909.53	583.00	2.20E+002	23.95%	1.37E+002
8	1989-	2005	1995.50	609.24	1.69E+002	27.83%	1.29E+002
9	2161-	2174	2166.62	661.48	5.23E+001	57.30%	6.57E+001
10	2371-	2388	2379.64	726.51	3.90E+001	96.46%	9.80E+001
11	2597-	2609	2603.49	794.84	2.32E+001	116.35%	6.08E+001
12	2976-	2993	2984.01	911.00	1.24E+002	31.42%	8.31E+001
13	3167-	3180	3172.80	968.64	4.74E+001	63.14%	6.66E+001
14	3661-	3676	3669.09	1120.14	6.10E+001	48.70%	5.60E+001
15	3836-	3849	3842.30	1173.01	2.90E+001	81.74%	4.10E+001
16	4076-	4089	4082.93	1246.47	2.54E+001	70.18%	2.06E+001
17	4355-	4373	4364.40	1332.39	5.95E+001	41.12%	2.85E+001
18	4506-	4519	4512.68	1377.66	1.83E+001	96.46%	2.27E+001
19	4773-	4797	4784.99	1460.79	1.11E+003	6.24%	3.37E+001
20	5772-	5791	5781.16	1764.89	7.40E+001	25.36%	5.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.997	511.00*	100.00	1.128E+001	31.84%
K-40	1.000	1460.81*	10.67	6.261E+002	10.22%
CO-60	0.998	1173.22*	100.00	1.746E+000	82.12%
		1332.49*	100.00	3.587E+000	41.86%
CS-137	0.998	661.65*	85.12	3.330E+000	58.50%
TL-208	0.741	277.35	6.80		
		510.84*	21.60	5.220E+001	32.87%
		583.14*	84.20	1.447E+001	27.02%
		763.13	1.64		
		860.37	12.46		
BI-212	0.530	727.17*	11.80	1.822E+001	97.21%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.465	74.81*	10.70	2.636E+002	44.42%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	4.171E+001	31.73%
		300.09	3.41		
BI-214	0.385	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	5.460E+001	31.98%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	6.480E+001	50.44%
		1133.66	0.28		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.385	1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		
		1280.96	1.44		
		1303.76	0.11		
		1377.67*	3.92	7.396E+001	97.38%
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	7.646E+001	28.48%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.585	53.23	1.11		
		74.82*	6.21	4.541E+002	44.07%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	3.327E+001	97.49%
		351.92*	37.20	3.101E+001	38.59%
AC-228	0.395	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	6.001E+001	65.41%
		409.51	2.13		
		463.00	4.40		
		794.70*	4.60	2.822E+001	118.73%
		835.50	1.75		
		911.07*	27.70	2.571E+001	33.54%
		964.60	5.20		
		969.11*	16.60	1.662E+001	67.22%
		1588.00	3.50		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30

Interference Corrected Activity Report 9/13/04 2:24:04 PM Page 5

Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.997	8.1510E+000	45.23%
K-40	1.000	6.2614E+002	10.22%
CO-60	0.998	2.6244E+000	39.52%
CS-137	0.998	3.3299E+000	58.50%
TL-208	0.741	1.4467E+001	26.83%
BI-212	0.530	1.8222E+001	97.21%
PB-212	0.465	4.4331E+001	29.37%
BI-214	0.385	6.3793E+001	20.99%
PB-214	0.585	3.2367E+001	34.28%
AC-228	0.395	2.3608E+001	27.93%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:24:02 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
16	1246.47	1.7834E-002	70.18

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	2.67E+000	2.44E+000
		1332.49*	100.00	2.44E+000	
+	CS-137	661.65*	85.12	3.45E+000	3.45E+000

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
\> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:25:40 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavations
Sample Identification           : FR0111-05-1-S017
Sample Type                     : EXC
Desc. 1 : FR0111-05-1-S017-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,    report UNIT = none.

Sample Taken On                 : 8/18/04  11:47:28 AM
Acquisition Started             : 8/18/04  11:47:28 AM

Live Time                       :     1000.0 seconds
Real Time                       :     1000.9 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : Soil 3m 90d
          Efficiency Calibration Used Done On   : 2/18/04
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:39 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	235-	257	246.42	75.30	6.33E+002	23.18%	1.27E+003
2	274-	284	278.07	84.96	8.52E+001	98.36%	7.24E+002
3	774-	788	781.82	238.74	1.19E+002	56.62%	3.70E+002
4	959-	975	967.37	295.39	7.67E+001	78.15%	2.74E+002
5	1102-	1113	1107.21	338.08	5.48E+001	75.70%	1.56E+002
6	1145-	1163	1152.53	351.91	1.32E+002	46.89%	2.52E+002
7	1665-	1681	1672.58	510.66	1.11E+002	40.81%	1.36E+002
8	1900-	1919	1909.42	582.96	1.58E+002	27.41%	9.42E+001
9	1987-	2003	1994.76	609.01	2.02E+002	20.43%	7.77E+001
10	2160-	2173	2166.59	661.47	6.08E+001	50.81%	6.82E+001
11	2373-	2387	2380.44	726.75	5.05E+001	48.88%	3.75E+001
12	2974-	2992	2982.99	910.69	1.20E+002	29.31%	5.81E+001
13	3165-	3182	3172.73	968.61	6.54E+001	50.70%	6.76E+001
14	3661-	3675	3668.20	1119.86	6.25E+001	39.55%	3.35E+001
15	3835-	3848	3841.42	1172.74	2.40E+001	105.32%	5.10E+001
16	4048-	4061	4054.52	1237.80	2.79E+001	82.73%	4.01E+001
17	4355-	4371	4363.43	1332.10	5.17E+001	42.29%	2.33E+001
18	4771-	4797	4783.70	1460.39	8.23E+002	7.01%	9.93E+000
19	5772-	5787	5779.25	1764.30	4.77E+001	32.72%	5.32E+000
20	7213-	7226	7219.49	2203.96	1.83E+001	64.72%	5.72E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.992	511.00*	100.00	4.137E-001	42.66%
K-40	0.988	1460.81*	10.67	3.158E+001	10.71%
CO-60	0.987	1173.22*	100.00	9.464E-002	105.61%
		1332.49*	100.00	2.117E-001	43.01%
CS-137	0.998	661.65*	85.12	2.437E-001	52.15%
TL-208	0.743	277.35	6.80		
		510.84*	21.60	1.915E+000	43.44%
		583.14*	84.20	6.673E-001	30.13%
		763.13	1.64		
		860.37	12.46		
BI-212	0.550	727.17*	11.80	1.496E+000	50.35%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.484	74.81*	10.70	4.188E+001	31.12%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.283E+000	58.64%
		300.09	3.41		
BI-214	0.471	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	2.089E+000	25.47%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	2.174E+000	41.47%
		1133.66	0.28		

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Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.471	1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	2.516E+000	83.64%
		1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	1.675E+000	34.96%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	2.030E+000	65.93%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.606	53.23	1.11		
		74.82*	6.21	7.216E+001	30.62%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	1.786E+000	79.63%
		351.92*	37.20	1.493E+000	49.13%
AC-228	0.329	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	2.053E+000	86.47%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	1.603E+000	31.58%
		964.60	5.20		
		969.11*	16.60	1.482E+000	55.70%
		1588.00	3.50		
TH-228	0.813	84.38*	1.22	4.743E+001	100.07%

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
TH-228	0.813	131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.992	2.6958E-001	67.40%
K-40	0.988	3.1578E+001	10.71%
CO-60	0.987	1.5859E-001	42.44%
CS-137	0.998	2.4373E-001	52.15%
TL-208	0.743	6.6729E-001	29.96%
BI-212	0.550	1.4958E+000	50.35%
PB-212	0.484	1.4266E+000	52.50%
BI-214	0.471	1.9683E+000	19.02%
PB-214	0.606	1.6161E+000	40.07%
AC-228	0.329	1.5969E+000	26.26%
TH-228	0.813	4.7432E+001	100.07%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:25:39 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.91E-001	1.46E-001
		1332.49*	100.00	1.46E-001	
+	CS-137	661.65*	85.12	2.21E-001	2.21E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

****
***** GAMMA SPECTRUM ANALYSIS *****
****

ISOCS Report Generator : ISOCSAN.TPL 2/26/96
Report Generated On : 9/13/04 2:24:08 PM

Spectrum File Name : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title : Excavations
Sample Identification : FR0111-05-1-S017
Sample Type : EXC
Desc. 1 : FR0111-05-1-S017-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8190
Peak Area Range (in channels) : 50 - 8190
Identification Energy Tolerance : 1.500 keV

Sample Size : 1.000E+000 gm

Note: For Point Source, report UNIT = none.

Sample Taken On : 8/18/04 11:47:28 AM
Acquisition Started : 8/18/04 11:47:28 AM

Live Time : 1000.0 seconds
Real Time : 1000.9 seconds

Energy Calibration Used Done On : 6/30/04
Efficiency / Geometry ID : 1M2_AREA_AT_EDGE
Efficiency Calibration Used Done On : 9/1/04

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:24:07 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
1	235-	257	246.42	75.30	6.33E+002	23.18%	1.27E+003
2	274-	284	278.07	84.96	8.52E+001	98.36%	7.24E+002
3	774-	788	781.82	238.74	1.19E+002	56.62%	3.70E+002
4	959-	975	967.37	295.39	7.67E+001	78.15%	2.74E+002
5	1102-	1113	1107.21	338.08	5.48E+001	75.70%	1.56E+002
6	1145-	1163	1152.53	351.91	1.32E+002	46.89%	2.52E+002
7	1665-	1681	1672.58	510.66	1.11E+002	40.81%	1.36E+002
8	1900-	1919	1909.42	582.96	1.58E+002	27.41%	9.42E+001
9	1987-	2003	1994.76	609.01	2.02E+002	20.43%	7.77E+001
10	2160-	2173	2166.59	661.47	6.08E+001	50.81%	6.82E+001
11	2373-	2387	2380.44	726.75	5.05E+001	48.88%	3.75E+001
12	2974-	2992	2982.99	910.69	1.20E+002	29.31%	5.81E+001
13	3165-	3182	3172.73	968.61	6.54E+001	50.70%	6.76E+001
14	3661-	3675	3668.20	1119.86	6.25E+001	39.55%	3.35E+001
15	3835-	3848	3841.42	1172.74	2.40E+001	105.32%	5.10E+001
16	4048-	4061	4054.52	1237.80	2.79E+001	82.73%	4.01E+001
17	4355-	4371	4363.43	1332.10	5.17E+001	42.29%	2.33E+001
18	4771-	4797	4783.70	1460.39	8.23E+002	7.01%	9.93E+000
19	5772-	5787	5779.25	1764.30	4.77E+001	32.72%	5.32E+000
20	7213-	7226	7219.49	2203.96	1.83E+001	64.72%	5.72E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.992	511.00*	100.00	9.004E+000	42.66%
K-40	0.988	1460.81*	10.67	6.626E+002	10.71%
CO-60	0.987	1173.22*	100.00	2.055E+000	105.61%
		1332.49*	100.00	4.441E+000	43.01%
CS-137	0.998	661.65*	85.12	5.517E+000	52.15%
TL-208	0.740	277.35	6.80		
		510.84*	21.60	4.169E+001	43.44%
		583.14*	84.20	1.482E+001	30.13%
		763.13	1.64		
		860.37	12.46		
BI-212	0.543	727.17*	11.80	3.363E+001	50.35%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.465	74.81*	10.70	6.815E+002	31.12%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.488E+001	58.64%
		300.09	3.41		
BI-214	0.466	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	4.670E+001	25.47%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	4.738E+001	41.47%
		1133.66	0.28		

Interference Corrected Activity Report 9/13/04 2:24:08 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.466	1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	5.385E+001	83.64%
		1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	3.516E+001	34.96%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	4.260E+001	65.93%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.585	53.23	1.11		
		74.82*	6.21	1.174E+003	30.62%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	3.577E+001	79.63%
		351.92*	37.20	3.071E+001	49.13%
AC-228	0.314	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	4.197E+001	86.47%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	3.546E+001	31.58%
		964.60	5.20		
		969.11*	16.60	3.264E+001	55.70%
		1588.00	3.50		
TH-228	0.818	84.38*	1.22	7.862E+002	100.07%

Interference Corrected Activity Report 9/13/04 2:24:08 PM Page 5

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
TH-228	0.818	131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

```
**************************************************************************
*****  I N T E R F E R E N C E  C O R R E C T E D  R E P O R T  *****
**************************************************************************
```

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.992	5.8036E+000	68.22%
K-40	0.988	6.6260E+002	10.71%
CO-60	0.987	3.3999E+000	42.18%
CS-137	0.998	5.5174E+000	52.15%
TL-208	0.740	1.4818E+001	29.96%
BI-212	0.543	3.3632E+001	50.35%
PB-212	0.465	2.8148E+001	51.55%
BI-214	0.466	4.2548E+001	19.06%
PB-214	0.585	3.3381E+001	39.66%
AC-228	0.314	3.5153E+001	26.23%
TH-228	0.818	7.8616E+002	100.07%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:24:06 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	4.15E+000	3.06E+000
		1332.49*	100.00	3.06E+000	
+	CS-137	661.65*	85.12	5.00E+000	5.00E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

****
***** GAMMA SPECTRUM ANALYSIS *****
****

ISOCS Report Generator : ISOCSAN.TPL 2/26/96
Report Generated On : 9/13/04 2:25:45 PM

Spectrum File Name : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title : Excavations
Sample Identification : FR0111-05-1-S018
Sample Type : EXC
Desc. 1 : FR0111-05-1-S018-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8190
Peak Area Range (in channels) : 50 - 8190
Identification Energy Tolerance : 1.500 keV

Sample Size : 1.000E+000 gm

Note: For Point Source, report UNIT = none.

Sample Taken On : 8/18/04 2:05:11 PM
Acquisition Started : 8/18/04 2:21:53 PM

Live Time : 1614.0 seconds
Real Time : 1615.4 seconds

Energy Calibration Used Done On : 6/30/04
Efficiency / Geometry ID : Soil 3m 90d
Efficiency Calibration Used Done On : 2/18/04

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:44 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	232-	257	238.38	72.85	2.55E+002	27.35%	1.34E+003
m	2	232-	257	246.18	75.23	5.13E+002	15.10%	1.63E+003
	3	273-	284	277.08	84.66	1.15E+002	95.26%	1.19E+003
	4	773-	787	781.31	238.59	2.76E+002	31.75%	5.96E+002
	5	957-	974	967.12	295.31	1.60E+002	44.30%	3.51E+002
	6	1145-	1160	1152.35	351.86	2.27E+002	28.08%	2.75E+002
	7	1660-	1682	1671.99	510.48	2.13E+002	32.29%	2.63E+002
	8	1902-	1918	1908.93	582.82	2.06E+002	24.26%	1.42E+002
	9	1984-	2004	1994.18	608.84	3.22E+002	18.87%	1.76E+002
	10	2158-	2172	2165.91	661.26	5.53E+001	75.14%	1.37E+002
	11	2974-	2991	2982.61	910.58	1.41E+002	29.53%	9.45E+001
	12	3164-	3179	3171.97	968.38	7.80E+001	48.14%	9.60E+001
	13	3658-	3677	3667.03	1119.51	1.18E+002	32.30%	7.32E+001
	14	3831-	3847	3840.53	1172.47	4.76E+001	72.65%	8.44E+001
	15	4046-	4059	4052.87	1237.29	3.27E+001	85.79%	6.23E+001
	16	4354-	4369	4361.40	1331.48	6.06E+001	44.59%	4.24E+001
	17	4502-	4517	4510.05	1376.85	4.10E+001	48.04%	2.00E+001
	18	4770-	4793	4782.75	1460.10	1.35E+003	5.62%	3.63E+001
	19	5658-	5671	5664.24	1729.19	2.90E+001	44.17%	5.01E+000
	20	5767-	5788	5777.69	1763.83	1.10E+002	21.27%	8.38E+000
	21	7214-	7227	7220.37	2204.23	3.14E+001	43.16%	5.59E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.981	511.00*	100.00	4.922E-001	34.60%
K-40	0.965	1460.81*	10.67	3.204E+001	9.86%
CO-60	0.946	1173.22*	100.00	1.166E-001	73.07%
		1332.49*	100.00	1.536E-001	45.27%
CS-137	0.989	661.65*	85.12	1.373E-001	76.06%
TL-208	0.739	277.35	6.80		
		510.84*	21.60	2.279E+000	35.55%
		583.14*	84.20	5.397E-001	27.30%
		763.13	1.64		
		860.37	12.46		
PB-212	0.486	74.81*	10.70	2.101E+001	25.69%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.840E+000	35.22%
		300.09	3.41		
BI-214	0.537	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	4.310E+000	24.69%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	5.313E+000	34.95%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	3.824E+000	86.80%

Interference Corrected Activity Report 9/13/04 2:25:45 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.537	1280.96	1.44		
		1303.76	0.11		
		1377.67*	3.92	7.317E+000	49.91%
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59*	2.88	7.041E+000	46.20%
		1764.49*	15.36	4.993E+000	25.02%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	4.522E+000	45.20%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.607	53.23	1.11		
		74.82*	6.21	3.620E+001	25.07%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	2.305E+000	46.85%
		351.92*	37.20	1.594E+000	31.67%
TH-228	0.829	84.38*	1.22	3.983E+001	97.03%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.981	3.7562E-001	46.11%
K-40	0.965	3.2036E+001	9.86%
CO-60	0.946	1.3883E-001	38.81%
CS-137	0.989	1.3726E-001	76.06%
TL-208	0.739	5.3973E-001	27.11%
PB-212	0.486	2.1303E+000	29.94%
BI-214	0.537	4.8177E+000	16.32%
PB-214	0.607	1.8022E+000	24.95%
TH-228	0.829	3.9831E+001	97.03%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:25:43 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	72.85	1.5806E-001	27.35
	11	910.58	8.7051E-002	29.53
	12	968.38	4.8327E-002	48.14

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.58E-001	1.17E-001
		1332.49*	100.00	1.17E-001	
+	CS-137	661.65*	85.12	1.94E-001	1.94E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator            ISOCSAN.TPL  2/26/96
Report Generated On               : 9/13/04    2:24:12 PM

Spectrum File Name                : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                      : Excavations
Sample Identification             : FR0111-05-1-S018
Sample Type                       : EXC
Desc. 1 : FR0111-05-1-S018-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold             :  3.00
Peak Locate Range (in channels)   :    50 -  8190
Peak Area Range (in channels)     :    50 -  8190
Identification Energy Tolerance   :    1.500 keV

Sample Size                       :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                   : 8/18/04    2:05:11 PM
Acquisition Started               : 8/18/04    2:21:53 PM

Live Time                         :     1614.0 seconds
Real Time                         :     1615.4 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 9/1/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:24:11 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	232-	257	238.38	72.85	2.55E+002	27.35%	1.34E+003
m	2	232-	257	246.18	75.23	5.13E+002	15.10%	1.63E+003
	3	273-	284	277.08	84.66	1.15E+002	95.26%	1.19E+003
	4	773-	787	781.31	238.59	2.76E+002	31.75%	5.96E+002
	5	957-	974	967.12	295.31	1.60E+002	44.30%	3.51E+002
	6	1145-	1160	1152.35	351.86	2.27E+002	28.08%	2.75E+002
	7	1660-	1682	1671.99	510.48	2.13E+002	32.29%	2.63E+002
	8	1902-	1918	1908.93	582.82	2.06E+002	24.26%	1.42E+002
	9	1984-	2004	1994.18	608.84	3.22E+002	18.87%	1.76E+002
	10	2158-	2172	2165.91	661.26	5.53E+001	75.14%	1.37E+002
	11	2974-	2991	2982.61	910.58	1.41E+002	29.53%	9.45E+001
	12	3164-	3179	3171.97	968.38	7.80E+001	48.14%	9.60E+001
	13	3658-	3677	3667.03	1119.51	1.18E+002	32.30%	7.32E+001
	14	3831-	3847	3840.53	1172.47	4.76E+001	72.65%	8.44E+001
	15	4046-	4059	4052.87	1237.29	3.27E+001	85.79%	6.23E+001
	16	4354-	4369	4361.40	1331.48	6.06E+001	44.59%	4.24E+001
	17	4502-	4517	4510.05	1376.85	4.10E+001	48.04%	2.00E+001
	18	4770-	4793	4782.75	1460.10	1.35E+003	5.62%	3.63E+001
	19	5658-	5671	5664.24	1729.19	2.90E+001	44.17%	5.01E+000
	20	5767-	5788	5777.69	1763.83	1.10E+002	21.27%	8.38E+000
	21	7214-	7227	7220.37	2204.23	3.14E+001	43.16%	5.59E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.981	511.00*	100.00	1.071E+001	34.60%
K-40	0.965	1460.81*	10.67	6.722E+002	9.86%
CO-60	0.946	1173.22*	100.00	2.532E+000	73.07%
		1332.49*	100.00	3.224E+000	45.27%
CS-137	0.989	661.65*	85.12	3.107E+000	76.06%
TL-208	0.735	277.35	6.80		
		510.84*	21.60	4.959E+001	35.55%
		583.14*	84.20	1.199E+001	27.30%
		763.13	1.64		
		860.37	12.46		
PB-212	0.466	74.81*	10.70	3.418E+002	25.69%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	3.568E+001	35.22%
		300.09	3.41		
BI-214	0.534	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	9.634E+001	24.69%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	1.158E+002	34.95%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	8.186E+001	86.80%

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.534	1280.96	1.44		
		1303.76	0.11		
		1377.67*	3.92	1.535E+002	49.91%
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59*	2.88	1.477E+002	46.20%
		1764.49*	15.36	1.048E+002	25.02%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	9.488E+001	45.20%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.585	53.23	1.11		
		74.82*	6.21	5.890E+002	25.07%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	4.616E+001	46.85%
		351.92*	37.20	3.278E+001	31.67%
TH-228	0.834	84.38*	1.22	6.598E+002	97.03%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.981	8.1233E+000	46.44%
K-40	0.965	6.7220E+002	9.86%
CO-60	0.946	2.9589E+000	38.73%
CS-137	0.989	3.1070E+000	76.06%
TL-208	0.735	1.1985E+001	27.11%
PB-212	0.466	4.2104E+001	29.28%
BI-214	0.534	1.0432E+002	16.30%
PB-214	0.585	3.7292E+001	24.66%
TH-228	0.834	6.5981E+002	97.03%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:24:10 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	72.85	1.5806E-001	27.35
	11	910.58	8.7051E-002	29.53
	12	968.38	4.8327E-002	48.14

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	3.44E+000	2.47E+000
		1332.49*	100.00	2.47E+000	
+	CS-137	661.65*	85.12	4.39E+000	4.39E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On            : 9/13/04   2:25:49 PM

Spectrum File Name             : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                   : Excavations
Sample Identification          : FR0111-05-1-S027
Sample Type                    : EXC
Desc. 1 : FR0111-05-1-S027-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold          :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)  :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                    :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                : 8/18/04   2:38:32 PM
Acquisition Started            : 8/18/04   2:55:14 PM

Live Time                      :     1488.0 seconds
Real Time                      :     1489.2 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : Soil 3m 90d
          Efficiency Calibration Used Done On   : 2/18/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:48 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	241-	257	246.00	75.17	3.37E+002	44.01%	1.71E+003
	2	773-	787	781.48	238.64	2.86E+002	28.36%	4.92E+002
	3	957-	975	966.06	294.99	1.58E+002	48.17%	4.02E+002
	4	1100-	1116	1108.07	338.34	5.38E+001	115.88%	3.03E+002
	5	1145-	1164	1151.95	351.73	2.57E+002	26.14%	2.62E+002
	6	1664-	1682	1672.38	510.60	1.74E+002	31.96%	1.85E+002
	7	1901-	1921	1909.00	582.84	1.67E+002	34.22%	1.88E+002
	8	1984-	2001	1994.41	608.91	2.28E+002	22.99%	1.49E+002
	9	2157-	2173	2166.21	661.35	1.12E+002	34.95%	9.12E+001
	10	2375-	2388	2380.75	726.85	4.45E+001	74.78%	8.75E+001
	11	2808-	2822	2815.78	859.65	4.33E+001	63.36%	5.27E+001
	12	2974-	2992	2982.36	910.50	1.47E+002	27.33%	8.02E+001
M	13	3148-	3180	3156.01	963.51	3.56E+001	55.61%	9.00E+001
m	14	3148-	3180	3172.01	968.39	1.01E+002	25.00%	9.90E+001
	15	3659-	3676	3667.28	1119.58	7.35E+001	43.92%	6.05E+001
	16	3834-	3847	3840.08	1172.33	2.56E+001	108.90%	6.44E+001
	17	4356-	4369	4362.15	1331.70	6.01E+001	38.52%	2.89E+001
	18	4770-	4794	4782.62	1460.06	1.18E+003	5.97%	2.81E+001
	19	5768-	5785	5776.50	1763.46	6.17E+001	31.55%	1.13E+001
	20	6045-	6058	6051.70	1847.47	1.28E+001	92.85%	8.25E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.989	511.00*	100.00	4.346E-001	34.29%
K-40	0.961	1460.81*	10.67	3.053E+001	10.06%
CO-60	0.952	1173.22*	100.00	6.809E-002	109.18%
		1332.49*	100.00	1.654E-001	39.31%
CS-137	0.994	661.65*	85.12	3.011E-001	36.88%
TL-208	0.894	277.35	6.80		
		510.84*	21.60	2.012E+000	35.25%
		583.14*	84.20	4.755E-001	36.44%
		763.13	1.64		
		860.37*	12.46	8.518E-001	64.20%
BI-212	0.554	727.17*	11.80	8.863E-001	75.74%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.486	74.81*	10.70	1.498E+001	48.67%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.071E+000	32.20%
		300.09	3.41		
BI-214	0.357	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	3.201E+000	27.90%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08*	0.38	6.326E+001	60.84%
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	3.483E+000	45.86%
		1133.66	0.28		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.357	1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		
		1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	2.954E+000	34.13%
		1838.36	0.40		
		1847.42*	2.04	4.597E+000	93.80%
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.605	53.23	1.11		
		74.82*	6.21	2.582E+001	48.35%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	2.481E+000	50.53%
		351.92*	37.20	1.961E+000	29.96%
AC-228	0.407	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	1.355E+000	123.19%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	1.318E+000	29.75%
		964.60*	5.20	1.729E+000	60.70%
		969.11*	16.60	1.540E+000	34.02%
		1588.00	3.50		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30

Interference Corrected Activity Report 9/13/04 2:25:49 PM Page 5

Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.989	3.2451E-001	47.22%
K-40	0.961	3.0525E+001	10.06%
CO-60	0.952	1.2323E-001	39.72%
CS-137	0.994	3.0114E-001	36.88%
TL-208	0.894	5.0971E-001	32.28%
BI-212	0.554	8.8628E-001	75.74%
PB-212	0.486	2.1693E+000	30.32%
BI-214	0.357	3.1779E+000	20.77%
PB-214	0.605	2.0887E+000	25.02%
AC-228	0.407	1.4356E+000	18.41%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:25:47 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.42E-001	1.02E-001
		1332.49*	100.00	1.02E-001	
+	CS-137	661.65*	85.12	1.81E-001	1.81E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

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*****************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S           *****
*****************************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:24:16 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavations
Sample Identification           : FR0111-05-1-S027
Sample Type                     : EXC
Desc. 1 : FR0111-05-1-S027-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/18/04   2:38:32 PM
Acquisition Started             : 8/18/04   2:55:14 PM

Live Time                       :     1488.0 seconds
Real Time                       :     1489.2 seconds


            Energy Calibration Used Done On       : 6/30/04
            Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
            Efficiency Calibration Used Done On   : 9/1/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:24:14 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	241-	257	246.00	75.17	3.37E+002	44.01%	1.71E+003
	2	773-	787	781.48	238.64	2.86E+002	28.36%	4.92E+002
	3	957-	975	966.06	294.99	1.58E+002	48.17%	4.02E+002
	4	1100-	1116	1108.07	338.34	5.38E+001	115.88%	3.03E+002
	5	1145-	1164	1151.95	351.73	2.57E+002	26.14%	2.62E+002
	6	1664-	1682	1672.38	510.60	1.74E+002	31.96%	1.85E+002
	7	1901-	1921	1909.00	582.84	1.67E+002	34.22%	1.88E+002
	8	1984-	2001	1994.41	608.91	2.28E+002	22.99%	1.49E+002
	9	2157-	2173	2166.21	661.35	1.12E+002	34.95%	9.12E+001
	10	2375-	2388	2380.75	726.85	4.45E+001	74.78%	8.75E+001
	11	2808-	2822	2815.78	859.65	4.33E+001	63.36%	5.27E+001
	12	2974-	2992	2982.36	910.50	1.47E+002	27.33%	8.02E+001
M	13	3148-	3180	3156.01	963.51	3.56E+001	55.61%	9.00E+001
m	14	3148-	3180	3172.01	968.39	1.01E+002	25.00%	9.90E+001
	15	3659-	3676	3667.28	1119.58	7.35E+001	43.92%	6.05E+001
	16	3834-	3847	3840.08	1172.33	2.56E+001	108.90%	6.44E+001
	17	4356-	4369	4362.15	1331.70	6.01E+001	38.52%	2.89E+001
	18	4770-	4794	4782.62	1460.06	1.18E+003	5.97%	2.81E+001
	19	5768-	5785	5776.50	1763.46	6.17E+001	31.55%	1.13E+001
	20	6045-	6058	6051.70	1847.47	1.28E+001	92.85%	8.25E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.989	511.00*	100.00	9.459E+000	34.29%
K-40	0.961	1460.81*	10.67	6.405E+002	10.06%
CO-60	0.952	1173.22*	100.00	1.479E+000	109.18%
		1332.49*	100.00	3.471E+000	39.31%
CS-137	0.994	661.65*	85.12	6.817E+000	36.88%
TL-208	0.890	277.35	6.80		
		510.84*	21.60	4.379E+001	35.25%
		583.14*	84.20	1.056E+001	36.44%
		763.13	1.64		
		860.37*	12.46	1.892E+001	64.20%
BI-212	0.547	727.17*	11.80	1.993E+001	75.74%
		785.46	1.97		
		1620.62	2.75		
PB-212	0.467	74.81*	10.70	2.438E+002	48.67%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	4.015E+001	32.20%
		300.09	3.41		
BI-214	0.351	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	7.155E+001	27.90%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08*	0.38	1.394E+003	60.84%
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	7.590E+001	45.86%
		1133.66	0.28		

Interference Corrected Activity Report 9/13/04 2:24:16 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.351	1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		
		1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	6.199E+001	34.13%
		1838.36	0.40		
		1847.42*	2.04	9.645E+001	93.80%
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.584	53.23	1.11		
		74.82*	6.21	4.200E+002	48.35%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	4.967E+001	50.53%
		351.92*	37.20	4.033E+001	29.96%
AC-228	0.390	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	2.770E+001	123.19%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	2.916E+001	29.75%
		964.60*	5.20	3.810E+001	60.70%
		969.11*	16.60	3.390E+001	34.02%
		1588.00	3.50		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30

Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.989	7.0140E+000	47.60%
K-40	0.961	6.4050E+002	10.06%
CO-60	0.952	2.6410E+000	39.46%
CS-137	0.994	6.8168E+000	36.88%
TL-208	0.890	1.1319E+001	32.29%
BI-212	0.547	1.9928E+001	75.74%
PB-212	0.467	4.2281E+001	30.11%
BI-214	0.351	6.8972E+001	20.78%
PB-214	0.584	4.2920E+001	24.90%
AC-228	0.390	3.1613E+001	18.41%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:24:14 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	3.09E+000	2.14E+000
		1332.49*	100.00	2.14E+000	
+	CS-137	661.65*	85.12	4.09E+000	4.09E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

****
***** G A M M A S P E C T R U M A N A L Y S I S *****
****

ISOCS Report Generator : ISOCSAN.TPL 2/26/96
Report Generated On : 9/13/04 2:25:07 PM

Spectrum File Name : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title : Excavations
Sample Identification : FR0111-05-1-S016
Sample Type : EXC
Desc. 1 : FR0111-05-1-S016-GS-SCAN , recount,concrete/ledge@3m
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8190
Peak Area Range (in channels) : 50 - 8190
Identification Energy Tolerance : 1.500 keV

Sample Size : 1.000E+000 gm

Note: For Point Source, report UNIT = none.

Sample Taken On : 8/19/04 11:30:15 AM
Acquisition Started : 8/19/04 11:30:15 AM

Live Time : 1000.0 seconds
Real Time : 1000.8 seconds

Energy Calibration Used Done On : 6/30/04
Efficiency / Geometry ID : Soil 3m 90d
Efficiency Calibration Used Done On : 2/18/04

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:25:06 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	241-	252	246.25	75.25	1.23E+002	76.42%	8.64E+002
	2	272-	282	277.85	84.90	8.83E+001	94.38%	7.23E+002
M	3	777-	800	781.88	238.76	2.34E+002	17.83%	2.56E+002
m	4	777-	800	791.91	241.82	9.09E+001	35.78%	2.93E+002
	5	961-	972	966.89	295.24	7.26E+001	62.46%	1.84E+002
	6	1095-	1120	1107.84	338.27	1.55E+002	37.77%	1.74E+002
	7	1146-	1159	1152.71	351.97	1.46E+002	31.75%	1.50E+002
	8	1665-	1682	1672.59	510.67	8.59E+001	49.73%	1.19E+002
	9	1901-	1919	1909.24	582.91	1.35E+002	32.78%	1.12E+002
	10	1987-	2003	1995.00	609.09	1.90E+002	22.03%	8.50E+001
	11	2158-	2173	2166.44	661.42	8.51E+001	46.22%	1.06E+002
	12	2814-	2825	2819.06	860.65	1.95E+001	105.17%	3.55E+001
M	13	2957-	2990	2962.64	904.48	2.40E+001	54.36%	2.26E+001
m	14	2957-	2990	2983.11	910.73	1.01E+002	21.57%	3.21E+001
	15	3165-	3182	3173.29	968.78	4.82E+001	60.34%	5.28E+001
	16	3661-	3676	3668.20	1119.86	6.85E+001	40.86%	4.45E+001
	17	3835-	3848	3841.66	1172.82	2.63E+001	95.38%	4.97E+001
	18	4357-	4370	4363.45	1332.10	2.93E+001	55.05%	1.37E+001
	19	4773-	4796	4784.31	1460.58	7.20E+002	7.82%	2.64E+001
	20	5771-	5786	5779.17	1764.28	5.79E+001	31.85%	1.01E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.992	511.00*	100.00	3.195E-001	51.26%
K-40	0.996	1460.81*	10.67	2.761E+001	11.25%
CO-60	0.989	1173.22*	100.00	1.039E-001	95.70%
		1332.49*	100.00	1.200E-001	55.60%
CS-137	0.996	661.65*	85.12	3.412E-001	47.70%
TL-208	0.899	277.35	6.80		
		510.84*	21.60	1.479E+000	51.90%
		583.14*	84.20	5.722E-001	35.09%
		763.13	1.64		
		860.37*	12.46	5.704E-001	105.67%
PB-212	0.485	74.81*	10.70	8.140E+000	79.19%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.517E+000	23.46%
		300.09	3.41		
BI-214	0.343	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	1.962E+000	26.77%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	2.383E+000	42.73%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.343	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	2.034E+000	34.15%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.747	53.23	1.11		
		74.82*	6.21	1.402E+001	78.99%
		77.11	10.50		
		87.30	4.67		
		241.98*	7.49	5.806E+000	39.02%
		295.21*	19.20	1.691E+000	64.29%
		351.92*	37.20	1.658E+000	34.97%
AC-228	0.332	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	5.814E+000	56.34%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	1.351E+000	24.56%
		964.60	5.20		
		969.11*	16.60	1.093E+000	64.60%
		1588.00	3.50		
TH-228	0.817	84.38*	1.22	4.921E+001	96.17%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.992	1.9599E-001	86.15%
K-40	0.996	2.7610E+001	11.25%
CO-60	0.989	1.1504E-001	48.18%
CS-137	0.996	3.4122E-001	47.70%
TL-208	0.899	5.7200E-001	33.17%
PB-212	0.485	2.5538E+000	22.62%
BI-214	0.343	2.0418E+000	20.25%
PB-214	0.747	1.8814E+000	26.19%
AC-228	0.332	1.3419E+000	22.29%
TH-228	0.817	4.9208E+001	96.17%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:25:06 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	13	904.48	2.3989E-002	54.36

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.88E-001	1.10E-001
		1332.49*	100.00	1.10E-001	
+	CS-137	661.65*	85.12	2.83E-001	2.83E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:23:35 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavations
Sample Identification            : FR0111-05-1-S016
Sample Type                      : EXC
Desc. 1 : FR0111-05-1-S016-GS-SCAN , recount,concrete/ledge@3m
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/19/04  11:30:15 AM
Acquisition Started              : 8/19/04  11:30:15 AM

Live Time                        :     1000.0 seconds
Real Time                        :     1000.8 seconds


          Energy Calibration Used Done On       : 6/30/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 9/1/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7607
Sample Title: Excavations
Peak Analysis Performed on: 9/13/04 2:23:34 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	241-	252	246.25	75.25	1.23E+002	76.42%	8.64E+002
	2	272-	282	277.85	84.90	8.83E+001	94.38%	7.23E+002
M	3	777-	800	781.88	238.76	2.34E+002	17.83%	2.56E+002
m	4	777-	800	791.91	241.82	9.09E+001	35.78%	2.93E+002
	5	961-	972	966.89	295.24	7.26E+001	62.46%	1.84E+002
	6	1095-	1120	1107.84	338.27	1.55E+002	37.77%	1.74E+002
	7	1146-	1159	1152.71	351.97	1.46E+002	31.75%	1.50E+002
	8	1665-	1682	1672.59	510.67	8.59E+001	49.73%	1.19E+002
	9	1901-	1919	1909.24	582.91	1.35E+002	32.78%	1.12E+002
	10	1987-	2003	1995.00	609.09	1.90E+002	22.03%	8.50E+001
	11	2158-	2173	2166.44	661.42	8.51E+001	46.22%	1.06E+002
	12	2814-	2825	2819.06	860.65	1.95E+001	105.17%	3.55E+001
M	13	2957-	2990	2962.64	904.48	2.40E+001	54.36%	2.26E+001
m	14	2957-	2990	2983.11	910.73	1.01E+002	21.57%	3.21E+001
	15	3165-	3182	3173.29	968.78	4.82E+001	60.34%	5.28E+001
	16	3661-	3676	3668.20	1119.86	6.85E+001	40.86%	4.45E+001
	17	3835-	3848	3841.66	1172.82	2.63E+001	95.38%	4.97E+001
	18	4357-	4370	4363.45	1332.10	2.93E+001	55.05%	1.37E+001
	19	4773-	4796	4784.31	1460.58	7.20E+002	7.82%	2.64E+001
	20	5771-	5786	5779.17	1764.28	5.79E+001	31.85%	1.01E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.992	511.00*	100.00	6.955E+000	51.26%
K-40	0.996	1460.81*	10.67	5.793E+002	11.25%
CO-60	0.989	1173.22*	100.00	2.257E+000	95.70%
		1332.49*	100.00	2.519E+000	55.60%
CS-137	0.996	661.65*	85.12	7.724E+000	47.70%
TL-208	0.895	277.35	6.80		
		510.84*	21.60	3.220E+001	51.90%
		583.14*	84.20	1.271E+001	35.09%
		763.13	1.64		
		860.37*	12.46	1.267E+001	105.67%
PB-212	0.466	74.81*	10.70	1.324E+002	79.19%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	4.881E+001	23.46%
		300.09	3.41		
BI-214	0.337	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	4.385E+001	26.77%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	5.193E+001	42.73%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.337	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	4.269E+001	34.15%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.725	53.23	1.11		
		74.82*	6.21	2.282E+002	78.99%
		77.11	10.50		
		87.30	4.67		
		241.98*	7.49	1.128E+002	39.02%
		295.21*	19.20	3.387E+001	64.29%
		351.92*	37.20	3.411E+001	34.97%
AC-228	0.317	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	1.189E+002	56.34%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	2.988E+001	24.56%
		964.60	5.20		
		969.11*	16.60	2.407E+001	64.60%
		1588.00	3.50		
TH-228	0.822	84.38*	1.22	8.155E+002	96.17%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.992	4.2109E+000	87.37%
K-40	0.996	5.7933E+002	11.25%
CO-60	0.989	2.4415E+000	48.13%
CS-137	0.996	7.7241E+000	47.70%
TL-208	0.895	1.2703E+001	33.17%
PB-212	0.466	4.9511E+001	22.59%
BI-214	0.337	4.4586E+001	20.25%
PB-214	0.725	3.8581E+001	26.03%
AC-228	0.317	2.9700E+001	22.24%
TH-228	0.822	8.1549E+002	96.17%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:23:34 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	13	904.48	2.3989E-002	54.36

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7607
Sample Geometry: Soil 3m 90d
Sample Title: Excavations
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	4.09E+000	2.31E+000
		1332.49*	100.00	2.31E+000	
+	CS-137	661.65*	85.12	6.41E+000	6.41E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

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**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S        *****
**************************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:26:10 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavation
Sample Identification           : FR0111-05-1-C003
Sample Type                     : Exc
Desc. 1 : FR0111-05-1-C003-GS-CONC,concrete@2m
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/18/04  10:12:46 AM
Acquisition Started             : 8/18/04  10:29:29 AM

Live Time                       :     2000.0 seconds
Real Time                       :     2001.4 seconds


          Energy Calibration Used Done On       : 4/29/04
          Efficiency / Geometry ID              : Conc 2m 90d
          Efficiency Calibration Used Done On   : 6/9/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7722
Sample Title: Excavation
Peak Analysis Performed on: 9/13/04 2:26:09 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	232-	250	238.49	72.85	2.47E+002	21.41%	1.07E+003
m	2	232-	250	245.87	75.11	4.40E+002	14.23%	1.21E+003
	3	274-	290	278.22	84.98	3.20E+002	45.49%	1.65E+003
	4	774-	786	781.81	238.70	2.05E+002	37.22%	5.01E+002
	5	959-	973	967.02	295.24	9.94E+001	64.62%	3.39E+002
	6	1146-	1160	1152.45	351.84	2.46E+002	24.93%	2.56E+002
	7	1663-	1681	1672.36	510.54	2.34E+002	23.37%	1.61E+002
	8	1903-	1919	1910.05	583.09	1.52E+002	30.92%	1.36E+002
	9	1986-	2002	1995.23	609.10	2.96E+002	17.52%	1.29E+002
	10	2157-	2173	2166.62	661.41	1.70E+002	26.89%	1.19E+002
	11	2977-	2990	2983.77	910.85	1.40E+002	25.42%	6.83E+001
	12	3166-	3180	3173.38	968.72	7.24E+001	43.71%	6.56E+001
	13	3661-	3677	3670.29	1120.41	9.65E+001	37.26%	7.65E+001
	14	3838-	3851	3843.69	1173.33	4.48E+001	57.27%	4.53E+001
	15	4052-	4063	4056.70	1238.36	3.08E+001	86.98%	6.12E+001
	16	4354-	4374	4365.75	1332.69	6.19E+001	40.47%	2.81E+001
	17	4775-	4796	4785.81	1460.92	1.23E+003	5.75%	1.93E+001
	18	5772-	5791	5782.60	1765.18	1.06E+002	23.27%	1.50E+001
	19	7219-	7231	7224.89	2205.44	2.85E+001	46.52%	6.50E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.985	511.00*	100.00	5.915E-001	26.47%
K-40	0.999	1460.81*	10.67	3.690E+001	9.93%
CO-60	0.998	1173.22*	100.00	1.361E-001	57.80%
		1332.49*	100.00	1.981E-001	41.22%
CS-137	0.996	661.65*	85.12	4.898E-001	29.36%
TL-208	0.743	277.35	6.80		
		510.84*	21.60	2.739E+000	27.70%
		583.14*	84.20	4.511E-001	33.36%
		763.13	1.64		
		860.37	12.46		
PB-212	0.458	74.81*	10.70	1.294E+001	25.19%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.271E+000	40.22%
		300.09	3.41		
BI-214	0.467	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	4.957E+000	23.93%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	5.897E+000	39.73%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	4.940E+000	88.04%

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.467	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	6.692E+000	26.96%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	5.684E+000	48.55%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.576	53.23	1.11		
		74.82*	6.21	2.230E+001	24.56%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	1.394E+000	66.39%
		351.92*	37.20	1.749E+000	28.91%
TH-228	0.818	84.38*	1.22	8.145E+001	49.09%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.985	4.9409E-001	32.36%
K-40	0.999	3.6901E+001	9.93%
CO-60	0.998	1.6592E-001	34.14%
CS-137	0.996	4.8975E-001	29.36%
TL-208	0.743	4.5109E-001	33.20%
PB-212	0.458	1.5601E+000	32.12%
BI-214	0.467	5.5148E+000	17.80%
PB-214	0.576	1.7930E+000	24.25%
TH-228	0.818	8.1451E+001	49.09%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:26:09 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	72.85	1.2326E-001	21.41
	11	910.85	6.9828E-002	25.42
	12	968.72	3.6225E-002	43.71

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7722
Sample Geometry: Conc 2m 90d
Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.39E-001	1.33E-001
		1332.49*	100.00	1.33E-001	
+	CS-137	661.65*	85.12	2.20E-001	2.20E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S        *****
**************************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:26:38 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavation
Sample Identification            : FR0111-05-1-C003
Sample Type                      : Exc
Desc. 1 : FR0111-05-1-C003-GS-CONC,concrete@2m
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/18/04  10:12:46 AM
Acquisition Started              : 8/18/04  10:29:29 AM

Live Time                        :     2000.0 seconds
Real Time                        :     2001.4 seconds


          Energy Calibration Used Done On       : 4/29/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 8/31/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7722
Sample Title: Excavation
Peak Analysis Performed on: 9/13/04 2:26:37 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	232-	250	238.49	72.85	2.47E+002	21.41%	1.07E+003
m	2	232-	250	245.87	75.11	4.40E+002	14.23%	1.21E+003
	3	274-	290	278.22	84.98	3.20E+002	45.49%	1.65E+003
	4	774-	786	781.81	238.70	2.05E+002	37.22%	5.01E+002
	5	959-	973	967.02	295.24	9.94E+001	64.62%	3.39E+002
	6	1146-	1160	1152.45	351.84	2.46E+002	24.93%	2.56E+002
	7	1663-	1681	1672.36	510.54	2.34E+002	23.37%	1.61E+002
	8	1903-	1919	1910.05	583.09	1.52E+002	30.92%	1.36E+002
	9	1986-	2002	1995.23	609.10	2.96E+002	17.52%	1.29E+002
	10	2157-	2173	2166.62	661.41	1.70E+002	26.89%	1.19E+002
	11	2977-	2990	2983.77	910.85	1.40E+002	25.42%	6.83E+001
	12	3166-	3180	3173.38	968.72	7.24E+001	43.71%	6.56E+001
	13	3661-	3677	3670.29	1120.41	9.65E+001	37.26%	7.65E+001
	14	3838-	3851	3843.69	1173.33	4.48E+001	57.27%	4.53E+001
	15	4052-	4063	4056.70	1238.36	3.08E+001	86.98%	6.12E+001
	16	4354-	4374	4365.75	1332.69	6.19E+001	40.47%	2.81E+001
	17	4775-	4796	4785.81	1460.92	1.23E+003	5.75%	1.93E+001
	18	5772-	5791	5782.60	1765.18	1.06E+002	23.27%	1.50E+001
	19	7219-	7231	7224.89	2205.44	2.85E+001	46.52%	6.50E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.985	511.00*	100.00	9.477E+000	26.47%
K-40	0.999	1460.81*	10.67	4.829E+002	9.93%
CO-60	0.998	1173.22*	100.00	1.874E+000	57.80%
		1332.49*	100.00	2.592E+000	41.22%
CS-137	0.996	661.65*	85.12	7.744E+000	29.36%
TL-208	0.740	277.35	6.80		
		510.84*	21.60	4.388E+001	27.70%
		583.14*	84.20	7.178E+000	33.36%
		763.13	1.64		
		860.37	12.46		
PB-212	0.465	74.81*	10.70	2.287E+002	25.19%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.116E+001	40.22%
		300.09	3.41		
BI-214	0.458	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	7.870E+001	23.93%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	8.212E+001	39.73%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	6.658E+001	88.04%

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.458	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	8.757E+001	26.96%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21*	4.86	7.438E+001	48.55%
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.583	53.23	1.11		
		74.82*	6.21	3.940E+002	24.56%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	2.297E+001	66.39%
		351.92*	37.20	2.855E+001	28.91%
TH-228	0.817	84.38*	1.22	1.430E+003	49.09%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.985	7.9267E+000	32.31%
K-40	0.999	4.8289E+002	9.93%
CO-60	0.998	2.2380E+000	33.99%
CS-137	0.996	7.7436E+000	29.36%
TL-208	0.740	7.1783E+000	33.20%
PB-212	0.465	2.5788E+001	32.42%
BI-214	0.458	8.0673E+001	17.74%
PB-214	0.583	2.9228E+001	24.35%
TH-228	0.817	1.4301E+003	49.09%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:26:37 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	72.85	1.2326E-001	21.41
	11	910.85	6.9828E-002	25.42
	12	968.72	3.6225E-002	43.71

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7722
Sample Geometry: Conc 2m 90d
Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.92E+000	1.74E+000
		1332.49*	100.00	1.74E+000	
+	CS-137	661.65*	85.12	3.48E+000	3.48E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

DR
9-16-04


```
ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:26:14 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavation
Sample Identification            : FR0111-05-1-S043
Sample Type                      : Exc
Desc. 1 : FR0111-05-1-S043-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/18/04   4:46:19 PM
Acquisition Started              : 8/18/04   4:46:19 PM

Live Time                        :     1000.0 seconds
Real Time                        :     1000.9 seconds


          Energy Calibration Used Done On       : 4/29/04
          Efficiency / Geometry ID              : Soil 3m 90d
          Efficiency Calibration Used Done On   : 1/29/04
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 7722
Sample Title: Excavation
Peak Analysis Performed on: 9/13/04 2:26:13 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	243-	250	245.94	75.13	1.53E+002	52.50%	7.57E+002
M	2	776-	799	781.71	238.67	2.03E+002	17.23%	2.24E+002
m	3	776-	799	791.88	241.78	9.95E+001	28.02%	2.13E+002
	4	961-	974	967.05	295.25	1.40E+002	36.18%	1.91E+002
	5	1105-	1112	1108.77	338.51	4.41E+001	70.39%	1.03E+002
	6	1148-	1160	1152.45	351.84	1.97E+002	23.40%	1.35E+002
	7	1901-	1915	1910.14	583.12	8.84E+001	42.26%	9.56E+001
	8	1987-	2002	1995.37	609.14	2.34E+002	18.58%	8.59E+001
	9	2160-	2174	2166.39	661.34	1.01E+002	30.98%	5.37E+001
	10	2977-	2991	2983.73	910.83	8.38E+001	37.53%	6.02E+001
	11	3662-	3677	3669.45	1120.15	6.97E+001	44.97%	6.13E+001
	12	3836-	3849	3841.86	1172.78	4.40E+001	50.76%	3.10E+001
	13	4052-	4064	4056.44	1238.28	3.85E+001	51.92%	2.45E+001
	14	4359-	4370	4365.48	1332.61	4.70E+001	40.01%	1.80E+001
	15	4775-	4797	4785.99	1460.97	8.27E+002	7.07%	1.66E+001
	16	5774-	5789	5782.06	1765.02	7.08E+001	26.22%	6.17E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
K-40	0.998	1460.81*	10.67	3.128E+001	10.75%
CO-60	0.993	1173.22*	100.00	1.717E-001	51.36%
		1332.49*	100.00	1.896E-001	40.77%
CS-137	0.993	661.65*	85.12	4.085E-001	33.14%
TL-208	0.474	277.35	6.80		
		510.84	21.60		
		583.14*	84.20	3.750E-001	44.07%
		763.13	1.64		
		860.37	12.46		
PB-212	0.483	74.81*	10.70	9.737E+000	56.47%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	2.153E+000	23.01%
		300.09	3.41		
BI-214	0.413	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	2.427E+000	24.01%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	2.399E+000	46.67%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	3.425E+000	53.37%
		1280.96	1.44		

Interference Corrected Activity Report 9/13/04 2:26:14 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.413	1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	2.452E+000	28.97%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.744	53.23	1.11		
		74.82*	6.21	1.678E+001	56.19%
		77.11	10.50		
		87.30	4.67		
		241.98*	7.49	6.259E+000	32.05%
		295.21*	19.20	3.224E+000	39.26%
		351.92*	37.20	2.221E+000	27.61%

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
K-40	0.998	3.1277E+001	10.75%
CO-60	0.993	1.8183E-001	31.97%
CS-137	0.993	4.0849E-001	33.14%
TL-208	0.474	3.7502E-001	44.07%
PB-212	0.483	2.2010E+000	22.00%
BI-214	0.413	2.4772E+000	17.99%
PB-214	0.744	2.7086E+000	19.22%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:26:13 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
5	338.51	4.4102E-002	70.39
10	910.83	8.3816E-002	37.53

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7722
Sample Geometry: Soil 3m 90d
Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.50E-001	1.16E-001
		1332.49*	100.00	1.16E-001	
+	CS-137	661.65*	85.12	2.03E-001	2.03E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S        *****
**************************************************************************

ISOCS Report Generator           ISOCSAN.TPL  2/26/96
Report Generated On              : 9/13/04   2:26:42 PM

Spectrum File Name               : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                     : Excavation
Sample Identification            : FR0111-05-1-S043
Sample Type                      : Exc
Desc. 1 : FR0111-05-1-S043-GS-SCAN
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8190
Peak Area Range (in channels)    :    50 -  8190
Identification Energy Tolerance  :    1.500 keV

Sample Size                      :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                  : 8/18/04   4:46:19 PM
Acquisition Started              : 8/18/04   4:46:19 PM

Live Time                        :     1000.0 seconds
Real Time                        :     1000.9 seconds


          Energy Calibration Used Done On       : 4/29/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 8/31/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7722
Sample Title: Excavation
Peak Analysis Performed on: 9/13/04 2:26:41 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
	1	243-	250	245.94	75.13	1.53E+002	52.50%	7.57E+002
M	2	776-	799	781.71	238.67	2.03E+002	17.23%	2.24E+002
m	3	776-	799	791.88	241.78	9.95E+001	28.02%	2.13E+002
	4	961-	974	967.05	295.25	1.40E+002	36.18%	1.91E+002
	5	1105-	1112	1108.77	338.51	4.41E+001	70.39%	1.03E+002
	6	1148-	1160	1152.45	351.84	1.97E+002	23.40%	1.35E+002
	7	1901-	1915	1910.14	583.12	8.84E+001	42.26%	9.56E+001
	8	1987-	2002	1995.37	609.14	2.34E+002	18.58%	8.59E+001
	9	2160-	2174	2166.39	661.34	1.01E+002	30.98%	5.37E+001
	10	2977-	2991	2983.73	910.83	8.38E+001	37.53%	6.02E+001
	11	3662-	3677	3669.45	1120.15	6.97E+001	44.97%	6.13E+001
	12	3836-	3849	3841.86	1172.78	4.40E+001	50.76%	3.10E+001
	13	4052-	4064	4056.44	1238.28	3.85E+001	51.92%	2.45E+001
	14	4359-	4370	4365.48	1332.61	4.70E+001	40.01%	1.80E+001
	15	4775-	4797	4785.99	1460.97	8.27E+002	7.07%	1.66E+001
	16	5774-	5789	5782.06	1765.02	7.08E+001	26.22%	6.17E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
K-40	0.998	1460.81*	10.67	6.498E+002	10.75%
CO-60	0.993	1173.22*	100.00	3.683E+000	51.36%
		1332.49*	100.00	3.939E+000	40.77%
CS-137	0.993	661.65*	85.12	9.238E+000	33.14%
TL-208	0.469	277.35	6.80		
		510.84	21.60		
		583.14*	84.20	8.324E+000	44.07%
		763.13	1.64		
		860.37	12.46		
PB-212	0.465	74.81*	10.70	1.595E+002	56.47%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	4.186E+001	23.01%
		300.09	3.41		
BI-214	0.406	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	5.422E+001	24.01%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	5.167E+001	46.67%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11*	5.86	7.248E+001	53.37%
		1280.96	1.44		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.406	1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	5.095E+001	28.97%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.723	53.23	1.11		
		74.82*	6.21	2.748E+002	56.19%
		77.11	10.50		
		87.30	4.67		
		241.98*	7.49	1.219E+002	32.05%
		295.21*	19.20	6.469E+001	39.26%
		351.92*	37.20	4.574E+001	27.61%

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
K-40	0.998	6.4985E+002	10.75%
CO-60	0.993	3.8317E+000	31.95%
CS-137	0.993	9.2377E+000	33.14%
TL-208	0.469	8.3242E+000	44.07%
PB-212	0.465	4.2818E+001	21.96%
BI-214	0.406	5.3623E+001	17.99%
PB-214	0.723	5.5684E+001	19.07%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 9/13/04 2:26:41 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
5	338.51	4.4102E-002	70.39
10	910.83	8.3816E-002	37.53

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7722
Sample Geometry: Soil 3m 90d
Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	3.21E+000	2.41E+000
		1332.49*	100.00	2.41E+000	
+	CS-137	661.65*	85.12	4.59E+000	4.59E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S        *****
**************************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:26:19 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavation
Sample Identification           : FR0111-05-1-S019
Sample Type                     : Exc
Desc. 1 : FR0111-05-1-S019-GS-SCAN , Soil @ 3mtr
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/19/04   6:48:03 AM
Acquisition Started             : 8/19/04   7:04:46 AM

Live Time                       :     1236.0 seconds
Real Time                       :     1237.0 seconds


          Energy Calibration Used Done On       : 4/29/04
          Efficiency / Geometry ID              : Soil 3m 90d
          Efficiency Calibration Used Done On   : 1/29/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7722
Sample Title: Excavation
Peak Analysis Performed on: 9/13/04 2:26:17 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	232-	250	238.83	72.96	2.07E+002	22.19%	7.72E+002
m	2	232-	250	246.20	75.21	2.78E+002	18.23%	8.43E+002
	3	275-	281	277.84	84.87	7.33E+001	91.28%	5.72E+002
	4	775-	786	781.29	238.54	2.27E+002	27.28%	3.03E+002
	5	961-	971	966.28	295.01	4.76E+001	94.90%	2.02E+002
	6	1147-	1156	1152.34	351.81	8.97E+001	46.42%	1.60E+002
	7	1902-	1915	1908.90	582.74	1.38E+002	28.78%	9.87E+001
	8	1988-	2003	1994.56	608.89	1.98E+002	22.40%	1.05E+002
	9	2159-	2172	2165.93	661.20	5.50E+001	62.97%	9.30E+001
	10	2975-	2990	2983.39	910.73	1.05E+002	32.88%	6.81E+001
	11	3167-	3182	3172.29	968.39	8.20E+001	35.79%	4.70E+001
	12	3661-	3674	3668.57	1119.88	6.94E+001	36.88%	3.66E+001
	13	3837-	3848	3841.55	1172.68	4.12E+001	58.07%	4.28E+001
	14	4358-	4369	4363.38	1331.97	5.19E+001	41.80%	2.81E+001
	15	4774-	4794	4784.18	1460.42	9.34E+002	6.66%	2.04E+001
	16	5773-	5787	5779.56	1764.26	5.58E+001	30.63%	7.15E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
K-40	0.989	1460.81*	10.67	2.855E+001	10.48%
CO-60	0.981	1173.22*	100.00	1.302E-001	58.60%
		1332.49*	100.00	1.694E-001	42.53%
CS-137	0.986	661.65*	85.12	1.794E-001	64.06%
TL-208	0.467	277.35	6.80		
		510.84	21.60		
		583.14*	84.20	4.747E-001	31.38%
		763.13	1.64		
		860.37	12.46		
PB-212	0.483	74.81*	10.70	1.428E+001	27.64%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.943E+000	31.25%
		300.09	3.41		
BI-214	0.337	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	3.169E+000	27.28%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	3.682E+000	39.08%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		
		1280.96	1.44		

Interference Corrected Activity Report 9/13/04 2:26:19 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.337	1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	2.978E+000	33.18%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.603	53.23	1.11		
		74.82*	6.21	2.461E+001	27.07%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	8.865E-001	96.11%
		351.92*	37.20	8.167E-001	48.68%
TH-228	0.820	84.38*	1.22	3.179E+001	93.12%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
K-40	0.989	2.8553E+001	10.48%
CO-60	0.981	1.5091E-001	34.71%
CS-137	0.986	1.7943E-001	64.06%
TL-208	0.467	4.7475E-001	31.38%
PB-212	0.483	2.2434E+000	26.46%
BI-214	0.337	3.1848E+000	20.15%
PB-214	0.603	8.9082E-001	40.13%
TH-228	0.820	3.1789E+001	93.12%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:26:17 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	72.96	1.6760E-001	22.19
	10	910.73	8.4860E-002	32.88
	11	968.39	6.6330E-002	35.79

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7722
Sample Geometry: Soil 3m 90d
Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.35E-001	1.15E-001
		1332.49*	100.00	1.15E-001	
+	CS-137	661.65*	85.12	2.08E-001	2.08E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:26:47 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavation
Sample Identification           : FR0111-05-1-S019
Sample Type                     : Exc
Desc. 1 : FR0111-05-1-S019-GS-SCAN , Soil @ 3mtr
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/19/04   6:48:03 AM
Acquisition Started             : 8/19/04   7:04:46 AM

Live Time                       :     1236.0 seconds
Real Time                       :     1237.0 seconds


          Energy Calibration Used Done On       : 4/29/04
          Efficiency / Geometry ID              : 1M2_AREA_AT_EDGE
          Efficiency Calibration Used Done On   : 8/31/04
```

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: 7722
Sample Title: Excavation
Peak Analysis Performed on: 9/13/04 2:26:45 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	232-	250	238.83	72.96	2.07E+002	22.19%	7.72E+002
m	2	232-	250	246.20	75.21	2.78E+002	18.23%	8.43E+002
	3	275-	281	277.84	84.87	7.33E+001	91.28%	5.72E+002
	4	775-	786	781.29	238.54	2.27E+002	27.28%	3.03E+002
	5	961-	971	966.28	295.01	4.76E+001	94.90%	2.02E+002
	6	1147-	1156	1152.34	351.81	8.97E+001	46.42%	1.60E+002
	7	1902-	1915	1908.90	582.74	1.38E+002	28.78%	9.87E+001
	8	1988-	2003	1994.56	608.89	1.98E+002	22.40%	1.05E+002
	9	2159-	2172	2165.93	661.20	5.50E+001	62.97%	9.30E+001
	10	2975-	2990	2983.39	910.73	1.05E+002	32.88%	6.81E+001
	11	3167-	3182	3172.29	968.39	8.20E+001	35.79%	4.70E+001
	12	3661-	3674	3668.57	1119.88	6.94E+001	36.88%	3.66E+001
	13	3837-	3848	3841.55	1172.68	4.12E+001	58.07%	4.28E+001
	14	4358-	4369	4363.38	1331.97	5.19E+001	41.80%	2.81E+001
	15	4774-	4794	4784.18	1460.42	9.34E+002	6.66%	2.04E+001
	16	5773-	5787	5779.56	1764.26	5.58E+001	30.63%	7.15E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
K-40	0.989	1460.81*	10.67	5.932E+002	10.48%
CO-60	0.981	1173.22*	100.00	2.793E+000	58.60%
		1332.49*	100.00	3.519E+000	42.53%
CS-137	0.986	661.65*	85.12	4.058E+000	64.06%
TL-208	0.462	277.35	6.80		
		510.84	21.60		
		583.14*	84.20	1.054E+001	31.38%
		763.13	1.64		
		860.37	12.46		
PB-212	0.464	74.81*	10.70	2.340E+002	27.64%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	3.778E+001	31.25%
		300.09	3.41		
BI-214	0.330	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	7.079E+001	27.28%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	7.930E+001	39.08%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		
		1280.96	1.44		

Interference Corrected Activity Report 9/13/04 2:26:47 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.330	1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	6.188E+001	33.18%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.582	53.23	1.11		
		74.82*	6.21	4.032E+002	27.07%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	1.779E+001	96.11%
		351.92*	37.20	1.682E+001	48.68%
TH-228	0.825	84.38*	1.22	5.302E+002	93.12%
		131.61	0.13		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
K-40	0.989	5.9324E+002	10.48%
CO-60	0.981	3.1883E+000	34.64%
CS-137	0.986	4.0577E+000	64.06%
TL-208	0.462	1.0537E+001	31.38%
PB-212	0.464	4.4344E+001	25.89%
BI-214	0.330	6.8772E+001	20.17%
PB-214	0.582	1.8499E+001	39.58%
TH-228	0.825	5.3025E+002	93.12%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:26:45 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	72.96	1.6760E-001	22.19
	10	910.73	8.4860E-002	32.88
	11	968.39	6.6330E-002	35.79

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7722
Sample Geometry: Soil 3m 90d
Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	2.89E+000	2.38E+000
		1332.49*	100.00	2.38E+000	
+	CS-137	661.65*	85.12	4.71E+000	4.71E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**********************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S        *****
**********************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:26:34 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavation
Sample Identification           : FR0111-05-1-S002
Sample Type                     : Exc
Desc. 1 : FR0111-05-1-S002-GS-SCAN ,soil@3m
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/19/04  11:00:28 AM
Acquisition Started             : 8/19/04  11:17:11 AM

Live Time                       :     1298.0 seconds
Real Time                       :     1299.0 seconds


        Energy Calibration Used Done On      : 4/29/04
        Efficiency / Geometry ID             : 1M2_AREA_AT_EDGE
        Efficiency Calibration Used Done On  : 8/31/04
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 7722
Sample Title: Excavation
Peak Analysis Performed on: 9/13/04 2:26:32 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	233-	252	239.17	73.06	1.88E+002	24.83%	8.40E+002
m	2	233-	252	245.99	75.15	4.08E+002	13.78%	9.01E+002
	3	776-	787	781.44	238.59	2.26E+002	29.11%	3.57E+002
	4	962-	974	966.60	295.11	1.11E+002	48.01%	2.35E+002
	5	1101-	1115	1107.42	338.09	9.00E+001	54.99%	1.90E+002
	6	1145-	1160	1152.54	351.87	1.94E+002	28.94%	2.08E+002
	7	1664-	1681	1673.23	510.80	1.62E+002	29.70%	1.37E+002
	8	1904-	1918	1909.31	582.87	1.72E+002	23.22%	8.41E+001
	9	1986-	2001	1995.40	609.15	2.20E+002	21.16%	1.15E+002
	10	2160-	2173	2167.26	661.61	9.57E+001	32.97%	5.93E+001
	11	2974-	2993	2983.89	910.88	1.41E+002	26.86%	6.53E+001
	12	3165-	3178	3173.69	968.82	7.49E+001	39.76%	5.51E+001
	13	3660-	3675	3669.56	1120.18	7.39E+001	41.32%	5.61E+001
	14	3837-	3850	3843.47	1173.27	2.36E+001	110.07%	5.44E+001
	15	4358-	4373	4364.31	1332.25	5.22E+001	46.58%	3.38E+001
	16	4777-	4797	4785.88	1460.94	1.05E+003	6.19%	1.41E+001
	17	5774-	5791	5781.63	1764.89	8.02E+001	28.80%	1.68E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.997	511.00*	100.00	1.015E+001	32.19%
K-40	0.999	1460.81*	10.67	6.347E+002	10.19%
CO-60	0.998	1173.22*	100.00	1.520E+000	110.34%
		1332.49*	100.00	3.372E+000	47.23%
CS-137	1.000	661.65*	85.12	6.723E+000	35.01%
TL-208	0.737	277.35	6.80		
		510.84*	21.60	4.697E+001	33.21%
		583.14*	84.20	1.247E+001	26.38%
		763.13	1.64		
		860.37	12.46		
PB-212	0.465	74.81*	10.70	3.267E+002	24.93%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	3.585E+001	32.86%
		300.09	3.41		
BI-214	0.334	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	7.607E+001	26.31%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	8.164E+001	43.32%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Interference Corrected Activity Report 9/13/04 2:26:34 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.334	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	8.599E+001	31.53%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.583	53.23	1.11		
		74.82*	6.21	5.630E+002	24.30%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	3.938E+001	50.37%
		351.92*	37.20	3.461E+001	32.44%
AC-228	0.318	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	5.278E+001	69.07%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	3.170E+001	29.32%
		964.60	5.20		
		969.11*	16.60	2.840E+001	45.97%
		1588.00	3.50		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.997	7.4525E+000	44.83%
K-40	0.999	6.3465E+002	10.19%
CO-60	0.998	2.4935E+000	46.31%
CS-137	1.000	6.7226E+000	35.01%
TL-208	0.737	1.2469E+001	26.18%
PB-212	0.465	4.2077E+001	27.42%
BI-214	0.334	7.9815E+001	19.89%
PB-214	0.583	3.8210E+001	25.14%
AC-228	0.318	3.1509E+001	23.53%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:26:32 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	73.06	1.4475E-001	24.83

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 7722
Sample Geometry: Soil 3m 90d
Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	3.21E+000	2.68E+000
		1332.49*	100.00	2.68E+000	
+	CS-137	661.65*	85.12	3.63E+000	3.63E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

```
**************************************************************************
*****       G A M M A   S P E C T R U M   A N A L Y S I S          *****
**************************************************************************

ISOCS Report Generator          ISOCSAN.TPL  2/26/96
Report Generated On             : 9/13/04   2:26:06 PM

Spectrum File Name              : C:\GENIE2K\CAMFILES\Geometry Area Size Eva
Sample Title                    : Excavation
Sample Identification           : FR0111-05-1-S002
Sample Type                     : Exc
Desc. 1 : FR0111-05-1-S002-GS-SCAN ,soil@3m
Desc. 2 :
Desc. 3 :
Desc. 4 :

Peak Locate Threshold           :  3.00
Peak Locate Range (in channels) :    50 -  8190
Peak Area Range (in channels)   :    50 -  8190
Identification Energy Tolerance :    1.500 keV

Sample Size                     :  1.000E+000 gm

Note:  For Point Source,   report UNIT = none.

Sample Taken On                 : 8/19/04  11:00:28 AM
Acquisition Started             : 8/19/04  11:17:11 AM

Live Time                       :     1298.0 seconds
Real Time                       :     1299.0 seconds


          Energy Calibration Used Done On       : 4/29/04
          Efficiency / Geometry ID              : Soil 3m 90d
          Efficiency Calibration Used Done On   : 1/29/04
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 7722
Sample Title: Excavation
Peak Analysis Performed on: 9/13/04 2:26:04 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8190

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area % Uncert.	Continuum Counts
M	1	233-	252	239.17	73.06	1.88E+002	24.83%	8.40E+002
m	2	233-	252	245.99	75.15	4.08E+002	13.78%	9.01E+002
	3	776-	787	781.44	238.59	2.26E+002	29.11%	3.57E+002
	4	962-	974	966.60	295.11	1.11E+002	48.01%	2.35E+002
	5	1101-	1115	1107.42	338.09	9.00E+001	54.99%	1.90E+002
	6	1145-	1160	1152.54	351.87	1.94E+002	28.94%	2.08E+002
	7	1664-	1681	1673.23	510.80	1.62E+002	29.70%	1.37E+002
	8	1904-	1918	1909.31	582.87	1.72E+002	23.22%	8.41E+001
	9	1986-	2001	1995.40	609.15	2.20E+002	21.16%	1.15E+002
	10	2160-	2173	2167.26	661.61	9.57E+001	32.97%	5.93E+001
	11	2974-	2993	2983.89	910.88	1.41E+002	26.86%	6.53E+001
	12	3165-	3178	3173.69	968.82	7.49E+001	39.76%	5.51E+001
	13	3660-	3675	3669.56	1120.18	7.39E+001	41.32%	5.61E+001
	14	3837-	3850	3843.47	1173.27	2.36E+001	110.07%	5.44E+001
	15	4358-	4373	4364.31	1332.25	5.22E+001	46.58%	3.38E+001
	16	4777-	4797	4785.88	1460.94	1.05E+003	6.19%	1.41E+001
	17	5774-	5791	5781.63	1764.89	8.02E+001	28.80%	1.68E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
ANN	0.997	511.00*	100.00	4.662E-001	32.19%
K-40	0.999	1460.81*	10.67	3.055E+001	10.19%
CO-60	0.998	1173.22*	100.00	7.086E-002	110.34%
		1332.49*	100.00	1.623E-001	47.23%
CS-137	1.000	661.65*	85.12	2.973E-001	35.01%
TL-208	0.741	277.35	6.80		
		510.84*	21.60	2.158E+000	33.21%
		583.14*	84.20	5.618E-001	26.38%
		763.13	1.64		
		860.37	12.46		
PB-212	0.483	74.81*	10.70	1.994E+001	24.93%
		77.11	18.00		
		87.30	8.00		
		238.63*	44.60	1.844E+000	32.86%
		300.09	3.41		
BI-214	0.341	76.86	0.45		
		79.29	0.76		
		89.80	0.34		
		273.70	0.17		
		387.00	0.29		
		389.10	0.37		
		405.74	0.18		
		454.77	0.28		
		469.69	0.14		
		609.31*	44.80	3.405E+000	26.31%
		665.45	1.29		
		703.11	0.37		
		719.86	0.42		
		752.84	0.14		
		768.36	4.80		
		786.10	0.30		
		806.17	1.12		
		821.18	0.18		
		934.06	3.03		
		964.08	0.38		
		1051.96	0.34		
		1069.96	0.28		
		1120.29*	14.80	3.791E+000	43.32%
		1133.66	0.28		
		1155.19	1.64		
		1207.68	0.49		
		1238.11	5.86		

Interference Corrected Activity Report 9/13/04 2:26:06 PM Page 4

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gm)	Activity Uncertainty
BI-214	0.341	1280.96	1.44		
		1303.76	0.11		
		1377.67	3.92		
		1385.31	0.89		
		1401.50	1.55		
		1407.98	2.80		
		1509.23	2.12		
		1538.50	0.51		
		1543.32	0.33		
		1583.22	0.70		
		1594.73	0.31		
		1599.31	0.38		
		1661.28	1.14		
		1683.99	0.25		
		1729.59	2.88		
		1764.49*	15.36	4.139E+000	31.53%
		1838.36	0.40		
		1847.42	2.04		
		1873.16	0.25		
		1896.30	0.17		
		2118.55	1.14		
		2204.21	4.86		
		2293.36	0.30		
		2447.86	1.50		
PB-214	0.604	53.23	1.11		
		74.82*	6.21	3.437E+001	24.30%
		77.11	10.50		
		87.30	4.67		
		241.98	7.49		
		295.21*	19.20	1.962E+000	50.37%
		351.92*	37.20	1.680E+000	32.44%
AC-228	0.332	89.95	2.10		
		93.35	3.50		
		105.00	1.60		
		129.08	2.80		
		209.28	4.40		
		270.23	3.60		
		327.64	3.20		
		338.32*	11.40	2.578E+000	69.07%
		409.51	2.13		
		463.00	4.40		
		794.70	4.60		
		835.50	1.75		
		911.07*	27.70	1.444E+000	29.32%
		964.60	5.20		
		969.11*	16.60	1.301E+000	45.97%
		1588.00	3.50		

* = Energy line found in the spectrum.
Energy tolerance used was 1.500
Nuclide confidence index threshold = 0.30
Errors quoted at 1.960 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gm)	Wt mean Activity Uncertainty
ANN	0.997	3.4481E-001	44.48%
K-40	0.999	3.0546E+001	10.19%
CO-60	0.998	1.1749E-001	46.59%
CS-137	1.000	2.9725E-001	35.01%
TL-208	0.741	5.6182E-001	26.18%
PB-212	0.483	2.1260E+000	28.01%
BI-214	0.341	3.6575E+000	19.92%
PB-214	0.604	1.8458E+000	25.45%
AC-228	0.332	1.4391E+000	23.57%

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis

Errors quoted at 1.960 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/13/04 2:26:04 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8190

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
M	1	73.06	1.4475E-001	24.83

M = First peak in a multiplet region
m = Other peak in a multiplet region

Errors quoted at 1.960 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 7722
Sample Geometry: Soil 3m 90d
Sample Title: Excavation
Nuclide Library Used: C:\GENIE2K\CAMFILES\Backyard.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gm)	Nuclide MDA (pCi/gm)
+	CO-60	1173.22*	100.00	1.50E-001	1.29E-001
		1332.49*	100.00	1.29E-001	
+	CS-137	661.65*	85.12	1.60E-001	1.60E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

Appendix B

Geometry Notebook

GDP Memorandum to file dated April 6, 2005 (GDP-05-005)

RAD REMEDIATION & FSS

MEMORANDUM

TO: File

DATE: April 6, 2005

FROM: G. Pillsbury

FILE: GDP-05-005

SUBJECT: ISOCS Geometries

This notebook contains the current list of FSS approved ISOCS geometries, listed by detector. Geometries established prior to 11/24/04 were attached to EC 003-04(MY).

Geometries available for use with ISOCS are:
Circular plane
Simple box
Complex box
Rectangular plane
Complex cylinder
Simple cylinder
Sphere
Well or maranelli beaker
Pipe
Special sphere
Exponential circular plane
Beaker
Round tube
U-channel
L-beam
H-beam
Rectangular beam
Room
Tank
Cone

Current Use

Geometry Composer Report

Date: Tuesday, April 05, 2005
Description: 1m_180d_soil
Comment: 1m_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7605 1m 180d soil m2.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

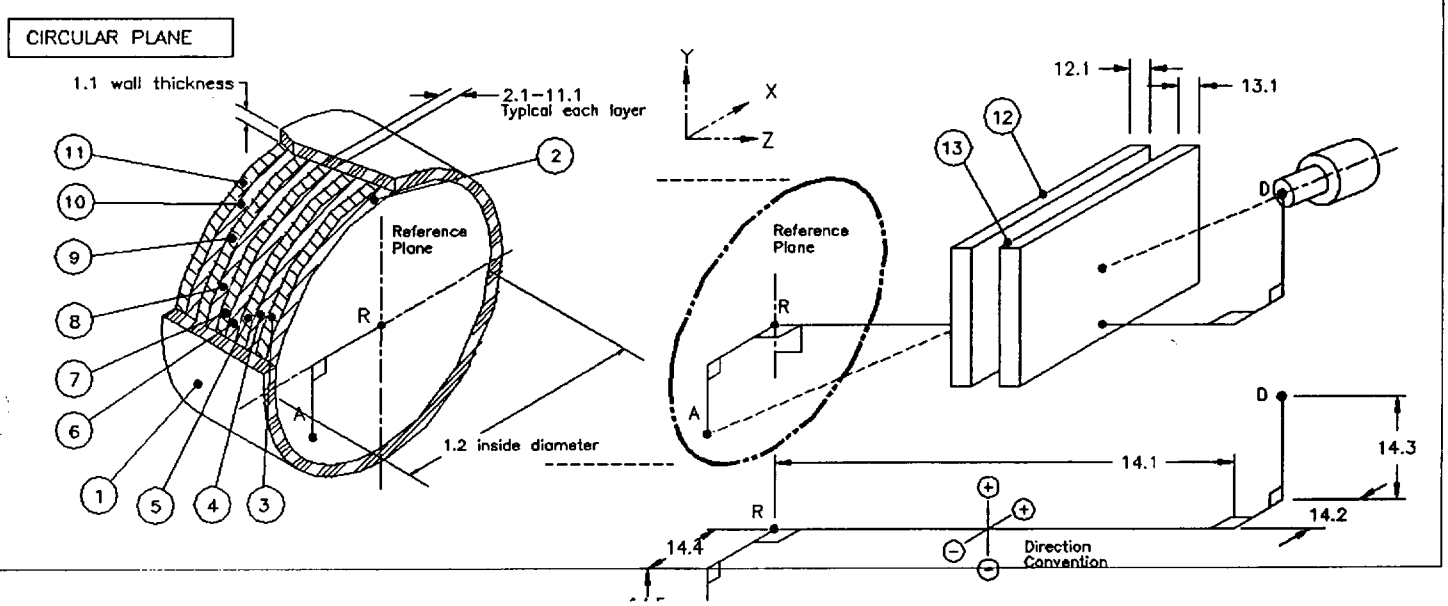
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		1000.00					none		
2	Layer 1	15.00						dirt4	1.70	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	100.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] APR 05 2005
Reviewed by DR 4-5-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7605
ISOCS/LabSOCS Time: 04/05/05 06:37:48
Template: CIRCULAR PLANE
Geom Description: 1M 180D SOIL
Comment: ISOCS:UNITS=ACT/M^2 1M_180D_SOIL
Detector: 7605
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 7.8540e+001 (C)
Mass [Grams]: 2.0028e+007 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	2.44300e-005	10.0	-0.300184	10200
88.03	8.60427e-005	10.0	-0.249010	5080
122.06(X)	1.32290e-004	10.0	-0.249910	5080
165.85	1.48204e-004	8.0	-0.256194	5080
391.69	1.20446e-004	8.0	-0.205242	5080
661.65	1.00796e-004	6.0	-0.174895	5080
898.02	9.51808e-005	6.0	-0.163895	5080
1173.22	8.79135e-005	4.0	-0.158444	5080
1332.49	8.49918e-005	4.0	-0.156951	5080
1836.01	7.67540e-005	4.0	-0.149930	5080

(X) = Crossover Energy

Geometry Composer Report

Date: Wednesday, March 30, 2005
Description: 13cm90d_dpm_m2
Comment: 13cm90d_dpm_m2
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7605 13cm90d conc.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

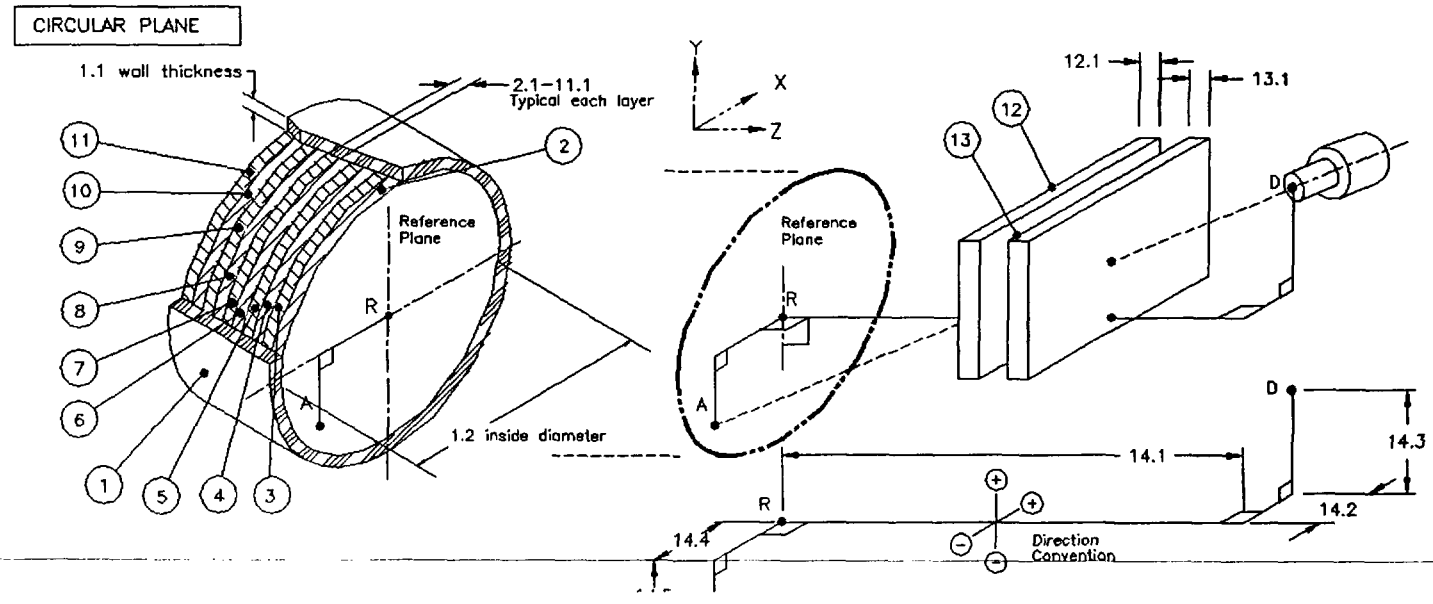
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		26.00					none		
2	Layer 1	17.78						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	13.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] MAR 30 2005
Reviewed by DR 3-30-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7605
ISOCS/LabSOCS Time: 03/30/05 13:47:06
Template: CIRCULAR PLANE
Geom Description: 13CM90D DPM M2
Comment: ISOCS:UNITS=ACT/M^2 13CM90D_DPM_M2
Detector: 7605
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 5.3093e-002 (C)
Mass [Grams]: 2.0768e+004 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	7.09098e-006	10.0	0.129594	12990
88.03	1.83931e-005	10.0	0.068475	12990
122.06(X)	2.46695e-005	10.0	0.033558	12990
165.85	2.63875e-005	8.0	0.012256	12990
391.69	2.13864e-005	8.0	-0.042402	12990
661.65	1.77222e-005	6.0	-0.045479	12990
898.02	1.65867e-005	6.0	-0.043148	12990
1173.22	1.51763e-005	4.0	-0.040327	12990
1332.49	1.45224e-005	4.0	-0.039837	12990
1836.01	1.27698e-005	4.0	-0.038444	12990

(X) = Crossover Energy

Geometry Composer Report

Date: Wednesday, March 30, 2005
Description: 1m_180d_conc
Comment: 1m_180d_conc
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7605 1m 180d conc.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		1000.00					none		
2	Layer 1	17.78						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	100.00								

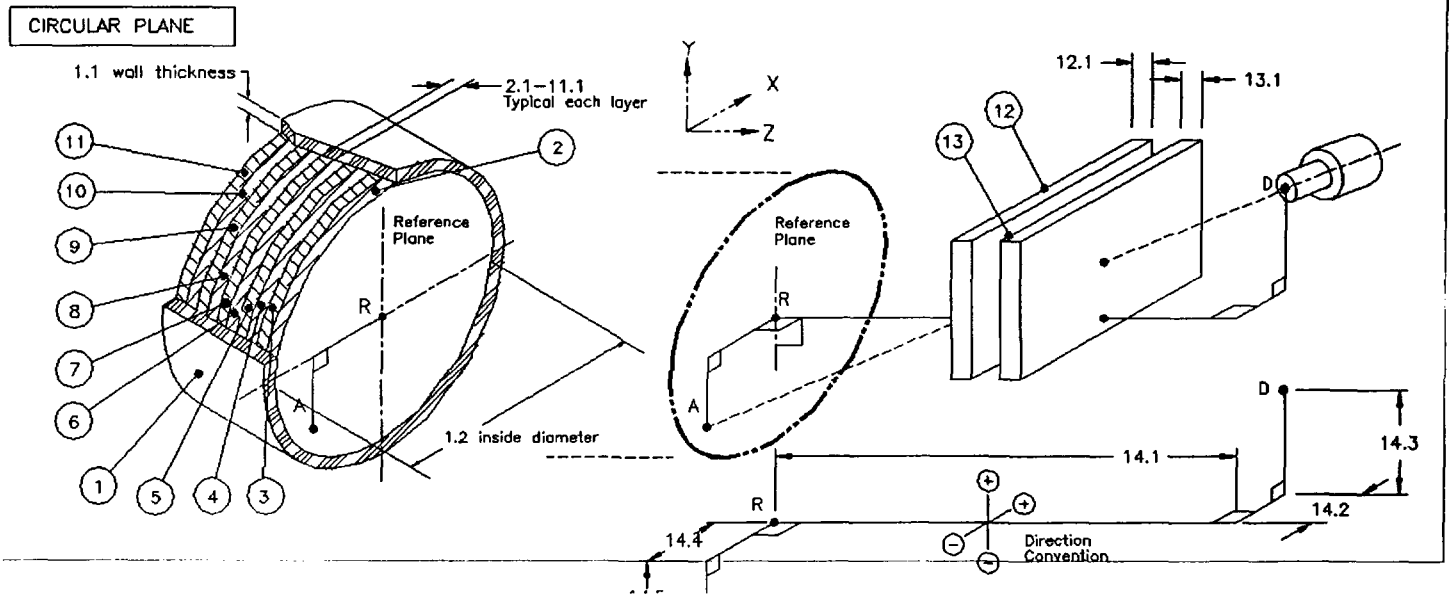
Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible]
Reviewed by DR

MAR 8 0 2005
3-30-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7605
ISOCS/LabSOCS Time: 03/30/05 13:33:14
Template: CIRCULAR PLANE
Custom Description: 1M 180D CONC
Comment: ISOCS:UNITS=ACT/M^2 1M_180D_CONC
Detector: 7605
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 7.8540e+001 (C)
Mass [Grams]: 3.0722e+007 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	1.80122e-005	10.0	-0.244530	12240
88.03	5.88842e-005	10.0	-0.155549	12240
122.06(X)	8.78373e-005	10.0	-0.175760	6096
165.85	9.71545e-005	8.0	-0.184159	6096
391.69	7.98765e-005	8.0	-0.164033	6096
661.65	6.82787e-005	6.0	-0.157966	6096
898.02	6.55454e-005	6.0	-0.158656	6096
1173.22	6.16080e-005	4.0	-0.159741	6096
1332.49	6.01027e-005	4.0	-0.161348	6096
1836.01	5.55924e-005	4.0	-0.160066	6096

(X) = Crossover Energy

Created by [handwritten initials] MAR 3 0 2005

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***** L I B R A R Y L I S T I N G R E P O R T *****

****

Reviewed by DR 3-30-05 concrete - Asphalt. NLB

Filename: ~~\)0000004~~ [initials] 3/30/05 Custom count to MDA Settings 2.6 [initials] 3/30/05 for Co + Cs => ~~+7~~ [illegible] /unit based on 78.5 m² FOV [initials] 3/30/05

Nuclide Library Description: Custom for Roads and Rails

Note: library identical to MANhole. NLB

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
ANN	3.156E+017	511.000	0.000	100.0000	0.0000
K-40	4.030E+016	1460.810*	0.040	10.6700	0.1100
CO-57	2.348E+007	122.061	0.000	85.9000	1.2000
		136.474*	0.001	10.3300	0.1000
CO-60	1.663E+008	1173.216*	0.021	100.0000	0.0000
		1332.486	0.022	100.0000	0.0000
NB-94	6.406E+011	702.627*	0.019	100.0000	0.0000
		871.099	0.018	100.0000	0.0000
SB-125	8.741E+007	176.334	0.011	6.8900	0.2200
		427.889*	0.015	29.3300	0.2500
		463.383	0.015	10.3500	0.1800
		600.557	0.018	17.8000	0.3000
		606.641	0.019	5.0200	0.0900
		635.895	0.018	11.3200	0.2000
CS-137	9.521E+008	661.649*	0.005	85.1200	0.2400
EU-152	4.292E+008	121.779	0.000	28.4000	0.7000
		244.693	0.001	7.4900	0.1600
		344.272	0.002	26.5000	0.4000
		443.979	0.006	2.8100	0.0700
		778.890	0.009	12.7400	0.2500
		867.320	0.010	4.1600	0.1400
		964.010	0.030	14.4000	0.3000
		1085.780	0.010	10.0000	0.3000
		1112.020	0.010	13.3000	0.3000
		1407.954*	0.010	20.7000	0.5000
EU-154	2.777E+008	123.070	0.004	40.5000	1.5000
		247.939	0.008	6.6000	0.2500
		591.810	0.040	4.8300	0.1900
		692.410	0.050	1.6900	0.0700
		723.300	0.040	19.7000	0.8000
		756.870	0.050	4.3300	0.1800
		873.190	0.050	11.5000	0.5000
		996.320	0.040	10.3000	0.4000
		1004.760	0.040	17.9000	0.7000
		1274.450*	0.090	35.5000	1.3000
		1596.530	0.150	1.8500	0.1200
TL-208	4.434E+017	277.351	0.010	6.8000	0.3000
		510.840	0.080	21.6000	0.9000
		583.139*	0.023	84.2000	1.4000
		763.130	0.080	1.6400	0.0900
		860.370	0.080	12.4600	0.2100
BI-212	4.433E+017	727.170*	0.100	11.8000	0.3000
		785.460	0.070	1.9700	0.0500
		1620.620	0.100	2.7500	0.1000

PB-212	4.433E+017	74.810	0.001	10.7000	0.5000

Library Title: Custom for Roads and Rails

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
PB-212	4.433E+017	77.108	0.001	18.0000	0.7000
		87.300	0.000	8.0000	0.4000
		238.625*	0.006	44.6000	1.0000
		300.087	0.100	3.4100	0.0100
BI-214	5.049E+010	609.312*	0.007	44.8000	0.5000
		665.453	0.022	1.2900	0.0300
		768.356	0.010	4.8000	0.0700
		806.174	0.018	1.1200	0.0300
		934.061	0.012	3.0300	0.0500
		1120.287	0.010	14.8000	0.2000
		1155.190	0.020	1.6400	0.0400
		1238.110	0.012	5.8600	0.0800
		1280.960	0.020	1.4400	0.0300
		1377.669	0.012	3.9200	0.0800
		1401.500	0.040	1.5500	0.1700
		1407.980	0.040	2.8000	0.4000
		1509.228	0.015	2.1200	0.0400
		1661.280	0.060	1.1400	0.0300
		1729.595	0.015	2.8800	0.0600
		1764.494	0.014	15.3600	0.2000
		1847.420	0.030	2.0400	0.0400
		2118.550	0.030	1.1400	0.0300
		2204.210	0.040	4.8600	0.0900
		2447.860	0.100	1.5000	0.0400
PB-214	5.049E+010	53.226	0.014	1.1100	0.0600
		74.815	0.001	6.2100	0.2300
		77.108	0.001	10.5000	0.4000
		87.300	0.000	4.6700	0.1800
		241.981	0.008	7.4900	0.2100
		295.213	0.008	19.2000	0.6000
		351.921*	0.008	37.2000	1.1000
RA-226	5.049E+010	186.100*	0.100	3.5000	0.0500
AC-228	4.434E+017	89.953	0.002	2.1000	1.0000
		93.350	0.002	3.5000	1.5000
		105.000	0.000	1.6000	0.7000
		129.080	0.050	2.8000	0.9000
		209.280	0.100	4.4000	1.4000
		270.230	0.100	3.6000	0.8000
		327.640	0.100	3.2000	0.7000
		338.320	0.100	11.4000	2.3000
		409.510	0.100	2.1300	0.2400
		463.000	0.100	4.4000	0.5000
		794.700	0.200	4.6000	0.5000
		835.500	0.300	1.7500	0.1800
		911.070*	0.030	27.7000	1.0000
		964.600	0.300	5.2000	0.6000
		969.110	0.100	16.6000	1.8000
		1588.000	0.200	3.5000	0.6000
PA-234M	1.410E+017	1001.030	0.030	0.5890	0.0001
TH-234	1.410E+017	63.290*	0.020	3.8000	0.3000
		92.590	0.010	5.4100	0.2200

U-235	2.221E+016	89.953	0.002	2.8000	0.9000

Library Title: Custom for Roads and Rails

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
U-235	2.221E+016	93.350	0.002	4.5000	1.4000
		143.760*	0.020	10.9000	0.2300
		185.715	0.005	57.5000	1.1000
AM-241	1.364E+010	59.537	0.001	35.9000	0.6000

* = key line

TOTALS: 20 Nuclides 101 Energy Lines

Geometry Composer Report

Date:	Wednesday, March 23, 2005
Description:	1m_180d_conc
Comment:	1m_180d_conc
File Name:	c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7605 1m 180d conc.geo
Software:	ISOCS
Template:	CIRCULAR_PLANE, Version: default
Detector:	7605
Environment:	Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration:	Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
		Dimensions (cm):								
1	Side Walls		1000.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	100.00								

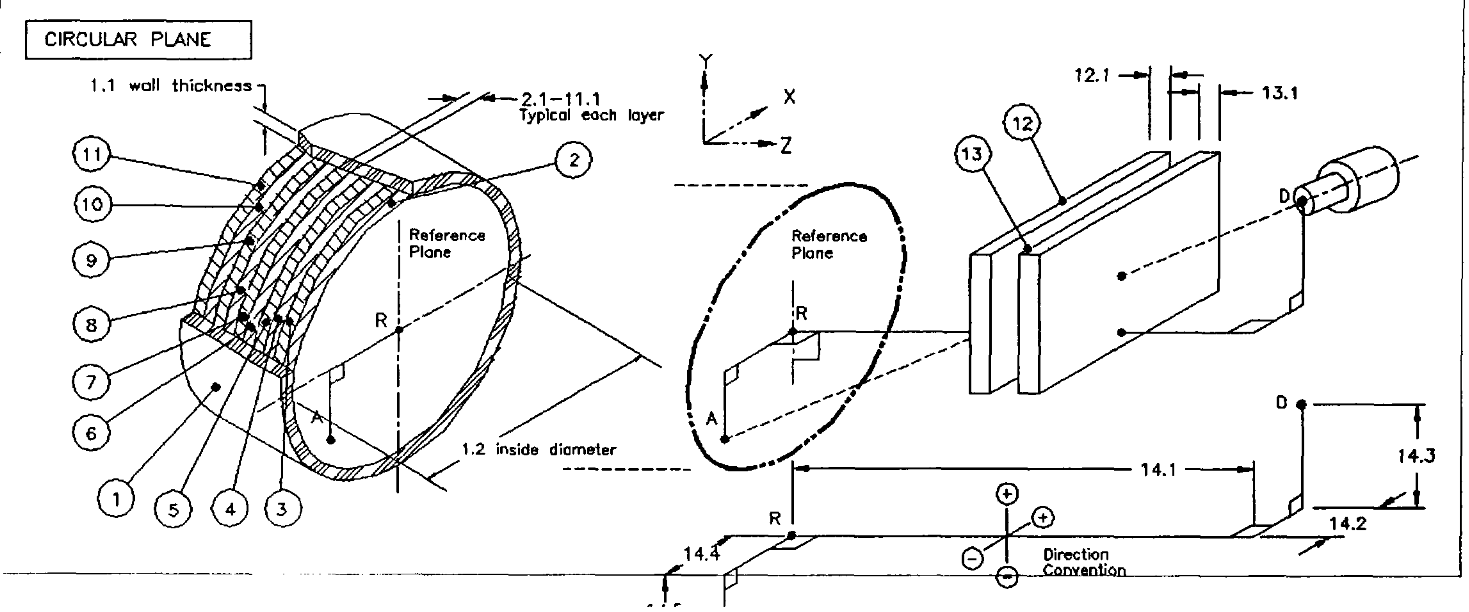
Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by: [signature] MAR 23 2005

reviewed by [signature] 3-23-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7605
ISOCS/LabSOCS Time: 03/23/05 15:13:42
Template: CIRCULAR PLANE
Custom Description: 1M 180D CONC
Comment: ISOCS:UNITS=ACT/M^2 1M_180D_CONC
Detector: 7605
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 7.8540e+001 (C)
Mass [Grams]: 8.6394e+006 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	6.32030e-005	10.0	-0.232612	6120
88.03	1.97908e-004	10.0	-0.196044	3048
122.06(X)	2.82609e-004	10.0	-0.186097	3048
165.85	3.01909e-004	8.0	-0.191867	3048
391.69	2.22576e-004	8.0	-0.136020	3048
661.65	1.75155e-004	6.0	-0.114322	3048
898.02	1.59093e-004	6.0	-0.113493	3048
1173.22	1.41795e-004	4.0	-0.118929	3048
1332.49	1.34686e-004	4.0	-0.121177	3048
1836.01	1.16728e-004	4.0	-0.123248	3048

(X) = Crossover Energy

Geometry Composer Report

Date: Tuesday, March 22, 2005
Description: 2m90d_dpm_m2
Comment: 2m90d_dpm_m2
File Name: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7605 2m90d dpm m2.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

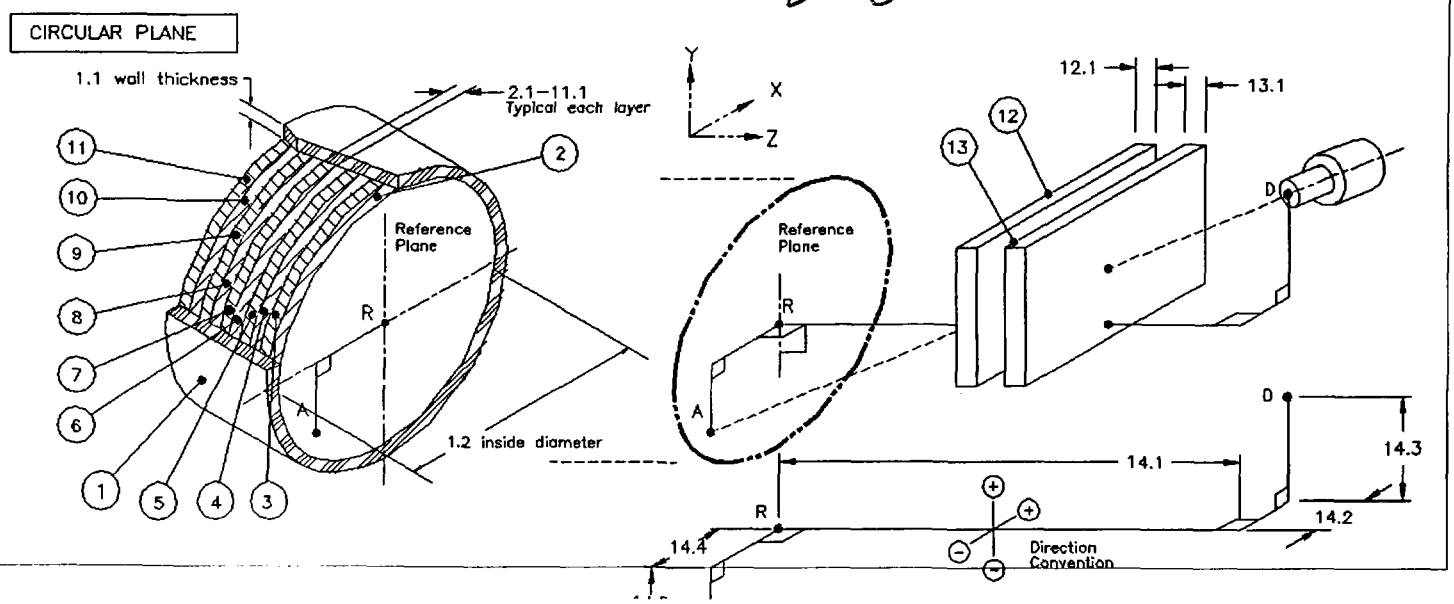
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by: [illegible] MAR 22 2005
reviewed by: [illegible] 3-22-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7605
ISOCS/LabSOCS Time: 03/22/05 08:48:10
Template: CIRCULAR PLANE
Item Description: 2M90D DPM M2
Comment: ISOCS:UNITS=ACT/M^2 2M90D_DPM_M2
Detector: 7605
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.2566e+001 (C)
Mass [Grams]: 1.3823e+006 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	2.52531e-005	10.0	-0.406830	768
88.03	6.39155e-005	10.0	-0.472633	768
122.06(X)	8.40994e-005	10.0	-0.530657	768
165.85	8.73676e-005	8.0	-0.571721	768
391.69	6.48734e-005	8.0	-0.624957	768
661.65	5.04463e-005	6.0	-0.516747	768
898.02	4.56620e-005	6.0	-0.438853	768
1173.22	4.06443e-005	4.0	-0.379041	768
1332.49	3.83866e-005	4.0	-0.358338	768
1836.01	3.26501e-005	4.0	-0.310140	768

(X) = Crossover Energy

Geometry Composer Report

Date:	Tuesday, March 22, 2005
Description:	2m90d_dpm_m2
Comment:	2m90d_dpm_m2
File Name:	C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\ 7607 2m90d dpm m2.geo
Software:	ISOCS
Template:	CIRCULAR_PLANE, Version: default
Detector:	7607
Environment:	Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration:	Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

Dimensions (cm):

# Geometry Compon.	d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1 Side Walls		400.00					none		
2 Layer 1	5.00						concrete	2.20	1.00
3 Layer 2							none		
4 Layer 3							none		
5 Layer 4							none		
6 Layer 5							none		
7 Layer 6							none		
8 Layer 7							none		
9 Layer 8							none		
10 Layer 9							none		
11 Layer 10							none		
12 Absorber1							none		
13 Absorber2							none		
14 Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

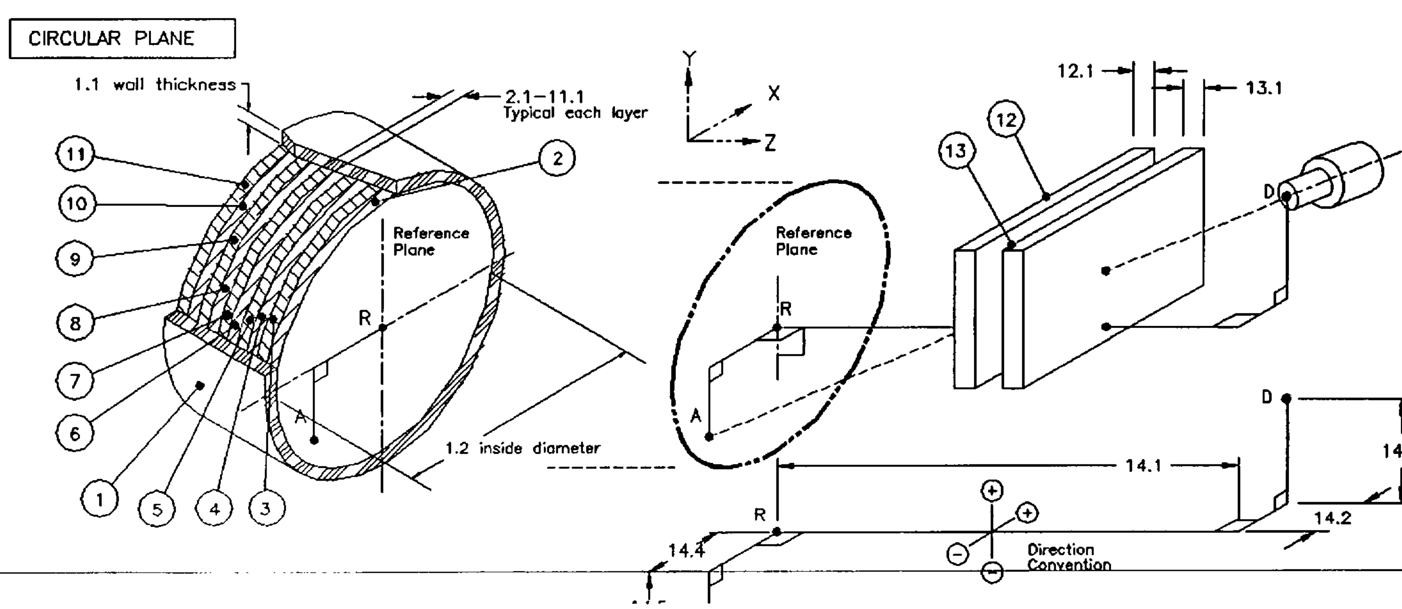
59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by: m

~~Created~~ m 3/22/05

MAR 22 2005

reviewed by: [signature] 3-22-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7607
ISOCS/LabSOCS Time: 03/22/05 08:47:34
Template: CIRCULAR PLANE
Item Description: 2M90D DPM M2
Comment: ISOCS:UNITS=ACT/M^2 2M90D_DPM_M2
Detector: 7607
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.2566e+001 (C)
Mass [Grams]: 1.3823e+006 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	3.66724e-005	10.0	-0.225284	6039
88.03	7.25129e-005	10.0	-0.166279	6039
122.06(X)	8.84617e-005	10.0	-0.157233	6039
165.85	8.88666e-005	8.0	-0.160071	6039
391.69	6.43422e-005	8.0	-0.138974	6039
661.65	5.04188e-005	6.0	-0.134604	6039
898.02	4.50544e-005	6.0	-0.135856	6039
1173.22	3.99921e-005	4.0	-0.139182	6039
1332.49	3.78159e-005	4.0	-0.138583	6039
1836.01	3.25736e-005	4.0	-0.139486	6039

(X) = Crossover Energy

Geometry Composer Report

Date: Tuesday, March 22, 2005
Description: 2m90d_dpm_m2
Comment: 2m90d_dpm_m2
File Name: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7780 2m90d dpm m2.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

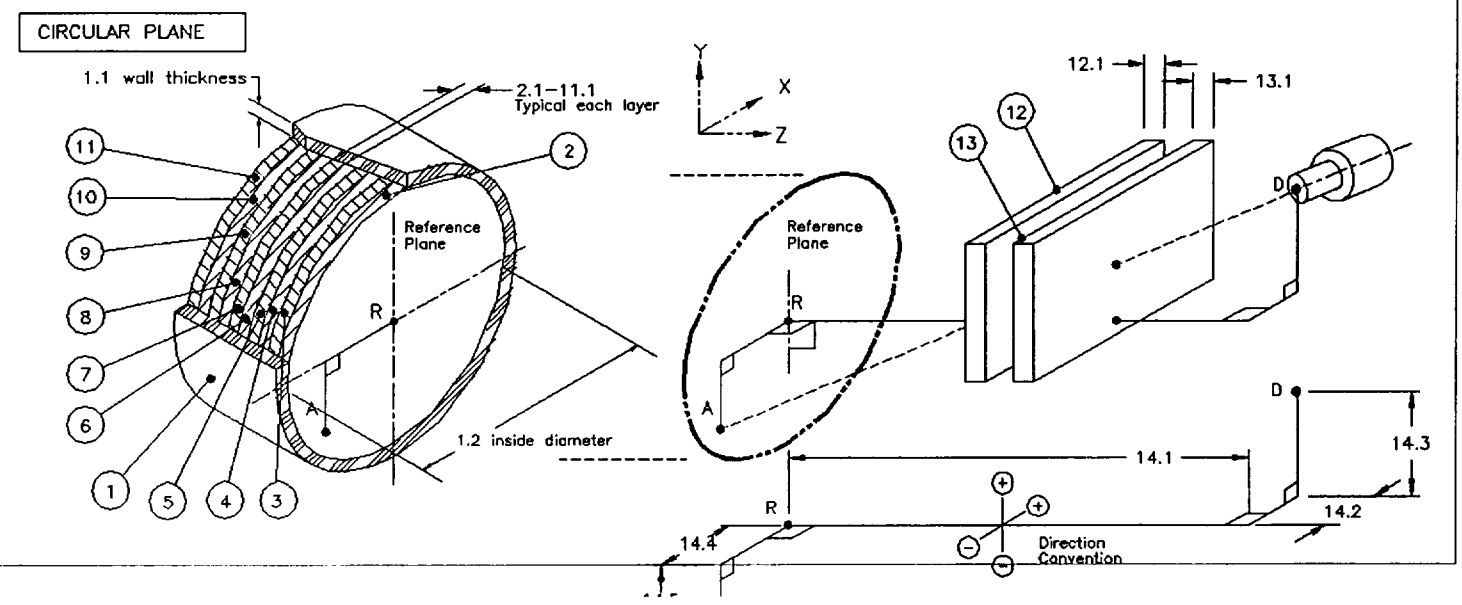
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by: [signature] MAR 22 2005
reviewed by: [signature] 3-22-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7780
ISOCS/LabSOCS Time: 03/22/05 08:46:52
Template: CIRCULAR PLANE
Custom Description: 2M90D DPM M2
Comment: ISOCS:UNITS=ACT/M^2 2M90D_DPM_M2
Detector: 7780
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.2566e+001 (C)
Mass [Grams]: 1.3823e+006 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	2.37592e-005	10.0	-0.144916	5931
88.03	6.14985e-005	10.0	-0.141681	5931
122.06(X)	8.17325e-005	10.0	-0.134177	5931
165.85	8.48682e-005	8.0	-0.127377	5931
391.69	6.32861e-005	8.0	-0.072313	5931
661.65	5.03248e-005	6.0	-0.058846	5931
898.02	4.56256e-005	6.0	-0.056541	5931
1173.22	4.12360e-005	4.0	-0.055118	5931
1332.49	3.85865e-005	4.0	-0.054660	5931
1836.01	3.29039e-005	4.0	-0.052828	5931

(X) = Crossover Energy

Geometry Composer Report

Date: Thursday, March 17, 2005
Description: 7780_70cm_180d_conc
Comment: 7780_70cm_180d_conc
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7780 70cm 180d conc.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		305.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

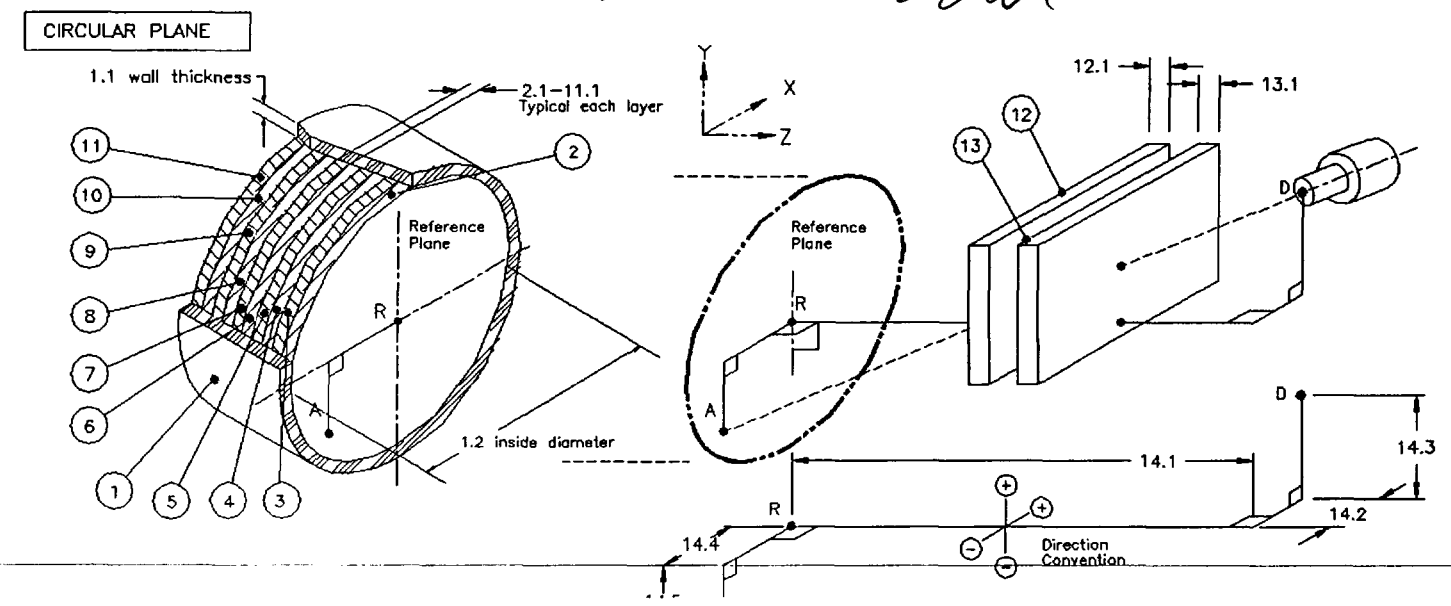
Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by: [signature] MAR 17 2005

Reviewed by: Dale Marshall 3-17-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7780
ISOCS/LabSOCS Time: 03/17/05 12:54:56
Template: CIRCULAR PLANE
Geom Description: 0 70CM 180D CONC
Comment: ISOCS:UNITS=ACT/G 7780_70CM_180D_CONC
Detector: 7780
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 7.3062e+000 (C)
Mass [Grams]: 8.0368e+005 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	6.52760e+000	10.0	-0.169653	2160
88.03	1.96770e+001	10.0	-0.115239	2160
122.06(X)	2.77045e+001	10.0	-0.106404	2160
165.85	2.94035e+001	8.0	-0.112045	2160
391.69	2.14212e+001	8.0	-0.128333	2160
661.65	1.67814e+001	6.0	-0.131237	2160
898.02	1.50363e+001	6.0	-0.129891	2160
1173.22	1.33923e+001	4.0	-0.129915	2160
1332.49	1.25432e+001	4.0	-0.128549	2160
1836.01	1.07643e+001	4.0	-0.122859	2160

(X) = Crossover Energy

Geometry Composer Report

Date: Thursday, March 17, 2005
Description: conc_3m90d
Comment: Surface
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\7780-conc_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

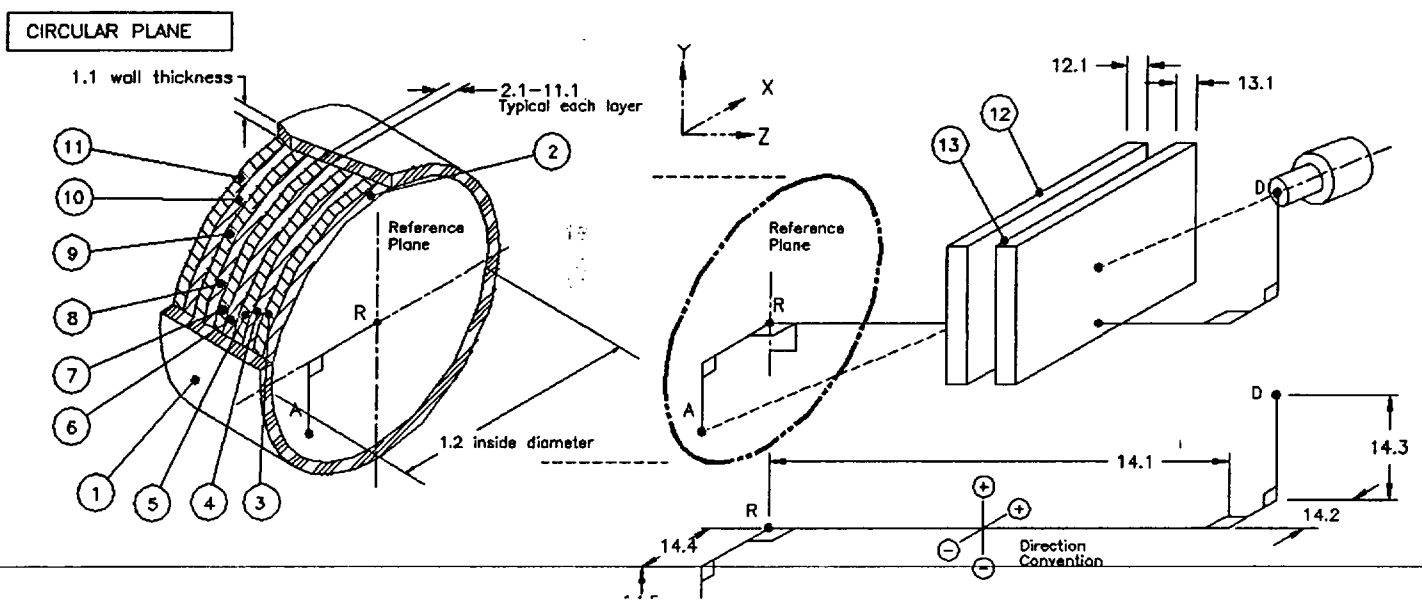
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Prepared by: Dal Randall 3-17-05
approved by:
MAR 17 2005



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\7780-
ISOCS/LabSOCS Time: 03/17/05 09:47:52
Template: CIRCULAR PLANE
Item Description: CONC 3M90D
Comment: ISOCS:UNITS=ACT/G SURFACE
Detector: 7780
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 2.8274e+001 (C)
Mass [Grams]: 3.1102e+006 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	2.56417e+000	10.0	-0.024173	5925
88.03	6.65103e+000	10.0	-0.055892	5925
122.06(X)	8.86075e+000	10.0	-0.071396	5925
165.85	9.22134e+000	8.0	-0.082728	5925
391.69	6.91583e+000	8.0	-0.078364	5925
661.65	5.52178e+000	6.0	-0.058025	5925
898.02	4.99125e+000	6.0	-0.046817	5925
1173.22	4.50485e+000	4.0	-0.039376	5925
1332.49	4.24549e+000	4.0	-0.036490	5925
1836.01	3.62936e+000	4.0	-0.030847	5925

(X) = Crossover Energy

Geometry Composer Report

Date: Thursday, March 17, 2005
Description: conc_3m90d
Comment: Surface
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\7607-conc_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

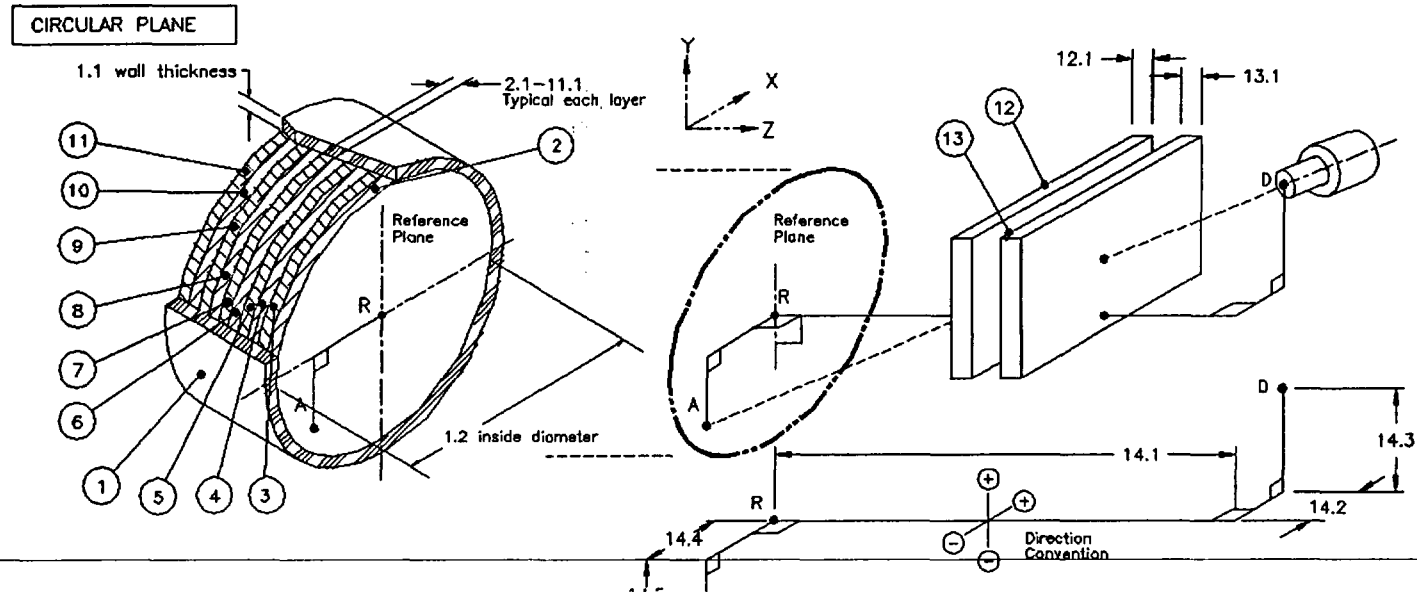
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by: Dale Randall 3-17-05
Approved by: [illegible] MAR 17 2005



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\7607-
ISOCS/LabSOCS Time: 03/17/05 09:59:30
Template: CIRCULAR PLANE
Sample Description: CONC 3M90D
Comment: ISOCS:UNITS=ACT/G SURFACE
Detector: 7607
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 2.8274e+001 (C)
Mass [Grams]: 3.1102e+006 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	3.94106e+000	10.0	-0.149329	6021
88.03	7.81181e+000	10.0	-0.176923	6021
122.06(X)	9.54166e+000	10.0	-0.190685	6021
165.85	9.61322e+000	8.0	-0.197945	6021
391.69	7.00475e+000	8.0	-0.222734	6021
661.65	5.48608e+000	6.0	-0.223138	6021
898.02	4.90429e+000	6.0	-0.218227	6021
1173.22	4.35652e+000	4.0	-0.214518	6021
1332.49	4.13184e+000	4.0	-0.211481	6021
1836.01	3.56980e+000	4.0	-0.205269	6021

(X) = Crossover Energy

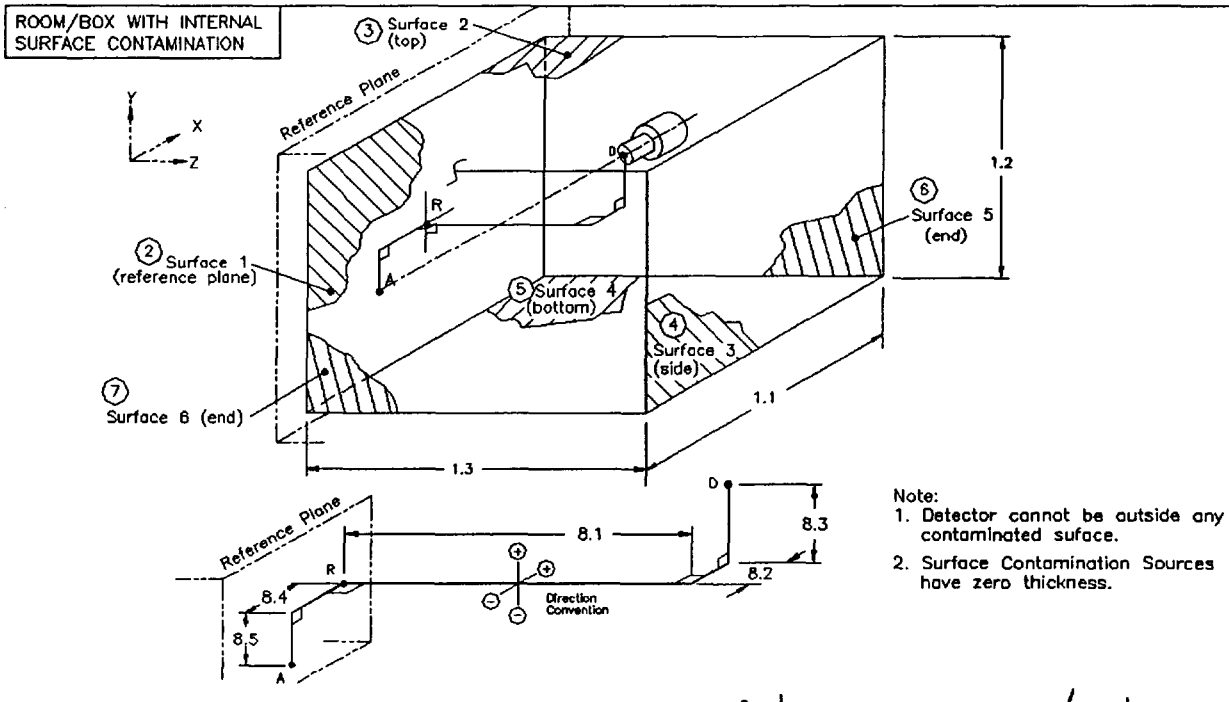
Geometry Composer Report

Date: Tuesday, December 21, 2004
Description: HH_unc_3ft
Comment: HH_unc_3ft
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\ROOM\hh_unc_3ft.geo
Software: ISOCS
Template: ROOM, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(44)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Room/Box Dimensions	4.00	4.00	3.00						
2	Surface 1									1.00
3	Surface 2									1.00
4	Surface 3									
5	Surface 4									1.00
6	Surface 5									1.00
7	Surface 6									1.00
8	Source-Detector	3.00								

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0



Created by: [signature] 12/21/04

Reviewed by: DR 10-17-05
DR

ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\ROOM\hh_unc_3ft.ecc
ISOCS/LabSOCS Time: 12/21/04 09:11:24
Template: ROOM
Geom Description: HH UNC 3FT
Comment: ISOCS:UNITS=ACT/M^2 HH_UNC_3FT
Detector: 7605
Collimator: no collimator
Convergence: 1.00 %
Area [Sq Meters]: 5.9458e+000 (C)
Mass [Grams]: 0.0000e+000 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	6.08183e-004	10.0	-0.016192	1275
88.03	1.24589e-003	10.0	-0.023134	1275
122.06(X)	1.48276e-003	10.0	-0.025916	1275
165.85	1.42270e-003	8.0	-0.029623	1275
391.69	8.09073e-004	8.0	-0.024466	1275
661.65	5.34427e-004	6.0	-0.029760	1275
898.02	4.37247e-004	6.0	-0.022125	1275
1173.22	3.58127e-004	4.0	-0.019842	1275
1332.49	3.24854e-004	4.0	-0.030617	1275
1460.80	3.03679e-004	4.0	-0.024290	1275
1836.01	2.55593e-004	4.0	-0.015047	1275

(X) = Crossover Energy

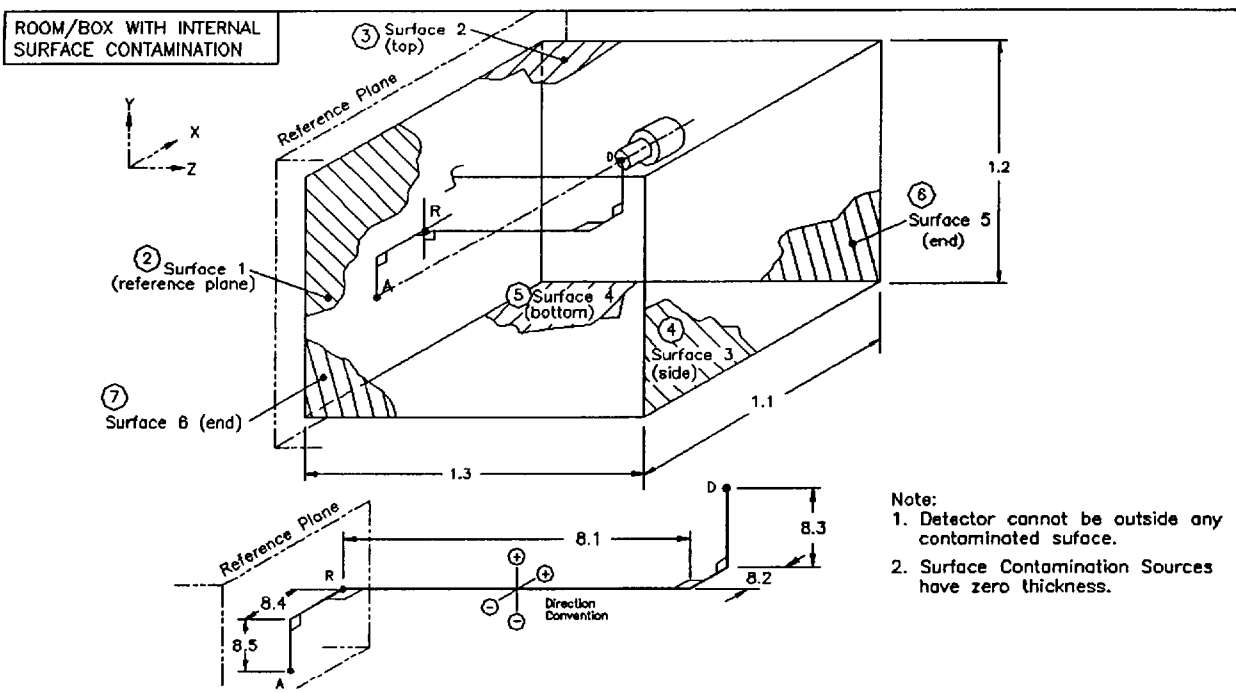
Geometry Composer Report

Date: Tuesday, December 21, 2004
Description: MH_unc_8ft
Comment: MH_unc_8ft
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\ROOM\mh_unc_8ft.geo
Software: ISOCS
Template: ROOM, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(44)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Room/Box Dimensions	10.00	10.00	8.00						
2	Surface 1									1.00
3	Surface 2									1.00
4	Surface 3									
5	Surface 4									1.00
6	Surface 5									1.00
7	Surface 6									1.00
8	Source-Detector	8.00								

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0



Note:
1. Detector cannot be outside any contaminated suface.
2. Surface Contamination Sources have zero thickness.

Created by: [signature] 12/21/04
Reviewed by DRI-17-05

ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\ROOM\mh_unc_8ft.ecc
ISOCS/LabSOCS Time: 12/21/04 09:13:32
Template: ROOM
Geom Description: MH UNC 8FT
Comment: ISOCS:UNITS=ACT/M^2 MH_UNC_8FT
Detector: 7605
Collimator: no collimator
Convergence: 1.00 %
Area [Sq Meters]: 3.9019e+001 (C)
Mass [Grams]: 0.0000e+000 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	6.11202e-004	10.0	-0.016141	1275
88.03	1.25687e-003	10.0	-0.015630	1275
122.06(X)	1.49605e-003	10.0	-0.023738	1275
165.85	1.43891e-003	8.0	-0.024669	1275
391.69	8.21540e-004	8.0	-0.019283	1275
661.65	5.43734e-004	6.0	-0.017515	1275
898.02	4.45113e-004	6.0	-0.010603	1275
1173.22	3.64336e-004	4.0	-0.015795	1275
1332.49	3.30502e-004	4.0	-0.021835	1275
1460.80	3.09822e-004	4.0	-0.020360	1275
1836.01	2.62731e-004	4.0	-0.014185	1275

(X) = Crossover Energy

****
**** LIBRARY LISTING REPORT *****
****

Filename: C:\GENIE2K\CAMFILES\Manhole.NLB

Created by — 12/21/04

Reviewed DR 1-17-05

Nuclide Library Description:

*library identical to backyard.NLB, USED CUSTOM MDA settings for Co-60 + Cs-137 — 1/17/05

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
ANN	3.156E+017	511.000	0.000	100.0000	0.0000
K-40	4.030E+016	1460.810*	0.040	10.6700	0.1100
CO-57	2.348E+007	122.061	0.000	85.9000	1.2000
		136.474*	0.001	10.3300	0.1000
CO-60	1.663E+008	1173.216*	0.021	100.0000	0.0000
		1332.486	0.022	100.0000	0.0000
NB-94	6.406E+011	702.627*	0.019	100.0000	0.0000
		871.099	0.018	100.0000	0.0000
SB-125	8.741E+007	176.334	0.011	6.8900	0.2200
		427.889*	0.015	29.3300	0.2500
		463.383	0.015	10.3500	0.1800
		600.557	0.018	17.8000	0.3000
		606.641	0.019	5.0200	0.0900
		635.895	0.018	11.3200	0.2000
CS-137	9.521E+008	661.649*	0.005	85.1200	0.2400
EU-152	4.292E+008	121.779	0.000	28.4000	0.7000
		244.693	0.001	7.4900	0.1600
		344.272	0.002	26.5000	0.4000
		443.979	0.006	2.8100	0.0700
		778.890	0.009	12.7400	0.2500
		867.320	0.010	4.1600	0.1400
		964.010	0.030	14.4000	0.3000
		1085.780	0.010	10.0000	0.3000
		1112.020	0.010	13.3000	0.3000
		1407.954*	0.010	20.7000	0.5000
EU-154	2.777E+008	123.070	0.004	40.5000	1.5000
		247.939	0.008	6.6000	0.2500
		591.810	0.040	4.8300	0.1900
		692.410	0.050	1.6900	0.0700
		723.300	0.040	19.7000	0.8000
		756.870	0.050	4.3300	0.1800
		873.190	0.050	11.5000	0.5000
		996.320	0.040	10.3000	0.4000
		1004.760	0.040	17.9000	0.7000
		1274.450*	0.090	35.5000	1.3000
		1596.530	0.150	1.8500	0.1200
TL-208	4.434E+017	277.351	0.010	6.8000	0.3000
		510.840	0.080	21.6000	0.9000
		583.139*	0.023	84.2000	1.4000
		763.130	0.080	1.6400	0.0900
		860.370	0.080	12.4600	0.2100
BI-212	4.433E+017	727.170*	0.100	11.8000	0.3000
		785.460	0.070	1.9700	0.0500
		1620.620	0.100	2.7500	0.1000

PB-212	4.433E+017	74.810	0.001	10.7000	0.5000

Library Title:

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
PB-212	4.433E+017	77.108	0.001	18.0000	0.7000
		87.300	0.000	8.0000	0.4000
		238.625*	0.006	44.6000	1.0000
		300.087	0.100	3.4100	0.0100
BI-214	5.049E+010	609.312*	0.007	44.8000	0.5000
		665.453	0.022	1.2900	0.0300
		768.356	0.010	4.8000	0.0700
		806.174	0.018	1.1200	0.0300
		934.061	0.012	3.0300	0.0500
		1120.287	0.010	14.8000	0.2000
		1155.190	0.020	1.6400	0.0400
		1238.110	0.012	5.8600	0.0800
		1280.960	0.020	1.4400	0.0300
		1377.669	0.012	3.9200	0.0800
		1401.500	0.040	1.5500	0.1700
		1407.980	0.040	2.8000	0.4000
		1509.228	0.015	2.1200	0.0400
		1661.280	0.060	1.1400	0.0300
		1729.595	0.015	2.8800	0.0600
		1764.494	0.014	15.3600	0.2000
		1847.420	0.030	2.0400	0.0400
		2118.550	0.030	1.1400	0.0300
		2204.210	0.040	4.8600	0.0900
		2447.860	0.100	1.5000	0.0400
PB-214	5.049E+010	53.226	0.014	1.1100	0.0600
		74.815	0.001	6.2100	0.2300
		77.108	0.001	10.5000	0.4000
		87.300	0.000	4.6700	0.1800
		241.981	0.008	7.4900	0.2100
		295.213	0.008	19.2000	0.6000
		351.921*	0.008	37.2000	1.1000
RA-226	5.049E+010	186.100*	0.100	3.5000	0.0500
AC-228	4.434E+017	89.953	0.002	2.1000	1.0000
		93.350	0.002	3.5000	1.5000
		105.000	0.000	1.6000	0.7000
		129.080	0.050	2.8000	0.9000
		209.280	0.100	4.4000	1.4000
		270.230	0.100	3.6000	0.8000
		327.640	0.100	3.2000	0.7000
		338.320	0.100	11.4000	2.3000
		409.510	0.100	2.1300	0.2400
		463.000	0.100	4.4000	0.5000
		794.700	0.200	4.6000	0.5000
		835.500	0.300	1.7500	0.1800
		911.070*	0.030	27.7000	1.0000
		964.600	0.300	5.2000	0.6000
		969.110	0.100	16.6000	1.8000
		1588.000	0.200	3.5000	0.6000
PA-234M	1.410E+017	1001.030	0.030	0.5890	0.0001
TH-234	1.410E+017	63.290*	0.020	3.8000	0.3000
		92.590	0.010	5.4100	0.2200

U-235	2.221E+016	89.953	0.002	2.8000	0.9000

Library Title:

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
U-235	2.221E+016	93.350	0.002	4.5000	1.4000
		143.760*	0.020	10.9000	0.2300
		185.715	0.005	57.5000	1.1000
AM-241	1.364E+010	59.537	0.001	35.9000	0.6000

* = key line

TOTALS: 20 Nuclides 101 Energy Lines

Geometry Composer Report

Date: Thursday, March 03, 2005
Description: 50cm_50_180d_soil → 7605_50cm_180d_soil 3/8/05
Comment: 50cm_50_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\50cm 50 180d soil.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

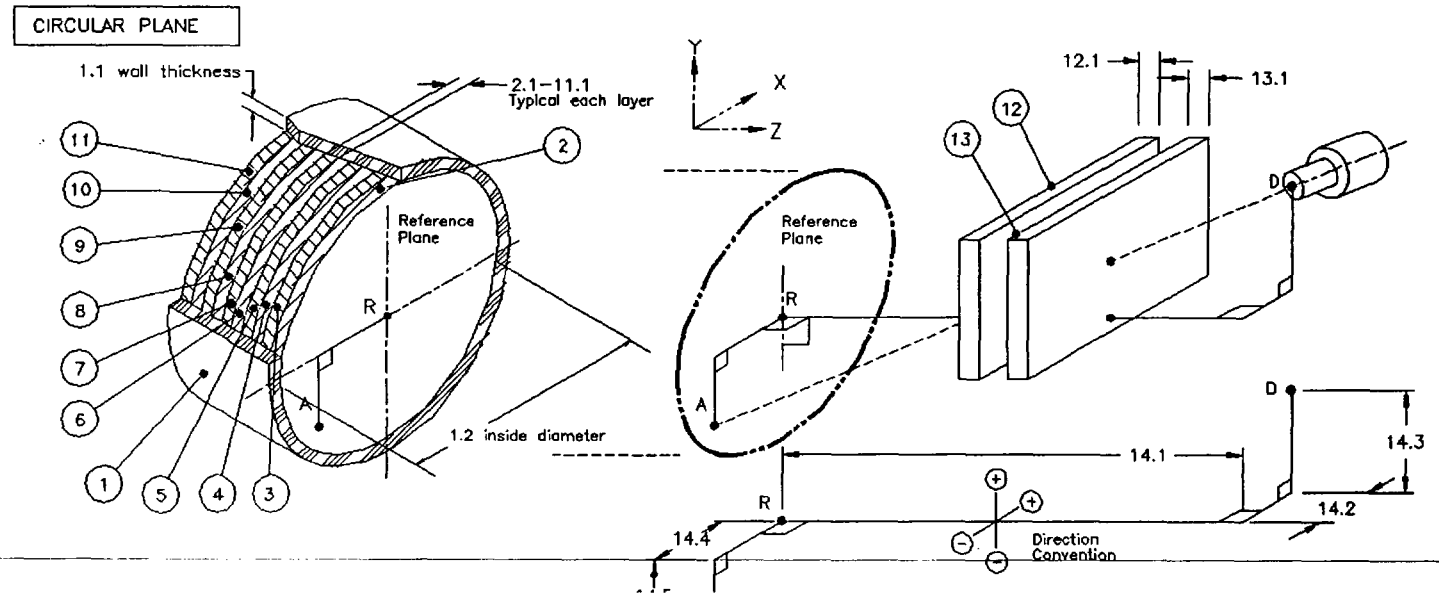
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		500.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	50.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by — MAR 03 2005)
Reviewed by DR 3-8-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\50cm
ISOCS/LabSOCS Time: 03/03/05 13:20:12
Template: CIRCULAR PLANE
Geom Description: 0CM 50 180D SOIL
Comment: ISOCS:UNITS=ACT/G 50CM_50_180D_SOIL
Detector: 7605
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.9635e+001 (C)
Mass [Grams]: 4.7124e+006 (C)
Length [Meters]: not used

(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	8.41312e+000	10.0	-0.067455	10195
88.03	2.48424e+001	10.0	-0.241909	5085
122.06(X)	3.52422e+001	10.0	-0.255802	5085
165.85	3.79479e+001	8.0	-0.279619	5085
391.69	2.99791e+001	8.0	-0.297975	5085
661.65	2.48488e+001	6.0	-0.287013	5085
898.02	2.33827e+001	6.0	-0.279770	5085
1173.22	2.16750e+001	4.0	-0.274573	5085
1332.49	2.09175e+001	4.0	-0.273896	5085
1836.01	1.87584e+001	4.0	-0.270961	5085

(X) = Crossover Energy

Geometry Composer Report

Date: Thursday, March 03, 2005
Description: 1m_50_180d_soil → 7605-1M-180d_soil m 3/8/05
Comment: 1m_50_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\1m 50 180d soil.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		1000.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	100.00								

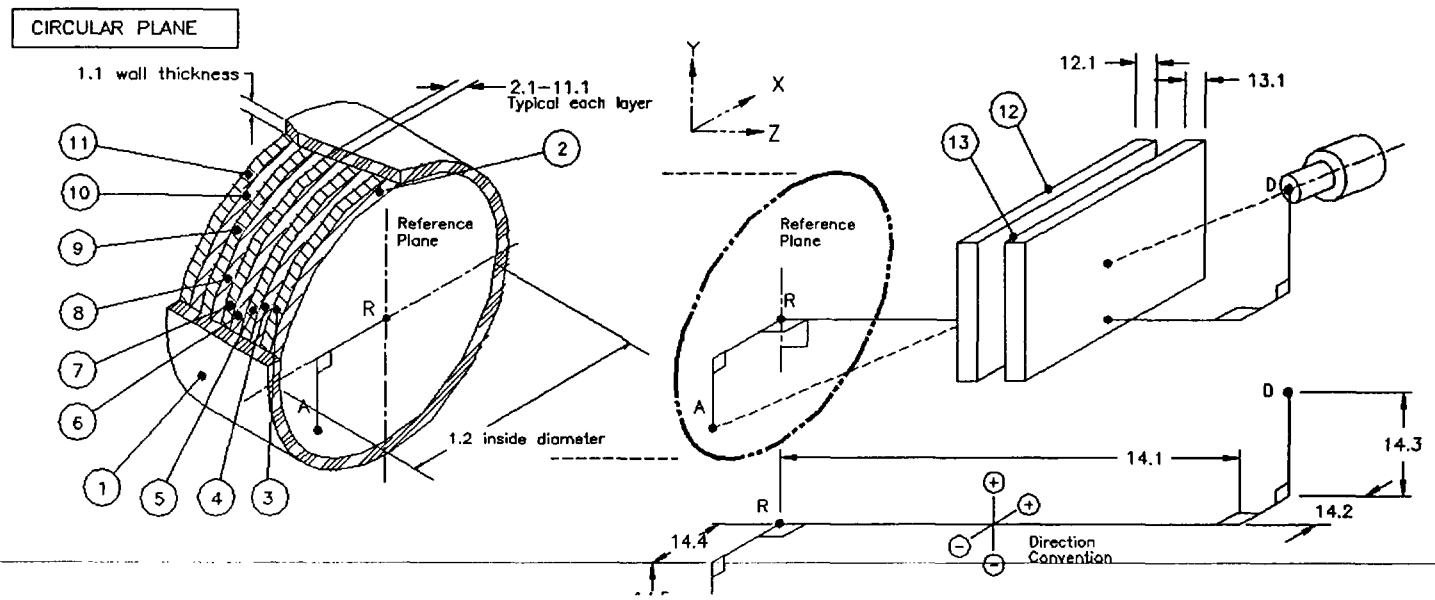
Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by m
Reviewed by DR 3-8-05

MAR 03 2005



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\1m 50
ISOCS/LabSOCS Time: 03/03/05 13:22:48
Template: CIRCULAR PLANE
Geom Description: 1M 50 180D SOIL
Comment: ISOCS:UNITS=ACT/G 1M_50_180D_SOIL
Detector: 7605
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 7.8540e+001 (C)
Mass [Grams]: 1.8850e+007 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	8.24497e+000	10.0	-0.315376	10200
88.03	2.46091e+001	10.0	-0.212570	5080
122.06(X)	3.49083e+001	10.0	-0.197436	5080
165.85	3.76726e+001	8.0	-0.204422	5080
391.69	2.98159e+001	8.0	-0.182652	5080
661.65	2.48521e+001	6.0	-0.160587	5080
898.02	2.34263e+001	6.0	-0.153168	5080
1173.22	2.16096e+001	4.0	-0.151068	5080
1332.49	2.08812e+001	4.0	-0.150952	5080
1836.01	1.88450e+001	4.0	-0.148356	5080

(X) = Crossover Energy

Geometry Composer Report

Date: Tuesday, March 08, 2005
Description: 7607_50cm_180d_soil
Comment: 7607_50cm_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7607 50cm 180d soil.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

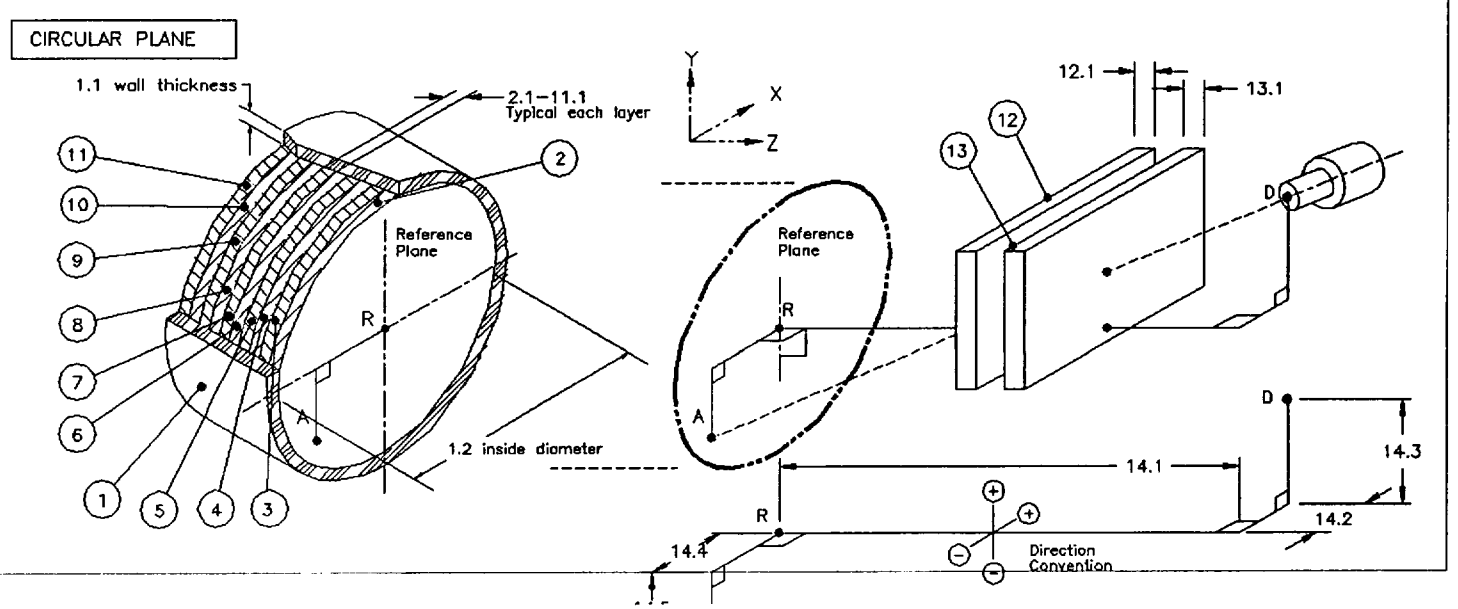
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		500.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	50.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] MAR 08 2005
reviewed by [illegible] 3-8-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7607
ISOCS/LabSOCS Time: 03/08/05 09:41:58
Template: CIRCULAR PLANE
Geom Description: 7 50CM 180D SOIL
Comment: ISOCS:UNITS=ACT/G 7607_50CM_180D_SOIL
Detector: 7607
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.9635e+001 (C)
Mass [Grams]: 4.7124e+006 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	1.33456e+001	10.0	-0.219056	10175
88.03	2.92994e+001	10.0	-0.146812	10175
122.06(X)	3.75674e+001	10.0	-0.135412	10175
165.85	3.89963e+001	8.0	0.149927	5065
391.69	3.00597e+001	8.0	0.129098	5065
661.65	2.46940e+001	6.0	0.129771	5065
898.02	2.29202e+001	6.0	0.128124	5065
1173.22	2.13925e+001	4.0	0.125586	5065
1332.49	2.08678e+001	4.0	0.130185	5065
1836.01	1.88956e+001	4.0	0.129370	5065

(X) = Crossover Energy

Geometry Composer Report

Date: Tuesday, March 08, 2005
Description: 7607_1m_180d_soil
Comment: 7607_1m_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7607 1m 180d soil.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

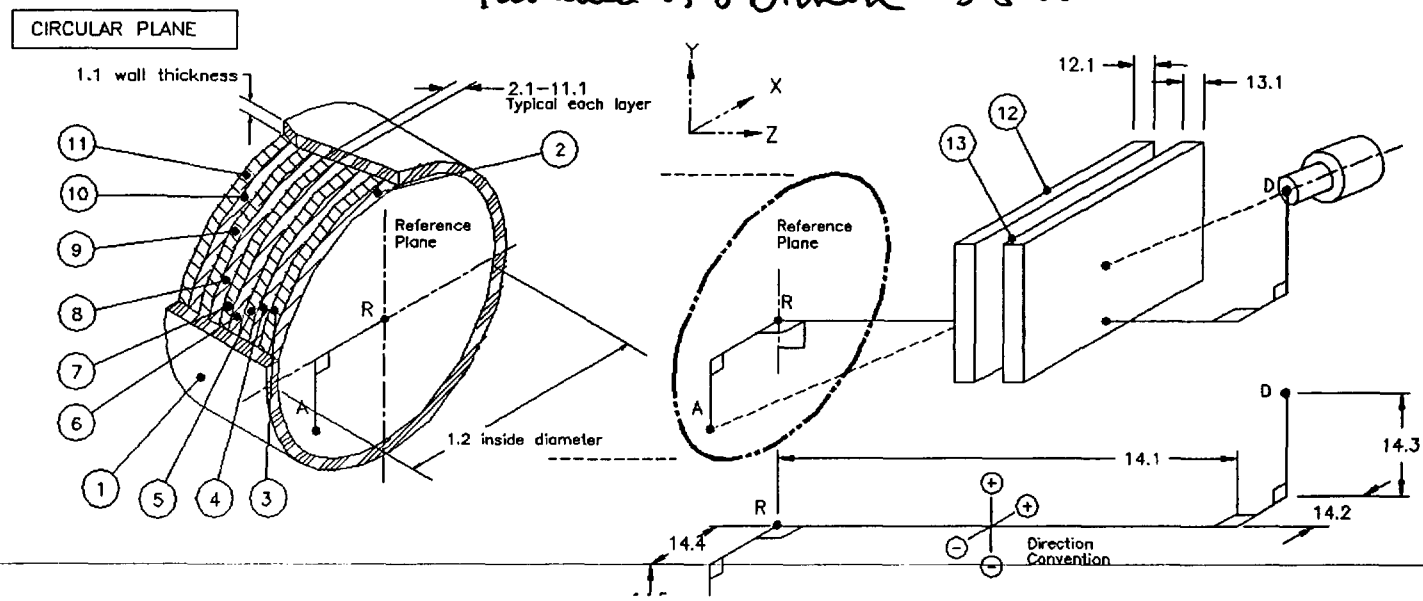
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		1000.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	100.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible]
MAR 08 2005
reviewed by [illegible] 3-8-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7607
ISOCS/LabSOCS Time: 03/08/05 09:40:00
Template: CIRCULAR PLANE
Geom Description: 607 1M 180D SOIL
Comment: ISOCS:UNITS=ACT/G 7607_1M_180D_SOIL
Detector: 7607
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 7.8540e+001 (C)
Mass [Grams]: 1.8850e+007 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	1.31514e+001	10.0	-0.078452	10185
88.03	2.89588e+001	10.0	-0.214924	5075
122.06(X)	3.71739e+001	10.0	-0.202822	5075
165.85	3.84807e+001	8.0	-0.194693	5075
391.69	2.98095e+001	8.0	-0.134455	5075
661.65	2.46440e+001	6.0	-0.123782	5075
898.02	2.29023e+001	6.0	-0.119966	5075
1173.22	2.13219e+001	4.0	-0.117832	5075
1332.49	2.07417e+001	4.0	-0.113292	5075
1836.01	1.88818e+001	4.0	-0.105780	5075

(X) = Crossover Energy

Geometry Composer Report

Date: Monday, March 07, 2005
Description: MH_180_8ft
Comment: MH_180_8ft
File Name: c:\genie2k\isocs\data\geometry\in-situ\room\7607_mh_180_8ft.geo
Software: ISOCS
Template: ROOM, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Room/Box Dimensions	10.00	10.00	8.00						
2	Surface 1									1.00
3	Surface 2									1.00
4	Surface 3									
5	Surface 4									1.00
6	Surface 5									1.00
7	Surface 6									1.00
8	Source-Detector	8.00								

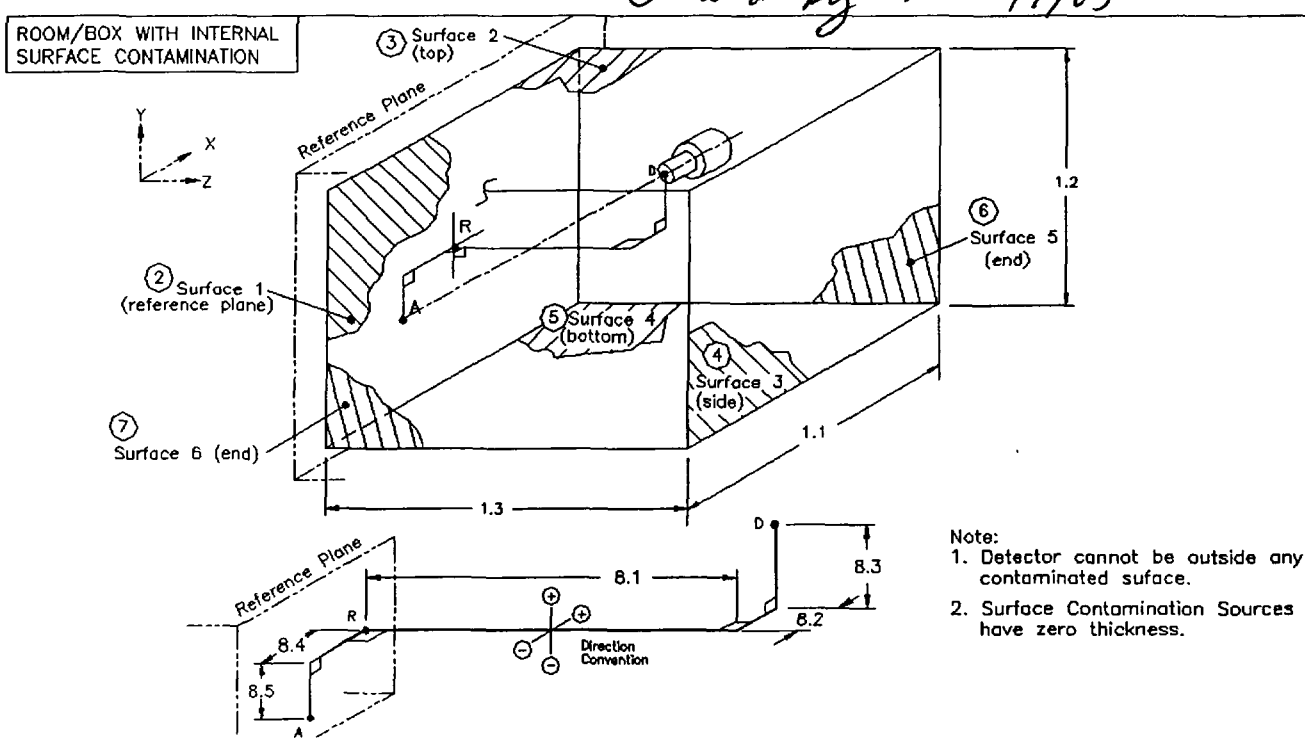
Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0

reviewed by [illegible] 3-7-05

Created by [illegible] 3/7/05



Note:
1. Detector cannot be outside any contaminated suface.
2. Surface Contamination Sources have zero thickness.

ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\ROOM\7607_mh_180_8ft
ISOCS/LabSOCS Time: 03/07/05 15:03:20
Template: ROOM
Room Description: MH 180 8FT
Comment: ISOCS:UNITS=ACT/M^2 MH_180_8FT
Detector: 7607
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 3.9019e+001 (C)
Mass [Grams]: 0.0000e+000 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	4.54793e-004	10.0	-0.147979	1275
88.03	6.99483e-004	10.0	-0.177263	1275
122.06(X)	7.57872e-004	10.0	-0.195371	1275
165.85	7.00162e-004	8.0	-0.191989	1275
391.69	4.06257e-004	8.0	-0.141906	1275
661.65	2.80178e-004	6.0	-0.123770	1275
898.02	2.35325e-004	6.0	-0.108559	1275
1173.22	1.98352e-004	4.0	-0.108084	1275
1332.49	1.85654e-004	4.0	-0.101222	1275
1460.80	1.76243e-004	4.0	-0.096438	1275
1836.01	1.53015e-004	4.0	-0.086273	1275

(X) = Crossover Energy

Geometry Composer Report

Date: Monday, March 07, 2005
Description: MH_180_1m
Comment: MH_180_1m
File Name: c:\genie2k\isocs\data\geometry\in-situ\room\7607_mh_180_1m.geo
Software: ISOCS
Template: ROOM, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

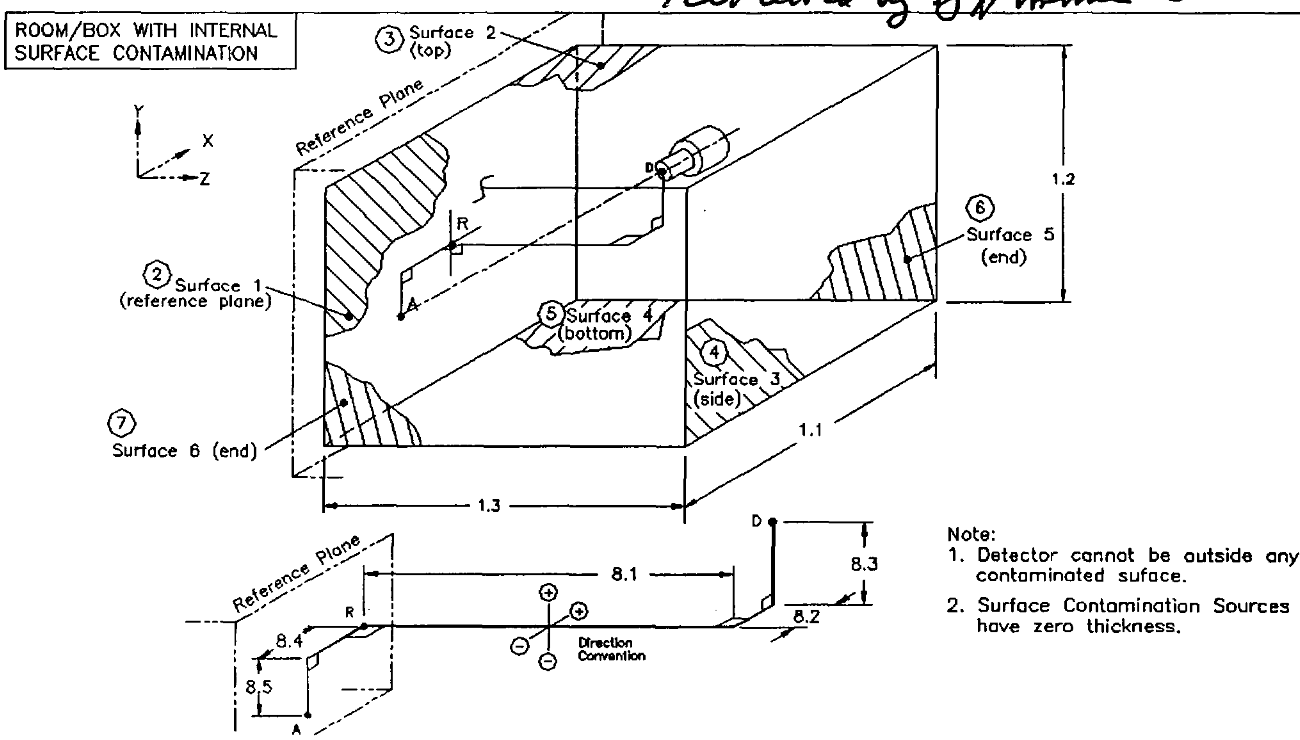
#	Geometry Compon.	d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
		Dimensions (m):								
1	Room/Box Dimensions	3.05	3.05	1.00						
2	Surface 1									1.00
3	Surface 2									1.00
4	Surface 3									
5	Surface 4									1.00
6	Surface 5									1.00
7	Surface 6									1.00
8	Source-Detector	1.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8
1836.0

Created by [illegible] 3/7/05
Reviewed by [illegible] 3-7-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\ROOM\7607_mh_180_1m.
ISOCS/LabSOCS Time: 03/07/05 15:00:32
Template: ROOM
Room Description: MH 180 1M
Comment: ISOCS:UNITS=ACT/M^2 MH_180_1M
Detector: 7607
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 2.1482e+001 (C)
Mass [Grams]: 0.0000e+000 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	4.52050e-004	10.0	-0.208603	1275
88.03	6.92991e-004	10.0	-0.208956	1275
122.06(X)	7.48742e-004	10.0	-0.228530	1275
165.85	6.89386e-004	8.0	-0.238266	1275
391.69	3.97717e-004	8.0	-0.216960	1275
661.65	2.73852e-004	6.0	-0.196268	1275
898.02	2.28694e-004	6.0	-0.187078	1275
1173.22	1.94594e-004	4.0	-0.180814	1275
1332.49	1.81695e-004	4.0	-0.178288	1275
1460.80	1.72254e-004	4.0	-0.175343	1275
1836.01	1.49047e-004	4.0	-0.171103	1275

(X) = Crossover Energy

Geometry Composer Report

Date: Tuesday, February 22, 2005
Description: Conc_70cm90d
Comment: Surface
File Name: c:\7780 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7780-conc_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

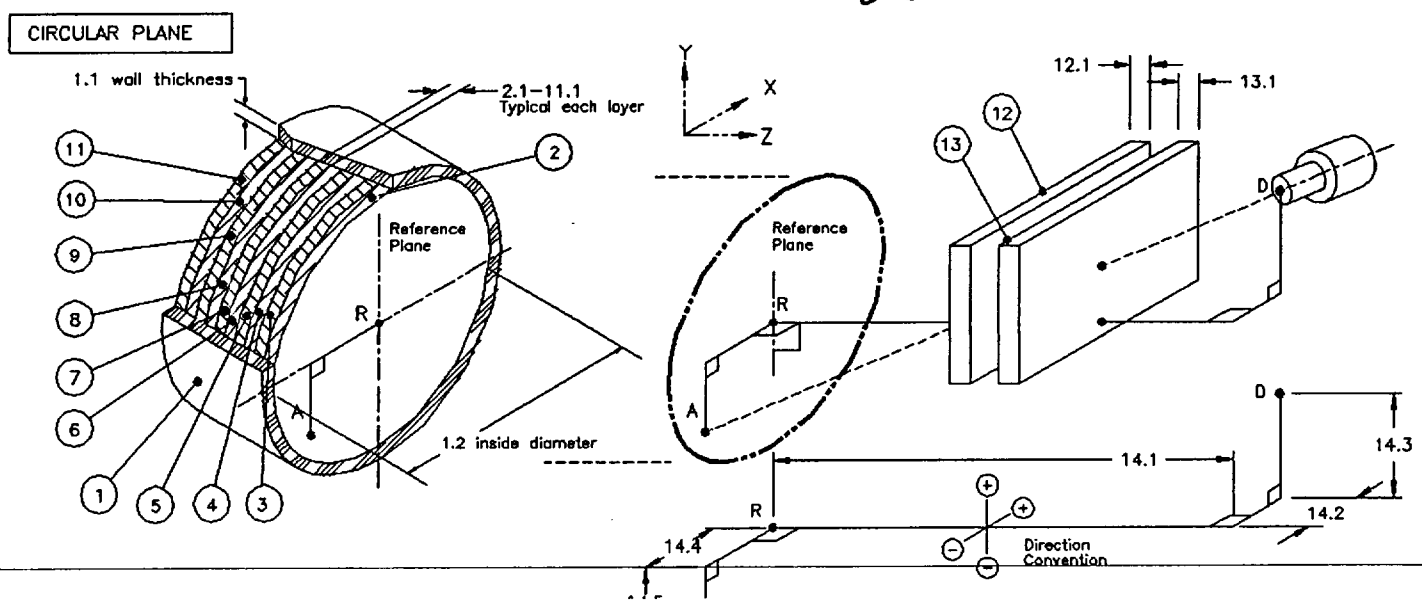
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] FEB 22 2005
Reviewed by [illegible] 2-22-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\7780 Backup\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR
ISOCS/LabSOCS Time: 02/22/05 14:19:28
Template: CIRCULAR PLANE
Item Description: CONC 70CM90D
Comment: ISOCS:UNITS=ACT/G SURFACE
Detector: 7780
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.5394e+000 (C)
Mass [Grams]: 1.6933e+005 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	2.68747e+000	10.0	-0.120051	6057
88.03	6.92620e+000	10.0	-0.052721	6057
122.06(X)	9.15756e+000	10.0	-0.038098	6057
165.85	9.49536e+000	8.0	-0.037521	6057
391.69	7.04277e+000	8.0	-0.064532	6057
661.65	5.61237e+000	6.0	-0.082421	6057
898.02	5.06550e+000	6.0	-0.089371	6057
1173.22	4.55383e+000	4.0	-0.093553	6057
1332.49	4.26281e+000	4.0	-0.093748	6057
1836.01	3.60457e+000	4.0	-0.093925	6057

(X) = Crossover Energy

2-22-05

Geometry Composer Report

Date: Tuesday, February 22, 2005
Description: conc_70cm90d
Comment: Surface
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-conc_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

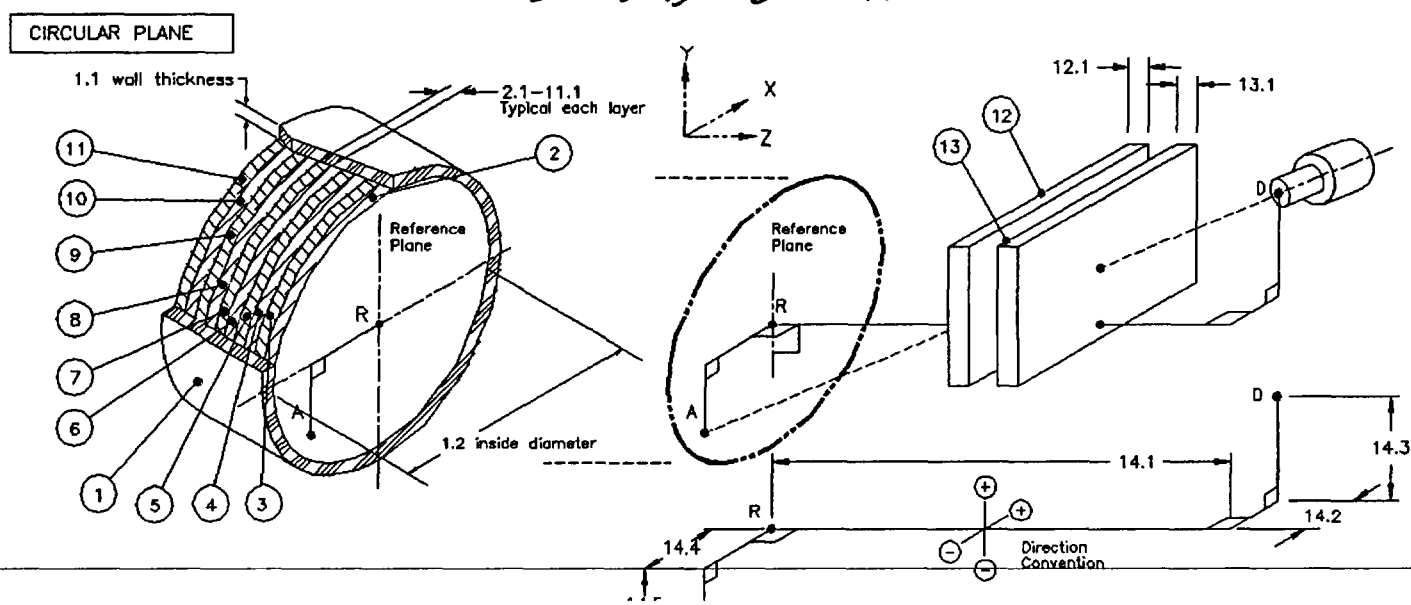
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by — FEB 22 2005
Reviewed by: JPL Ambrose 2-22-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\7605 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\CIRCULAR
ISOCS/LabSOCS Time: 02/10/05 09:30:30
Template: CIRCULAR PLANE
Sample Description: SOIL 70CM90D
Comment: ISOCS:UNITS=ACT/G SURFACE
Detector: 7605
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.5394e+000 (C)
Mass [Grams]: 3.6945e+005 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	4.78875e+000	10.0	0.134363	9865
88.03	9.26871e+000	10.0	0.105107	9865
122.06(X)	1.13873e+001	10.0	0.089517	9865
165.85	1.16348e+001	8.0	0.075893	9865
391.69	9.24703e+000	8.0	0.028496	9865
661.65	7.71403e+000	6.0	-0.002236	9865
898.02	7.13931e+000	6.0	-0.014010	9865
1173.22	6.60896e+000	4.0	-0.021739	9865
1332.49	6.37225e+000	4.0	-0.023763	9865
1836.01	5.61215e+000	4.0	-0.030414	9865

(X) = Crossover Energy

DSq
2-22-05

Geometry Composer Report

Date:	Tuesday, February 22, 2005
Description:	Conc_70cm90d
Comment:	Surface
File Name:	c:\7607 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7607-conc_70cm90d.geo
Software:	ISOCS
Template:	CIRCULAR_PLANE, Version: default
Detector:	7607
Environment:	Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration:	Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

Dimensions (cm):

#	Geometry Compon.	d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

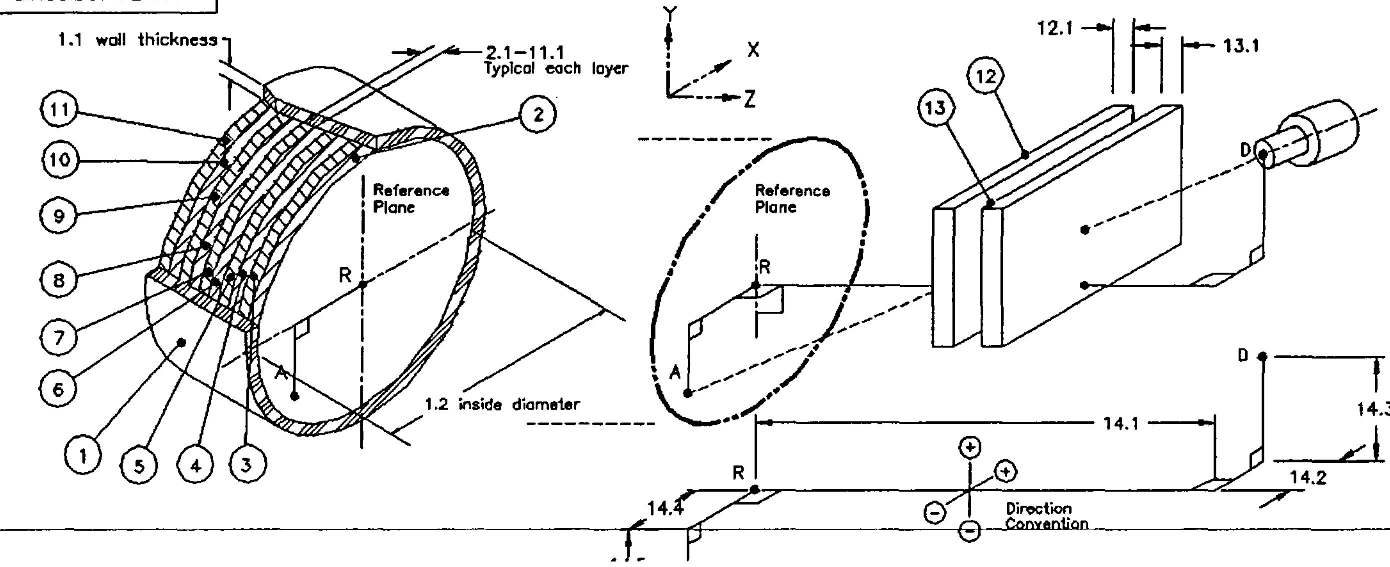
List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [signature] FEB 22 2005

Reviewed by [signature] 2-22-05

CIRCULAR PLANE



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\7607 Backup\GENIE2K\Isocs\Data\Geometry\In-Situ\CIRCULAR
ISOCS/LabSOCS Time: 02/22/05 14:17:40
Template: CIRCULAR PLANE
Sample Description: CONC 70CM90D
Comment: ISOCS:UNITS=ACT/G SURFACE
Detector: 7607
Collimator: 50MM-90D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.5394e+000 (C)
Mass [Grams]: 1.6933e+005 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	4.16464e+000	10.0	-0.055423	6126
88.03	8.14118e+000	10.0	-0.035452	6126
122.06(X)	9.89475e+000	10.0	-0.020974	6126
165.85	9.90635e+000	8.0	-0.002232	6126
391.69	7.15448e+000	8.0	0.038111	6126
661.65	5.57035e+000	6.0	0.038732	6126
898.02	4.93723e+000	6.0	0.035941	6126
1173.22	4.44073e+000	4.0	0.033756	6126
1332.49	4.19713e+000	4.0	0.033284	6126
1836.01	3.54407e+000	4.0	0.031635	6126

(X) = Crossover Energy

JA 2-22-05

Geometry Composer Report

Date: Tuesday, February 22, 2005
Description: MH_180_8ft
Comment: MH_180_8ft
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\room\mh_180_8ft.geo
Software: ISOCS
Template: ROOM, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

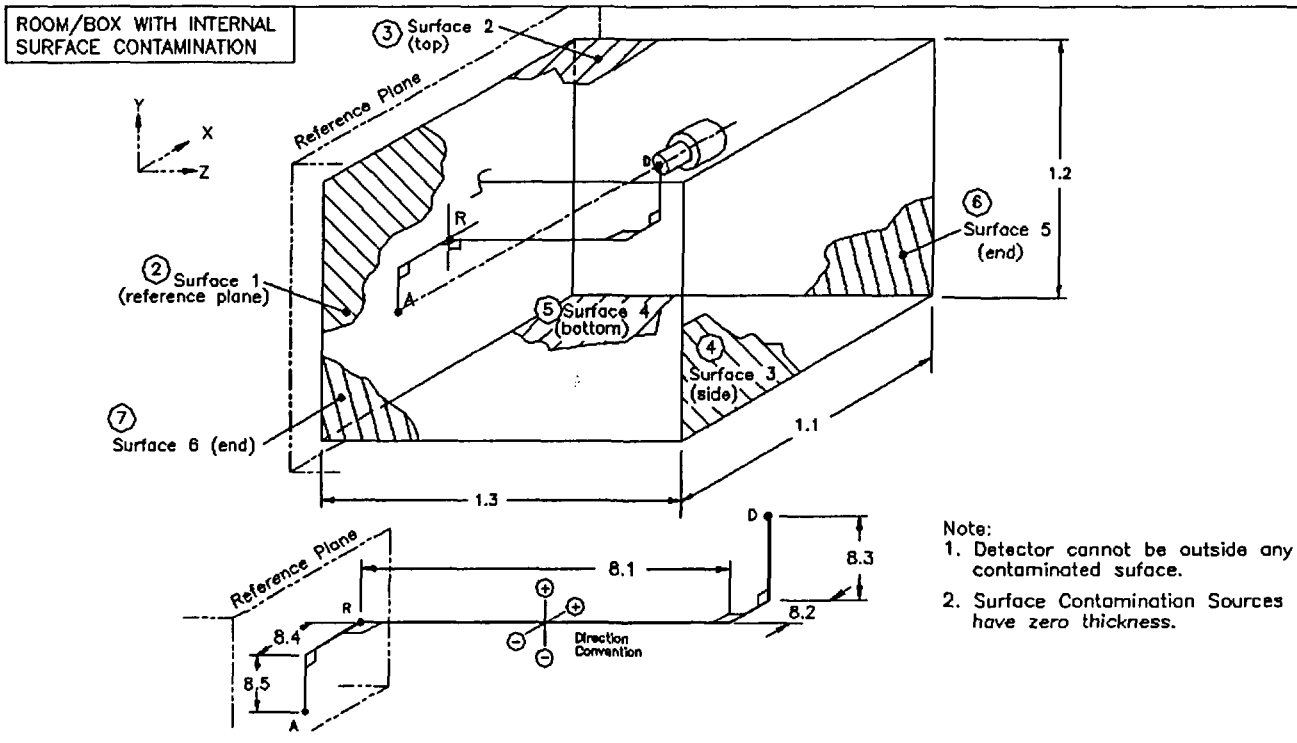
#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Room/Box Dimensions	10.00	10.00	8.00						
2	Surface 1									1.00
3	Surface 2									1.00
4	Surface 3									
5	Surface 4									1.00
6	Surface 5									1.00
7	Surface 6									1.00
8	Source-Detector	8.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0

Created by: m FEB 22 2005
reviewed by: [illegible] 2-22-05



Note:
1. Detector cannot be outside any contaminated suface.
2. Surface Contamination Sources have zero thickness.

ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\7605 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\ROOM\mh_
ISOCS/LabSOCS Time: 02/22/05 13:51:58
Template: ROOM
Room Description: MH 180 8FT
Comment: ISOCS:UNITS=ACT/M^2 MH_180_8FT
Detector: 7605
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 3.9019e+001 (C)
Mass [Grams]: 0.0000e+000 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	4.19547e-004	10.0	-0.104913	1275
88.03	6.77032e-004	10.0	-0.101510	1275
122.06(X)	7.50638e-004	10.0	-0.128118	1275
165.85	7.01914e-004	8.0	-0.153635	1275
391.69	4.11232e-004	8.0	-0.204153	1275
661.65	2.84378e-004	6.0	-0.204868	1275
898.02	2.38147e-004	6.0	-0.203937	1275
1173.22	2.02261e-004	4.0	-0.207610	1275
1332.49	1.90143e-004	4.0	-0.202316	1275
1460.80	1.78158e-004	4.0	-0.193225	1275
1836.01	1.51593e-004	4.0	-0.179616	1275

'X) = Crossover Energy

2-22-05

Geometry Composer Report

Date: Tuesday, February 22, 2005
Description: HH_180_3ft
Comment: HH_180_3ft
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\room\hh_180_3ft.geo
Software: ISOCS
Template: ROOM, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

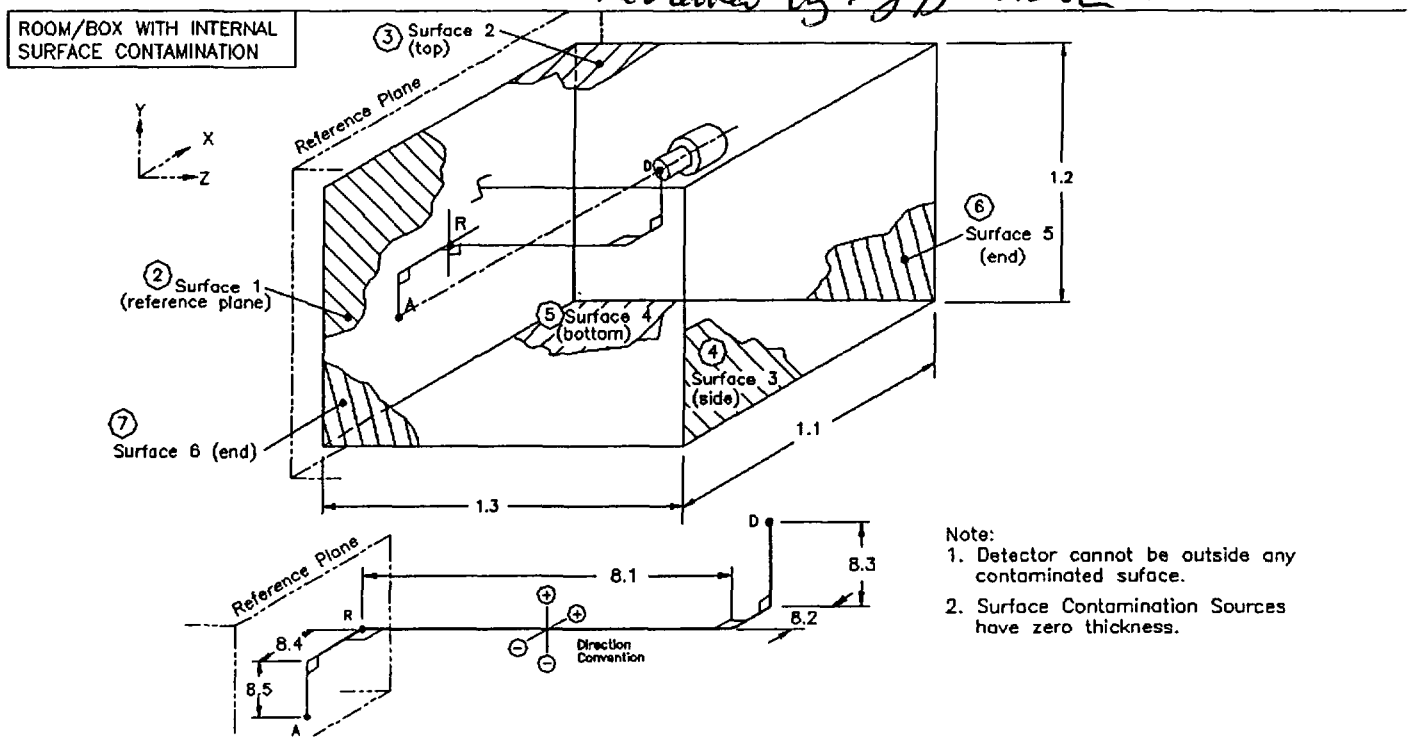
#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Room/Box Dimensions	3.00	3.00	3.00						
2	Surface 1									1.00
3	Surface 2									1.00
4	Surface 3									
5	Surface 4									1.00
6	Surface 5									1.00
7	Surface 6									1.00
8	Source-Detector	3.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0

Created by → FEB 22 2005
Reviewed by: JJP 2-22-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\7605 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\ROOM\hh_
ISOCS/LabSOCS Time: 02/22/05 13:54:30
Template: ROOM
Room Description: HH 180 3FT
Comment: ISOCS:UNITS=ACT/M^2 HH_180_3FT
Detector: 7605
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 4.1806e+000 (C)
Mass [Grams]: 0.0000e+000 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Area)	%Uncertainty	%Convergence	Final # of Voxels
59.54	4.71242e-004	10.0	-0.147597	1275
88.03	7.54275e-004	10.0	-0.160207	1275
122.06(X)	8.36609e-004	10.0	-0.187597	1275
165.85	7.80346e-004	8.0	-0.205902	1275
391.69	4.52659e-004	8.0	-0.159143	1275
661.65	3.13630e-004	6.0	-0.139782	1275
898.02	2.59786e-004	6.0	-0.134492	1275
1173.22	2.19919e-004	4.0	-0.130769	1275
1332.49	2.05466e-004	4.0	-0.124345	1275
1460.80	1.93075e-004	4.0	-0.129582	1275
1836.01	1.64481e-004	4.0	-0.137509	1275

(X) = Crossover Energy

2-22-05

Geometry Composer Report

Date: Thursday, February 10, 2005
Description: Soil_70cm90d
Comment: Surface
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-soil_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

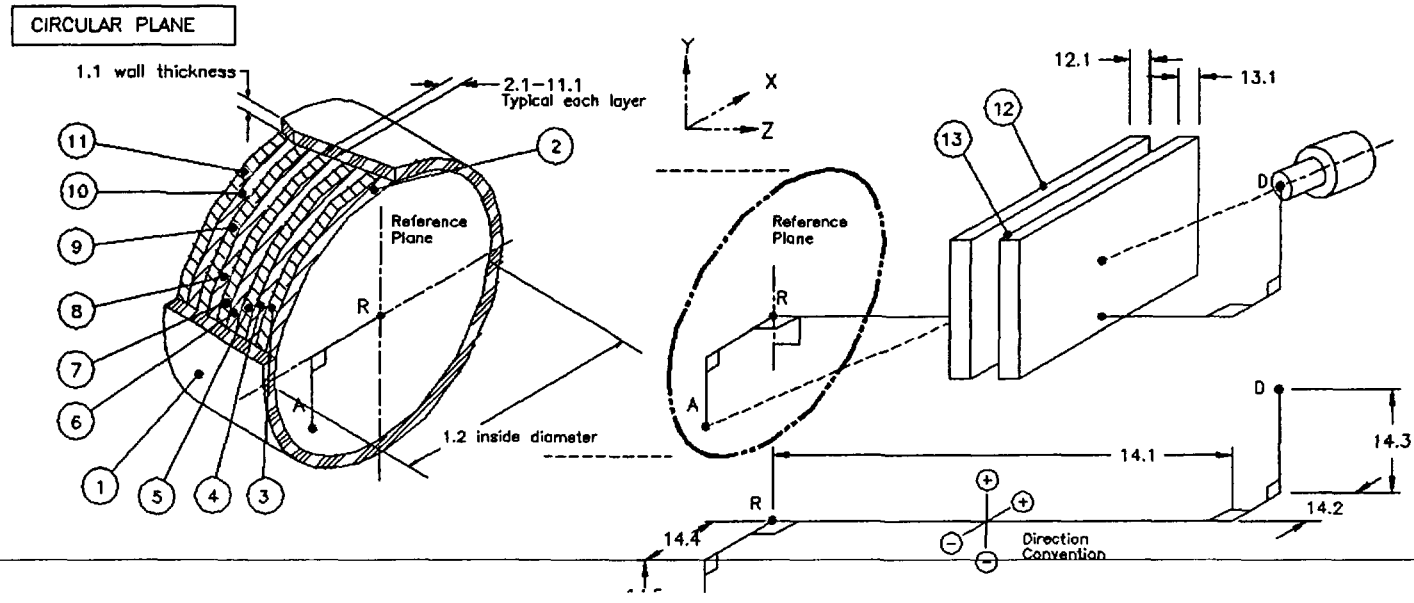
ORIGINAL

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by FEB 10 2005
Reviewed by 2-10-05



Geometry Composer Report

Date:	Thursday, February 10, 2005
Description:	Soil_3m90d
Comment:	Surface
File Name:	c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-soil_3m90d.geo
Software:	ISOCS
Template:	CIRCULAR_PLANE, Version: default
Detector:	7605
Environment:	Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration:	Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

Dimensions (cm):

#	Geometry Compon.	d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

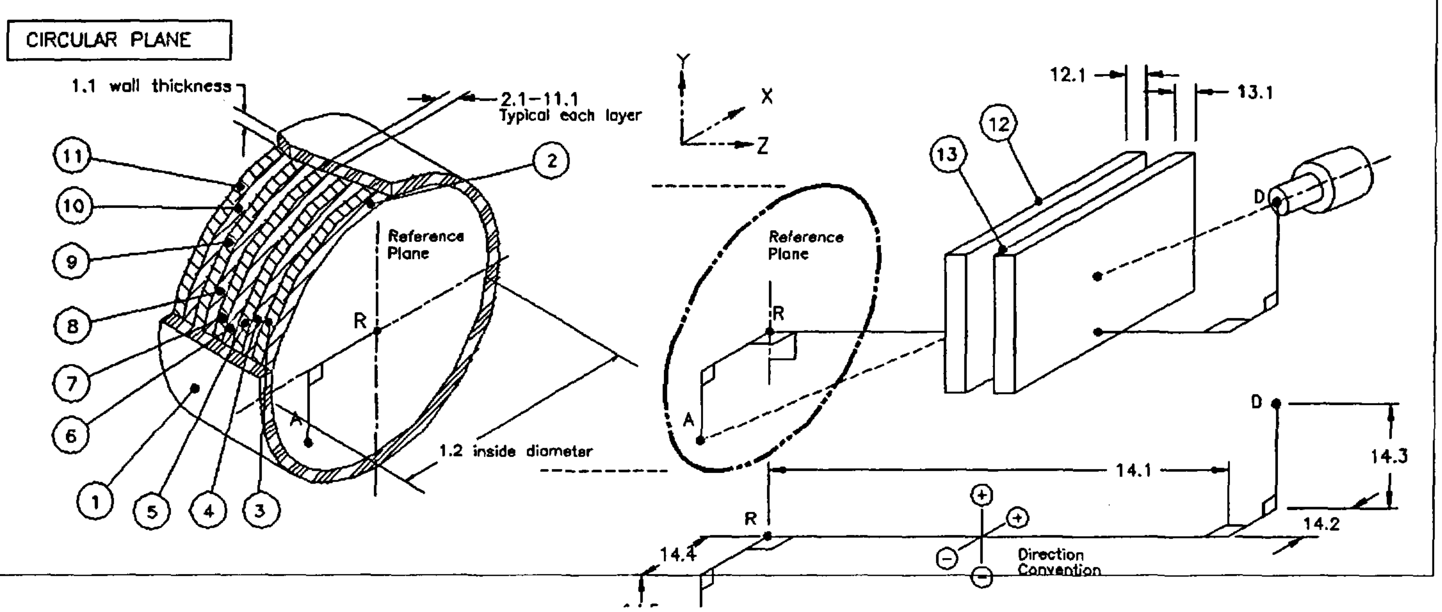
ORIGINAL

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [signature] FEB 10 2005
Reviewed by [signature] 2-10-05



Geometry Composer Report

Date: Thursday, February 10, 2005
Description: Soil_2m90d
Comment: Surface
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-soil_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

ORIGINAL

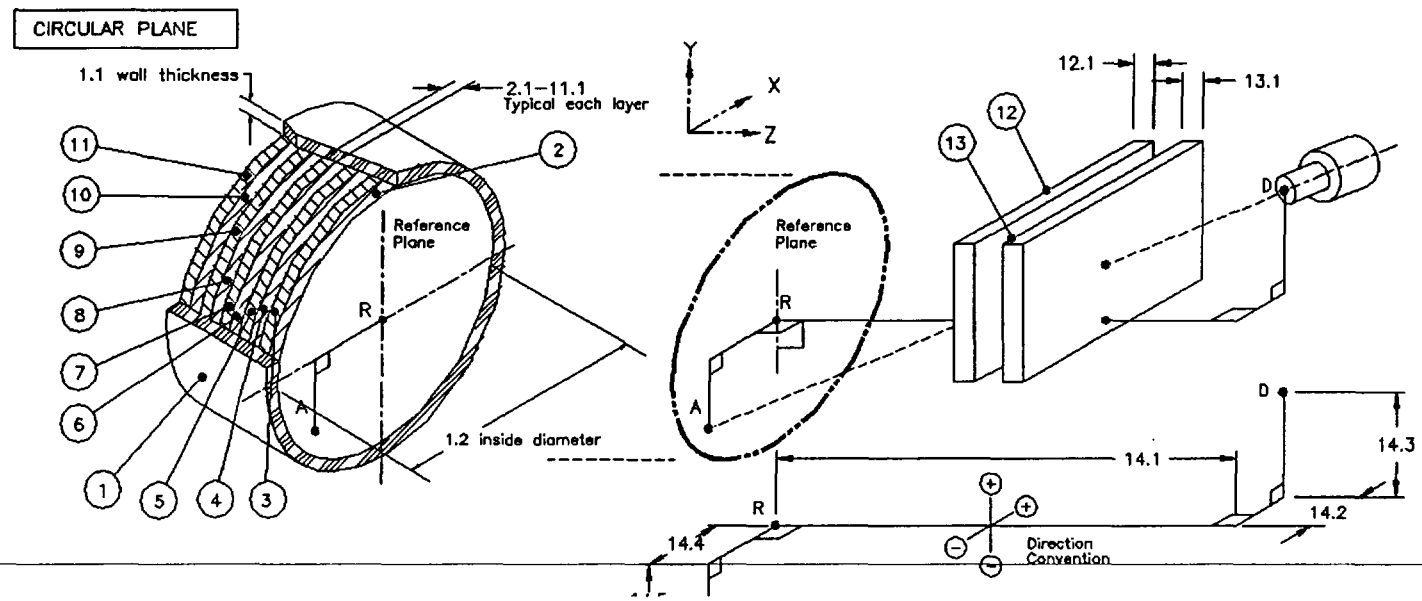
Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] FEB 10 2005

Reviewed by Jeff Gunter 2-10-05



Geometry Composer Report

Date: Thursday, February 10, 2005
Description: conc_2m90d
Comment: Surface
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-conc_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

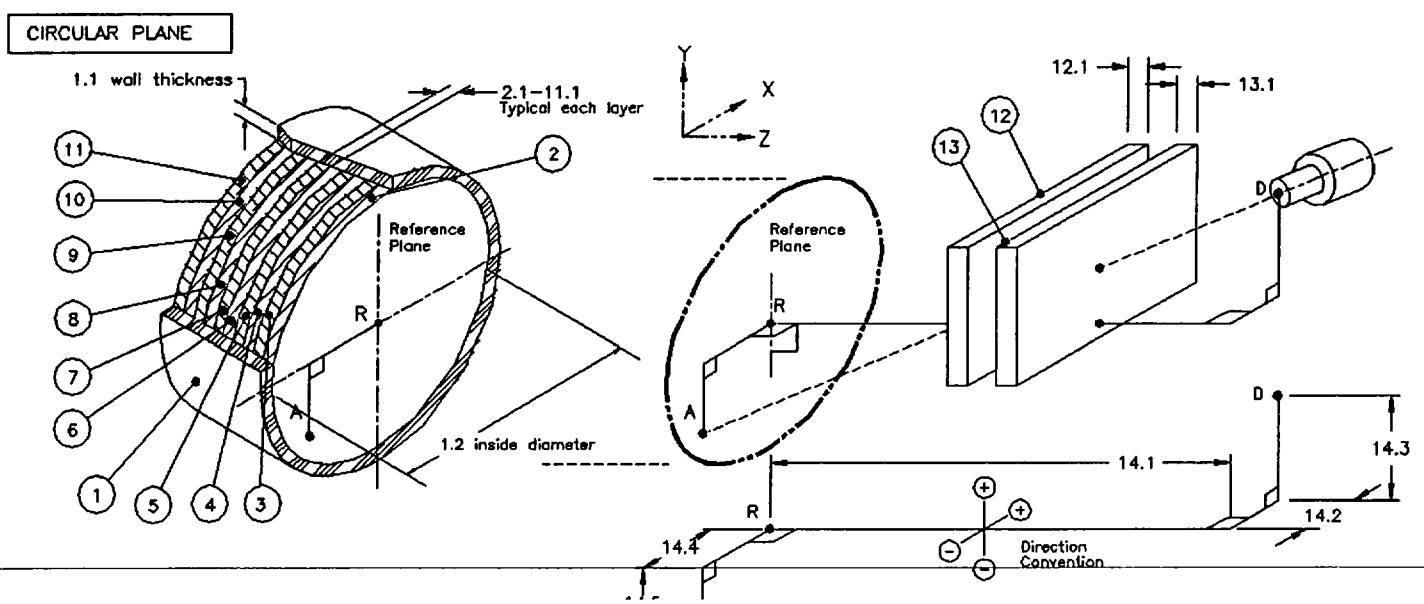
ORIGINAL

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] FEB 10 2005
Reviewed by JPS Cohn 2-10-05



Geometry Composer Report

Date: Thursday, February 10, 2005
Description: conc_3m90d
Comment: Surface
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-conc_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

ORIGINAL

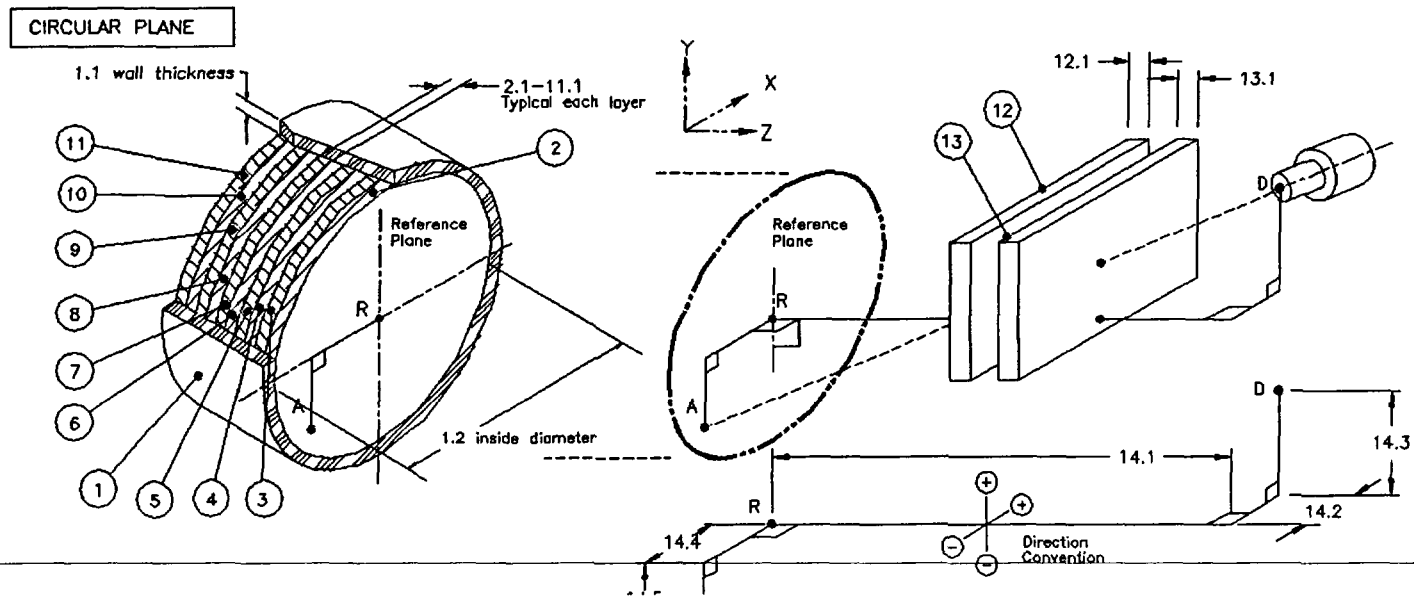
Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

FEB 10 2005

Created by
Reviewed by 2-10-05



Geometry Composer Report

Date: Monday, February 07, 2005
Description: Conc_2m90d
Comment: Concrete_Wall
File Name: s:\fss\isocs systems\data files\genie2k\approved geometries\7607-conc_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

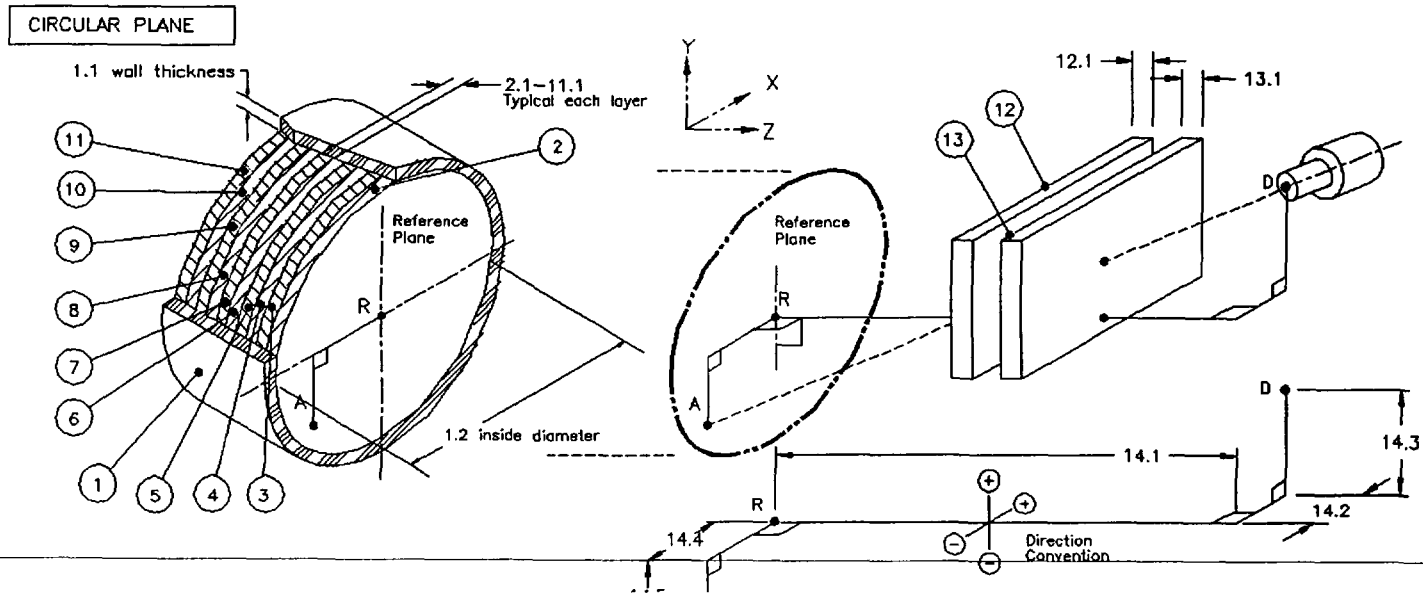
ORIGINAL

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] 2/7/05
Reviewed by DR 2-7-05



Geometry Composer Report

Date: Monday, February 07, 2005
Description: Conc_2m90d
Comment: Concrete_Wall
File Name: S:\FSS\ISOCS Systems\Data Files\GENIE2K\Approved Geometries\7780-Conc_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

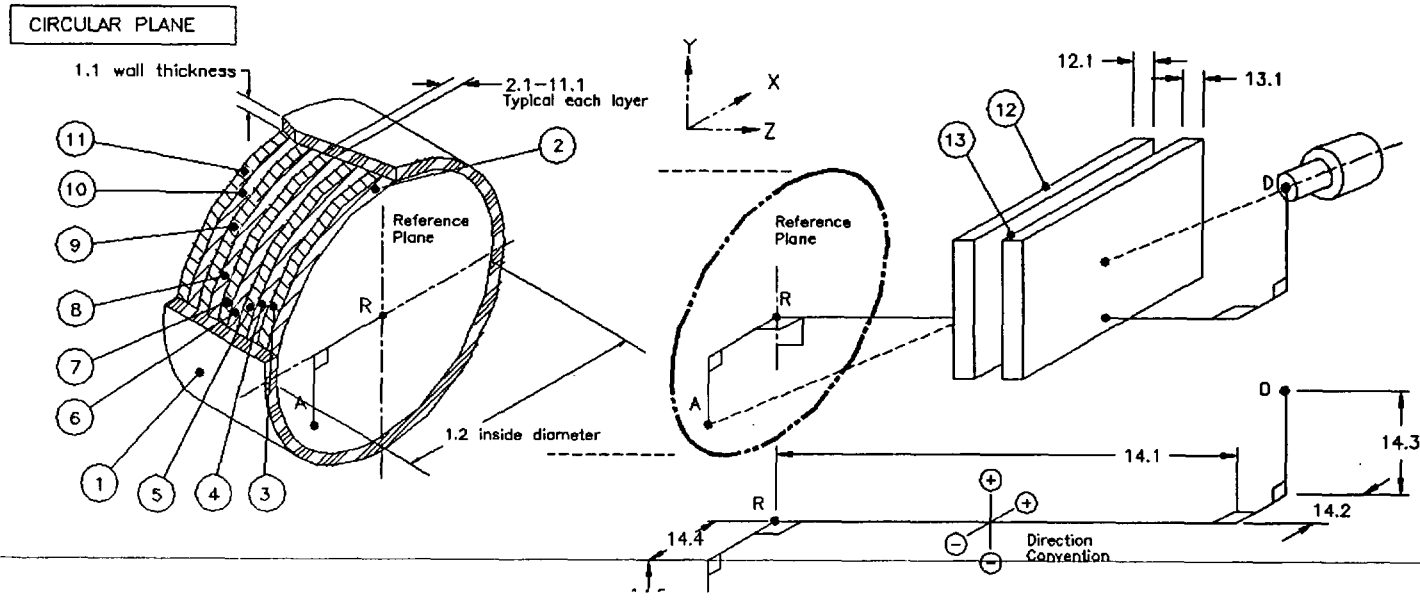
ORIGINAL

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by m 2/7/05
Reviewed by DR 2-7-05



Geometry Composer Report

Date: Monday, February 07, 2005
Description: Conc_2m90d
Comment: Concrete_Wall
File Name: S:\FSS\ISOCS Systems\Data Files\GENIE2K\Approved Geometries\7722-Conc_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7722
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

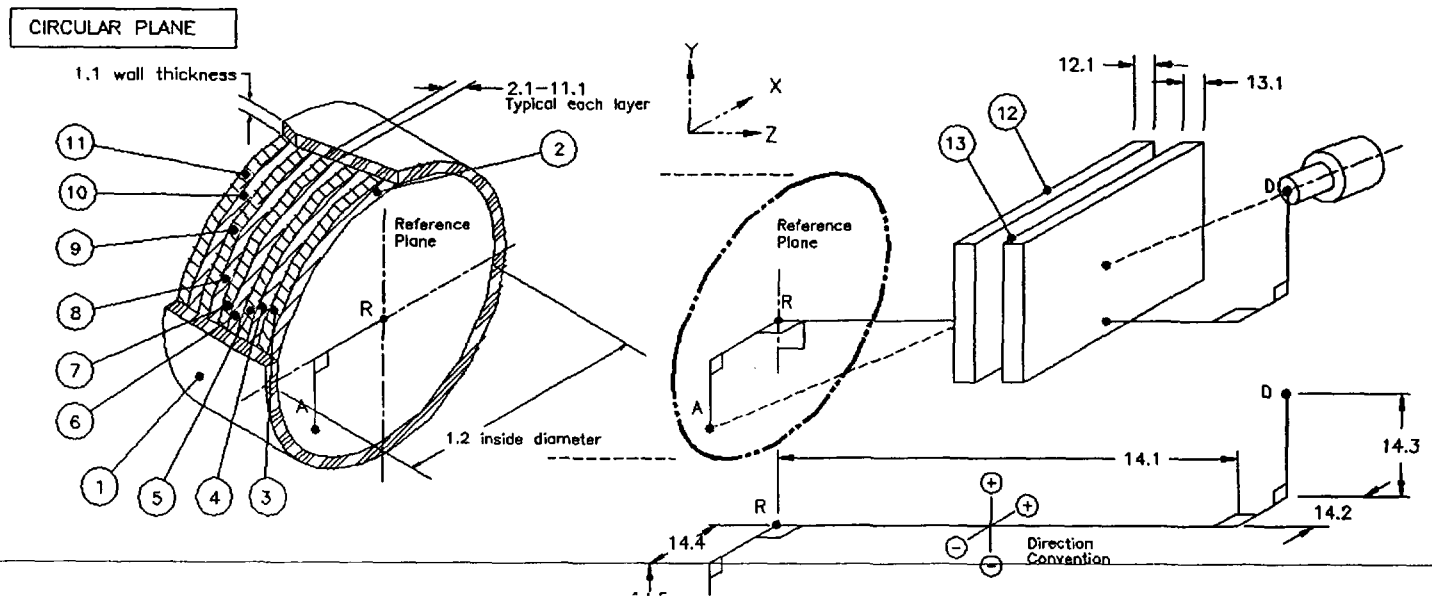
ORIGINAL

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by — 2/7/05
Reviewed by: DR 2-7-05



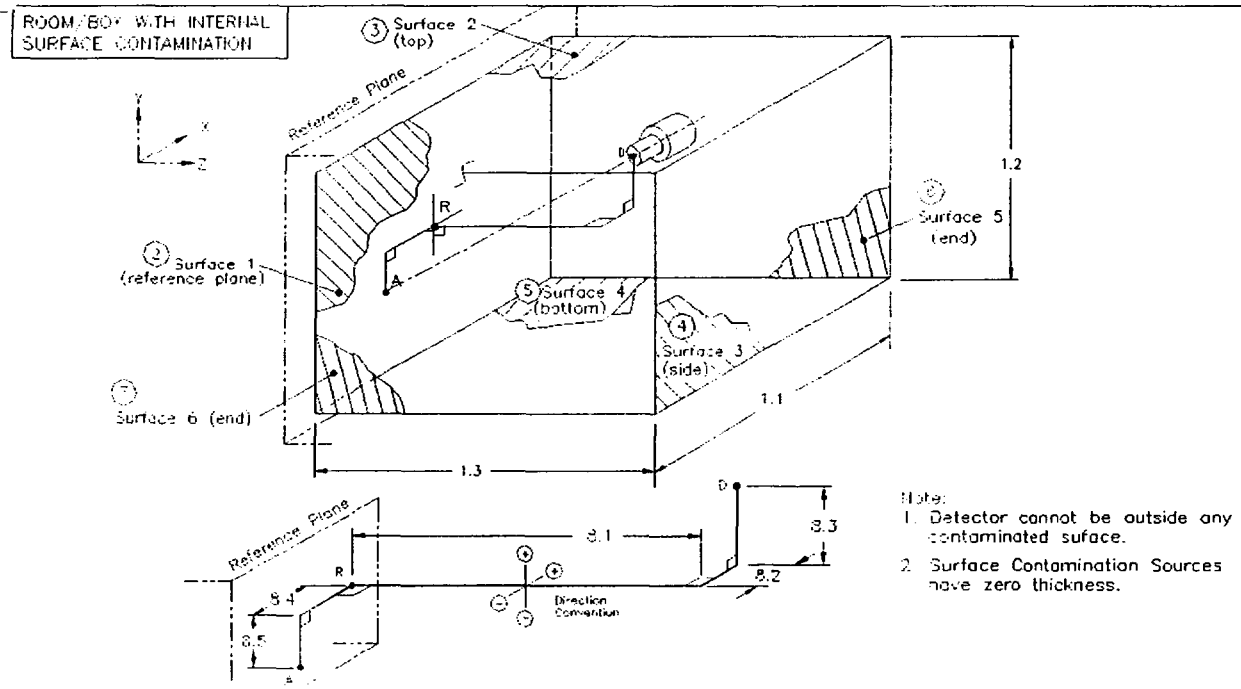
Geometry Composer Report

Date: Tuesday, December 21, 2004
Description: MH_unc_8ft
Comment: MH_unc_8ft
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\ROOM\mh_unc_8ft.geo
Software: ISOCS
Template: ROOM, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2`(4) CRPN= 2`(44)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Room/Box Dimensions	10.00	10.00	8.00						
2	Surface 1									1.00
3	Surface 2									1.00
4	Surface 3									
5	Surface 4									1.00
6	Surface 5									1.00
7	Surface 6									1.00
8	Source-Detector	8.00								

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0



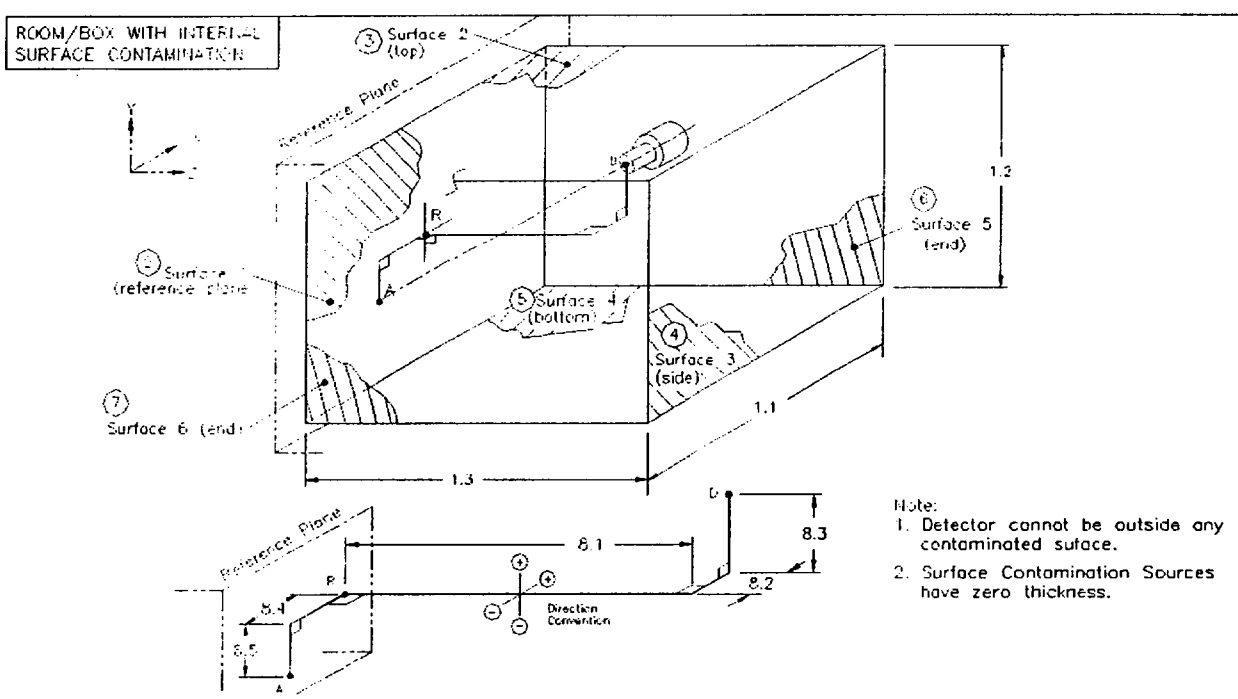
Geometry Composer Report

Date: [illegible], December 21, 2004
Description: [illegible]_3ft
Comment: [illegible]_3ft
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\ROOM\hh_unc_3ft.geo
Software: ISOCS
Template: ROOM, Version: default
Detector: [illegible]
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(44)

#	Geometry Comment	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Room/Box Dimensions	4.00	4.00	2.00						
2	Surface 1									1.00
3	Surface 2									1.00
4	Surface 3									
5	Surface 4									1.00
6	Surface 5									1.00
7	Surface 6									1.00
8	Source-Detector	3.00								

List of energies for efficiency curve generation:

59.5 88.0 [illegible] 165.9 391.7 661.7 898.0 1173.2 1332.5 1460.8 1836.0



Created by: [illegible] 12/21/04

Geometry Composer Report

Authorized/Implemented 12/7/04 WB

Reviewed DR 12-7-04

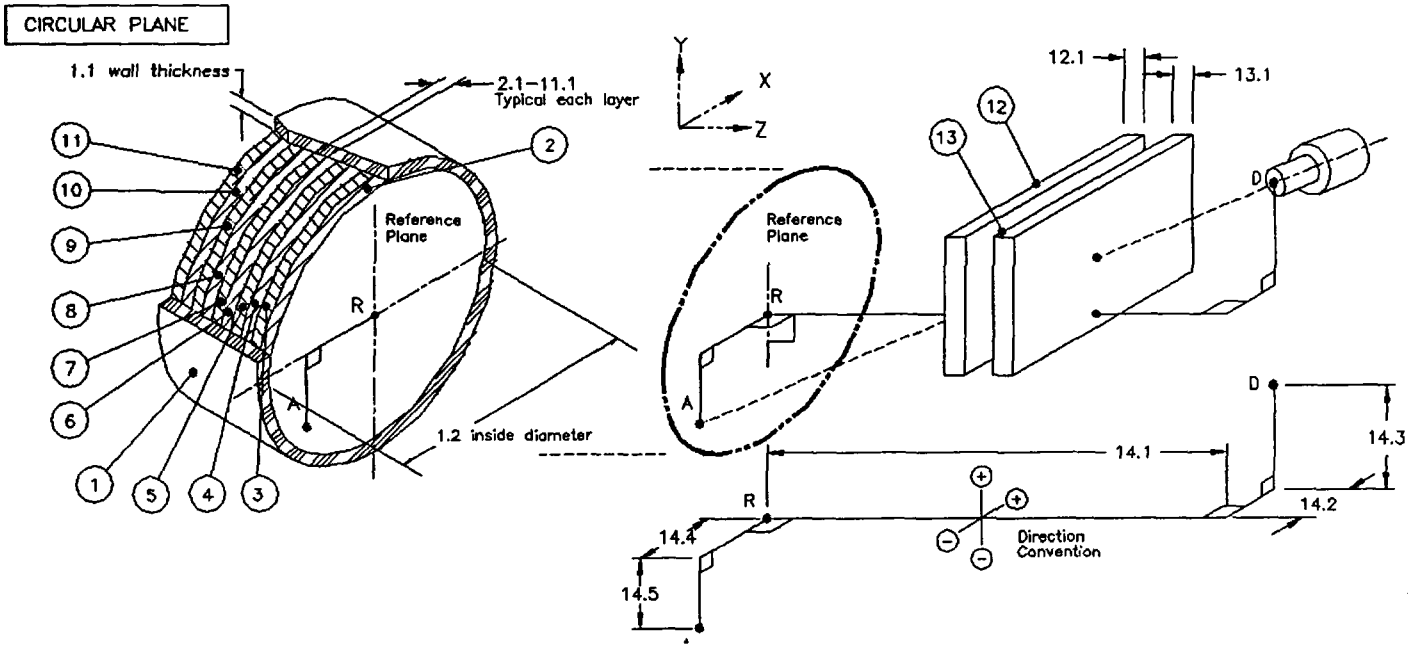
Date: Saturday, November 27, 2004
Description: Soil_70cm90d
Comment: Soil_Investigations
File Name: C:\7607 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil 70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Authorized/Implemented 11/30/04 W Bauman
Reviewed on 12/15/04

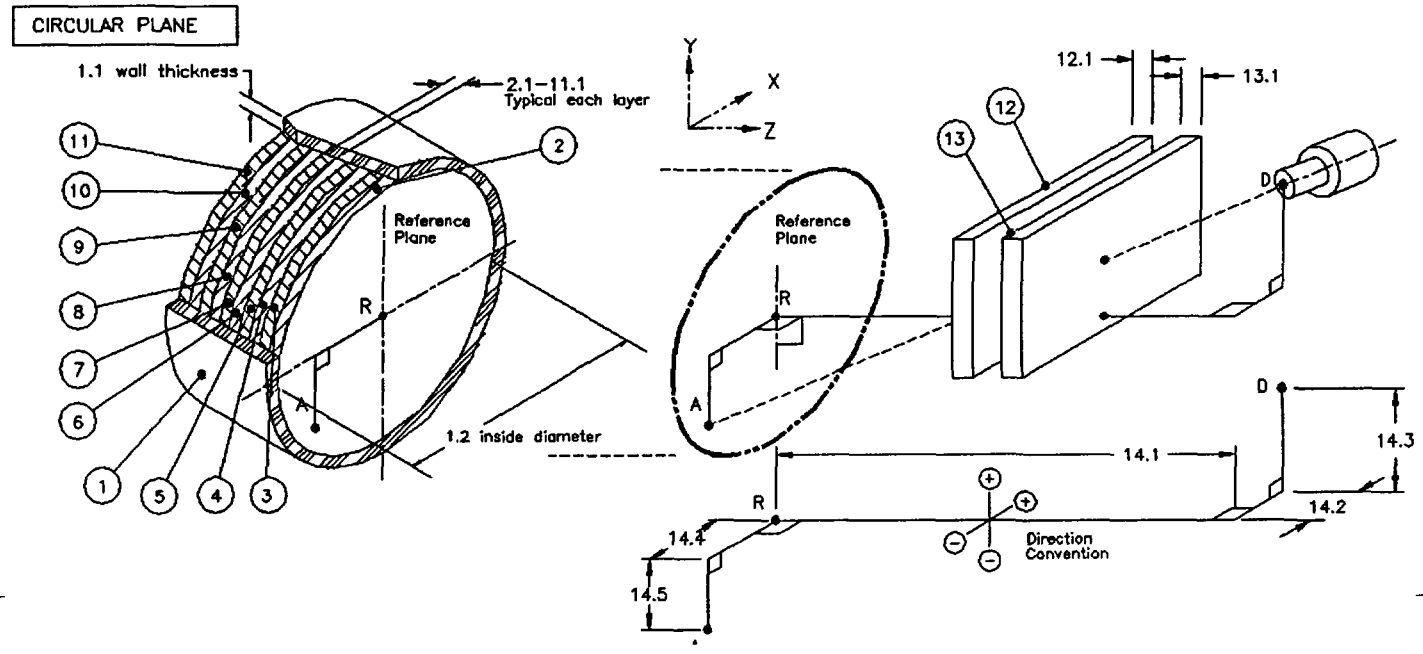
Date: Tuesday, November 30, 2004
Description: Soil_2m90d
Comment: Surface
File Name: C:\7607 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_at_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Authorized / Implemented 11/30/04 W Burnham
Reviewed / DR 12-1-04

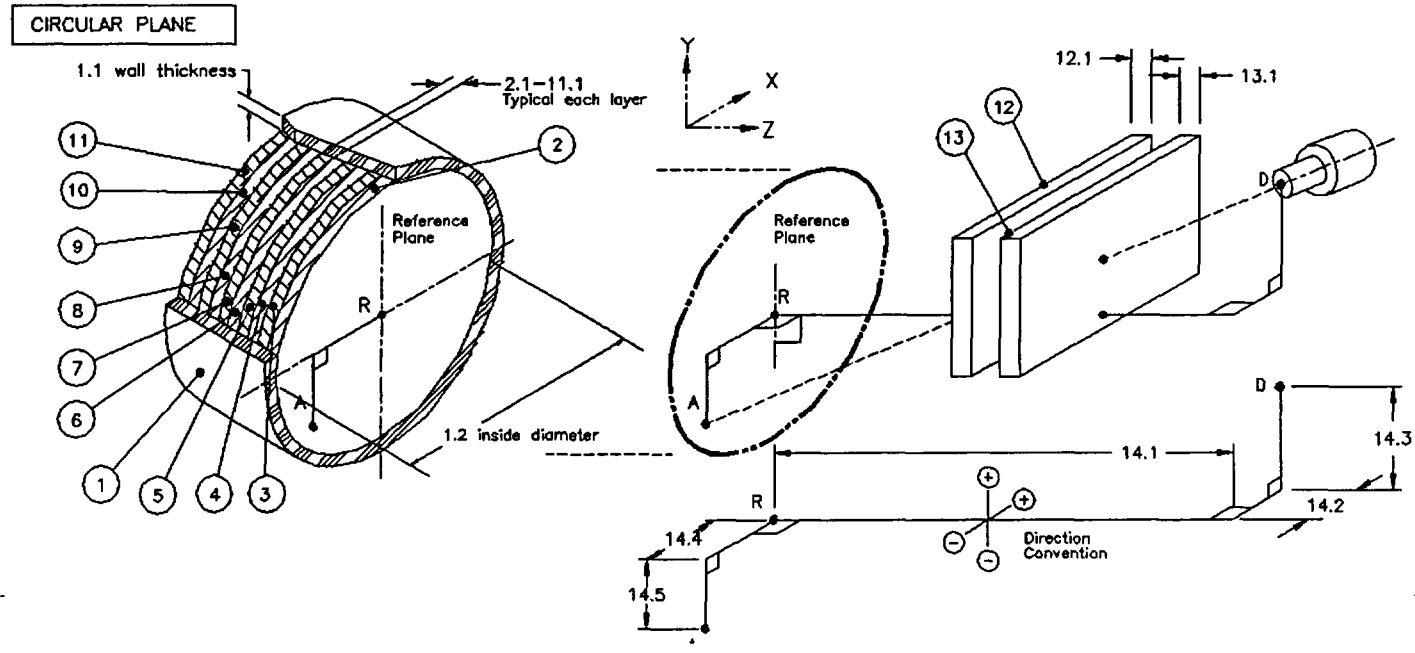
Date: Tuesday, November 30, 2004
Description: Soil_3m90d
Comment: Surface
File Name: C:\7607 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Authorized/Implemented 12/15/04 WB

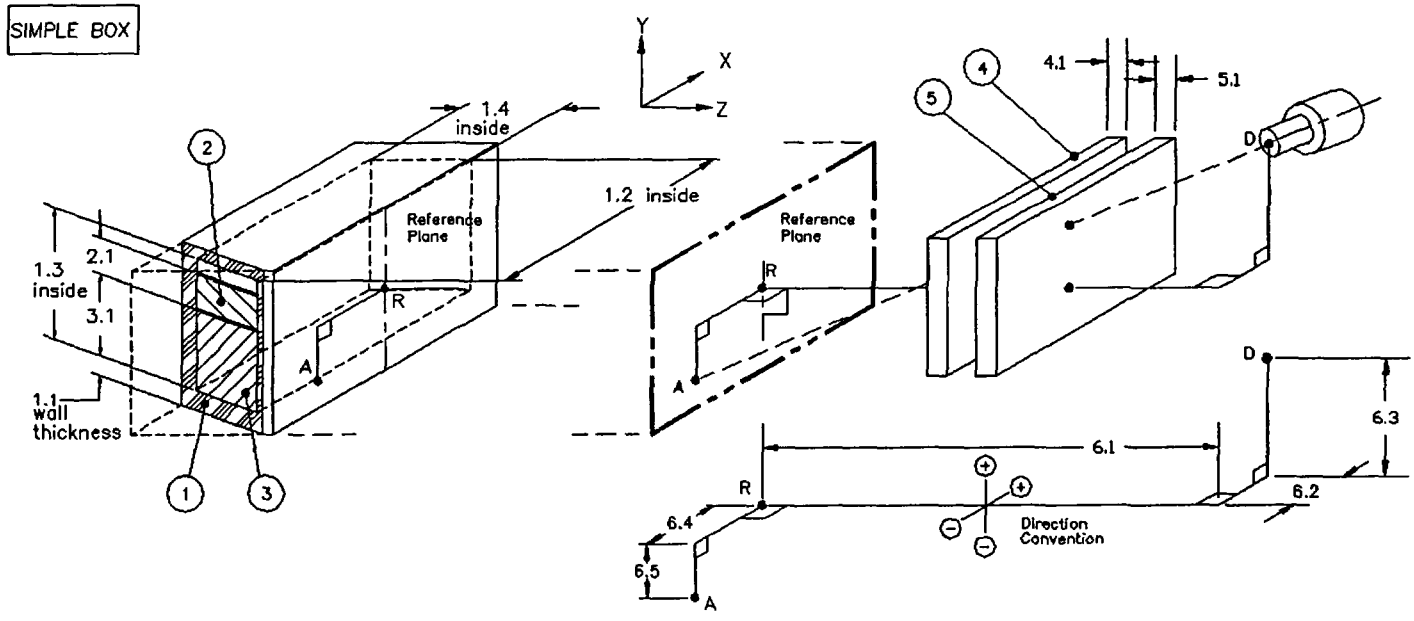
Date: Wednesday, December 15, 2004
Description: Truck_3314
Comment: Backyard
File Name: c:\genie2k\isocs\data\geometry\in-situ\simple_box\7607_truck_3314.ge
Software: ISOCS
Template: SIMPLE_BOX, Version: default
Detector: 7607
Environment: Temperature= 0 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Box		16.01	7.00	4.50			none		
2	Source-Top Layer	7.00						dirt1	1.60	1.00
3	Source-Bottom Layer							none		
4	Absorber1							none		
5	Absorber2							none		
6	Source-Detector	9.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Reviewed on 12/15/04

Geometry Composer Report

Authorized/Implemented 12/15/04 CJB

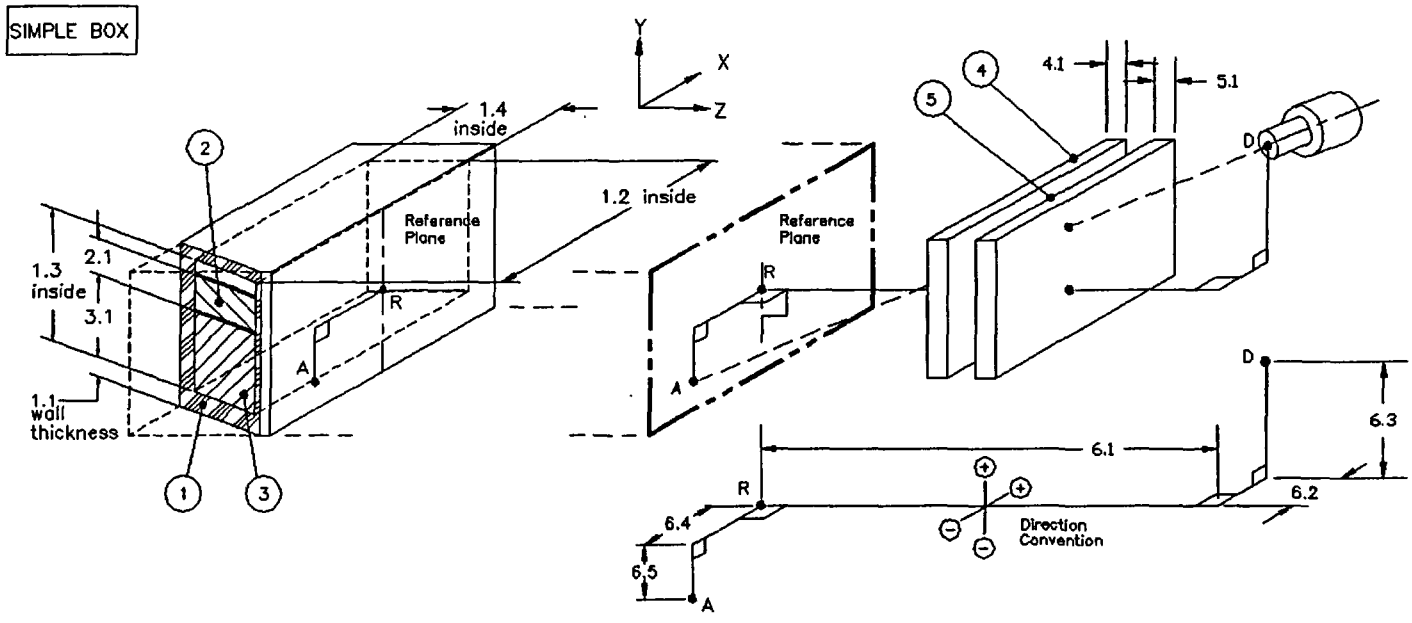
Date: Wednesday, December 15, 2004
Description: Truck_4113
Comment: Backyard
File Name: c:\genie2k\isocs\data\geometry\in-situ\simple_box\7607_truck_4113.ge
Software: ISOCS
Template: SIMPLE_BOX, Version: default
Detector: 7607
Environment: Temperature= 0 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Box		17.01	7.00	4.00			none		
2	Source-Top Layer	7.00						dirt1	1.60	1.00
3	Source-Bottom Layer							none		
4	Absorber1							none		
5	Absorber2							none		
6	Source-Detector	9.50								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Reviewed on 12/15/04

Geometry Composer Report

Authorized / Implemented 12/16/04 WB
Reviewed in 12/16/04

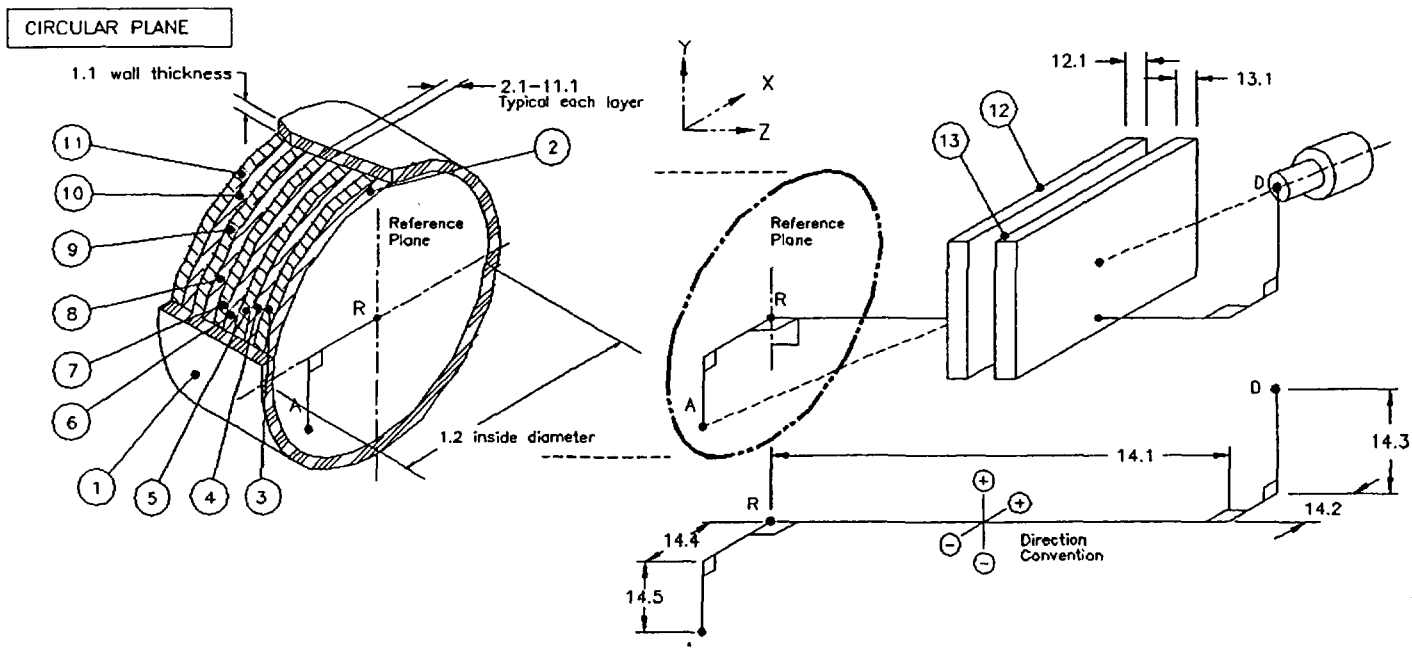
Date: Thursday, December 16, 2004
Description: Soil_70cm90d
Comment: none
File Name: C:\7722 Backup\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\7722-Soil_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7722
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Reauthorized/Implemented 11/29/04
WBunham

Reviewed 12/15/04

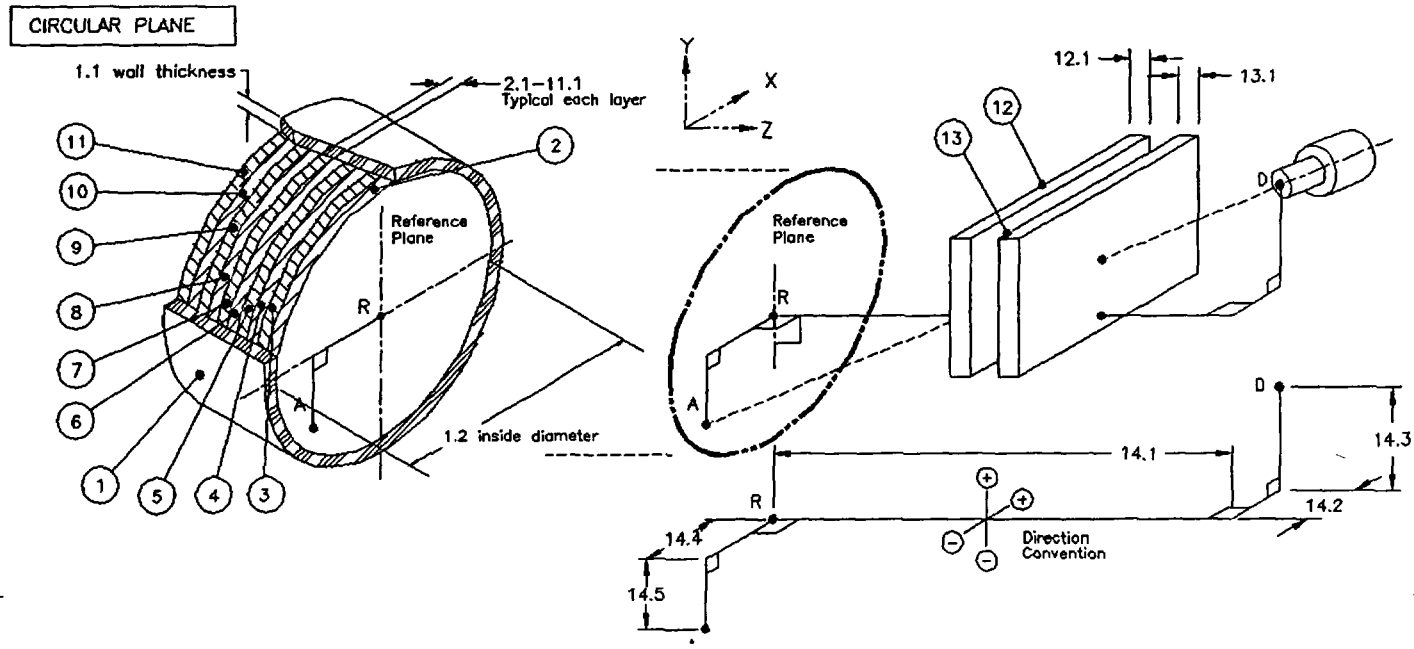
Date: Monday, November 29, 2004
Description: Soil_2m90d
Comment: Surface
File Name: C:\7722 Backup\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7722
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Authorized / Implemented 11/29/04
Reviewed / DR W Burnham 12-1-04

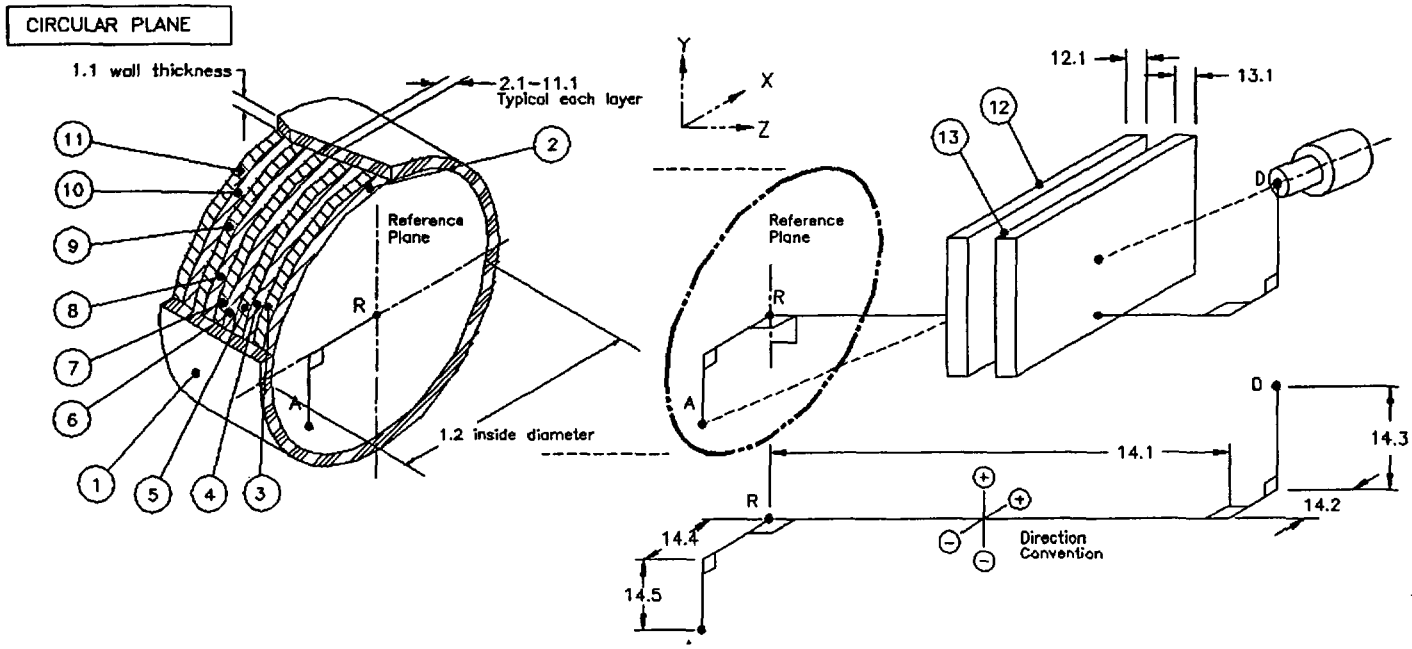
Date: Monday, November 29, 2004
Description: Soil_3m90d
Comment: Surface
File Name: C:\7722 Backup\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7722
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Reviewed m 12/15/04

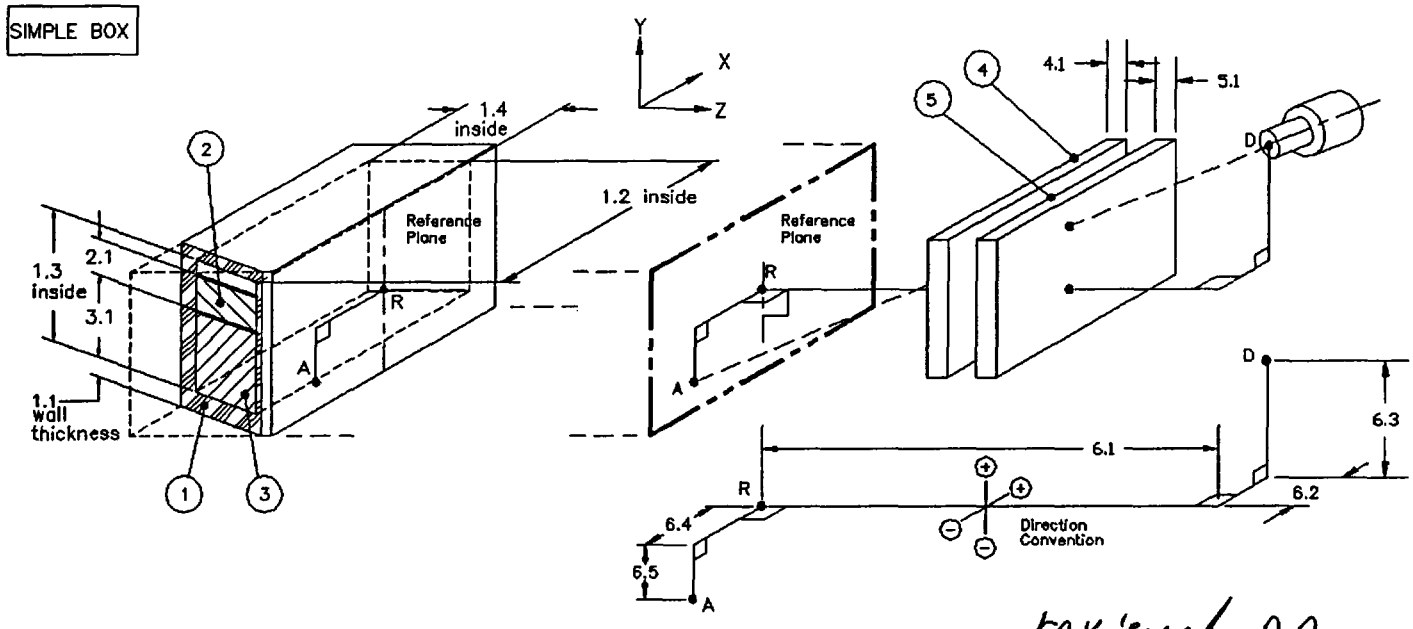
Date: Tuesday, November 23, 2004
Description: Truck_3314
Comment: Backyard
File Name: E:\Truck_3314.geo
Software: ISOCS
Template: SIMPLE_BOX, Version: default
Detector: 7722
Environment: Temperature= 0 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Box		16.01	7.00	4.50			none		
2	Source-Top Layer	7.00						dirt1	1.60	1.00
3	Source-Bottom Layer							none		
4	Absorber1							none		
5	Absorber2							none		
6	Source-Detector	9.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



reviewed DR 12-2-04

Loaded into detector 7722 11/23/04 @ 1030
and implemented
W Burnham 11/23/04

Geometry Composer Report

Authorized/Implemented 12/15/04 WB

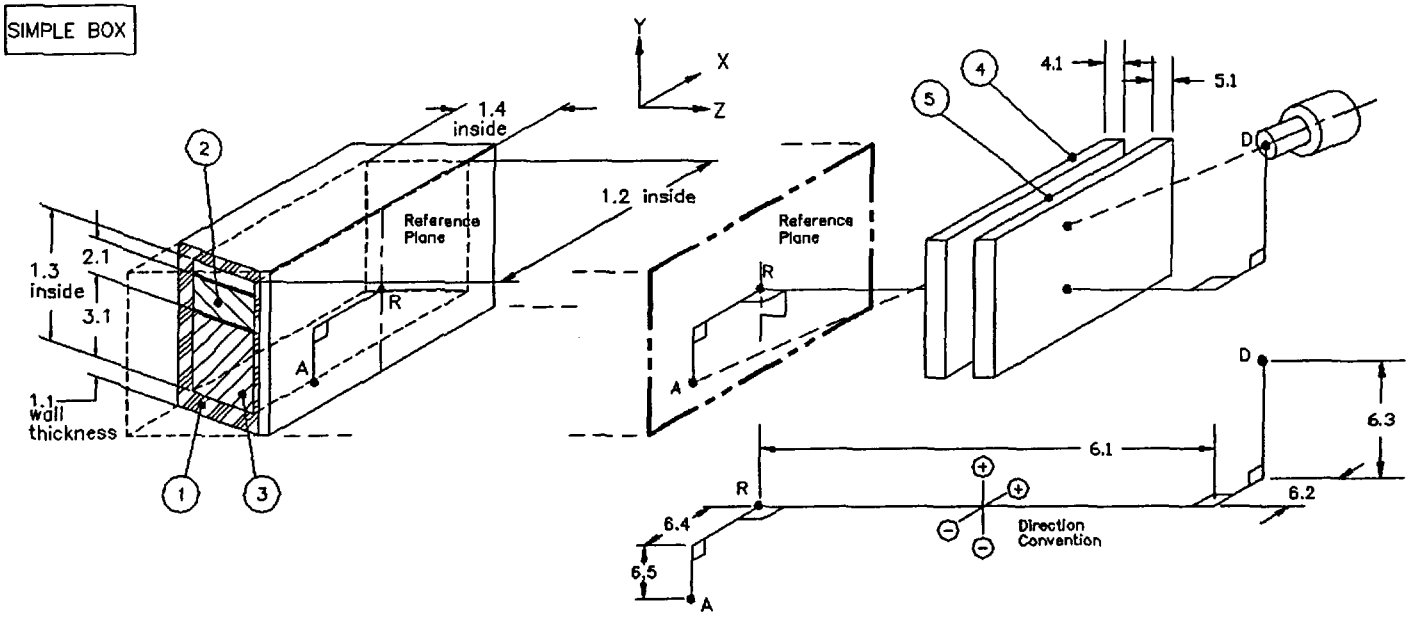
Date: Wednesday, December 15, 2004
Description: Truck_4113
Comment: Backyard
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\SIMPLE_BOX\7722_Truck_4113.ge
Software: ISOCS
Template: SIMPLE_BOX, Version: default
Detector: 7722
Environment: Temperature= 0 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Box		17.01	7.00	4.00			none		
2	Source-Top Layer	7.00						dirt1	1.60	1.00
3	Source-Bottom Layer							none		
4	Absorber1							none		
5	Absorber2							none		
6	Source-Detector	9.50								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Reviewed 12/15/04

Geometry Composer Report

Authorized/Implemented 12/16/04 WB
Reviewed by 12/16/04

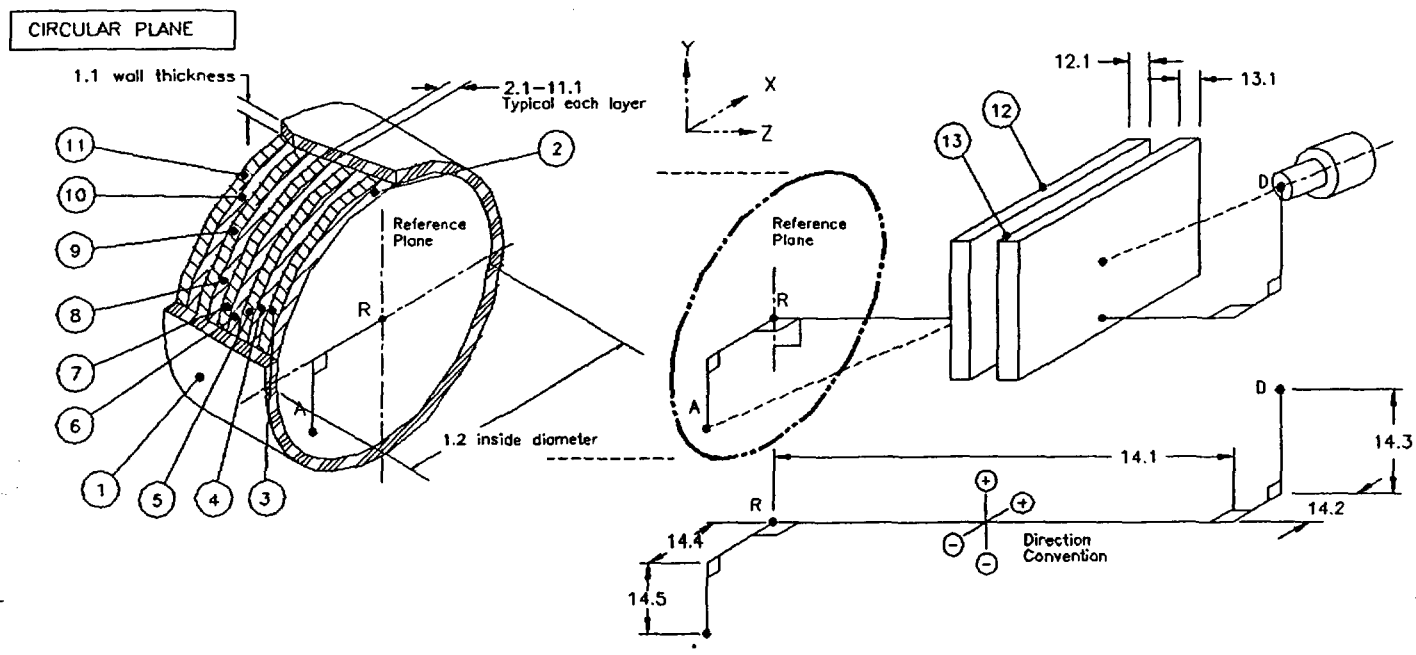
Date: Thursday, December 16, 2004
Description: Soil_70cm90d
Comment: none
File Name: C:\7780 Backup\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\7780-Soil_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Authorized/Implemented 11/29/04
W Bamboo 11/29/04

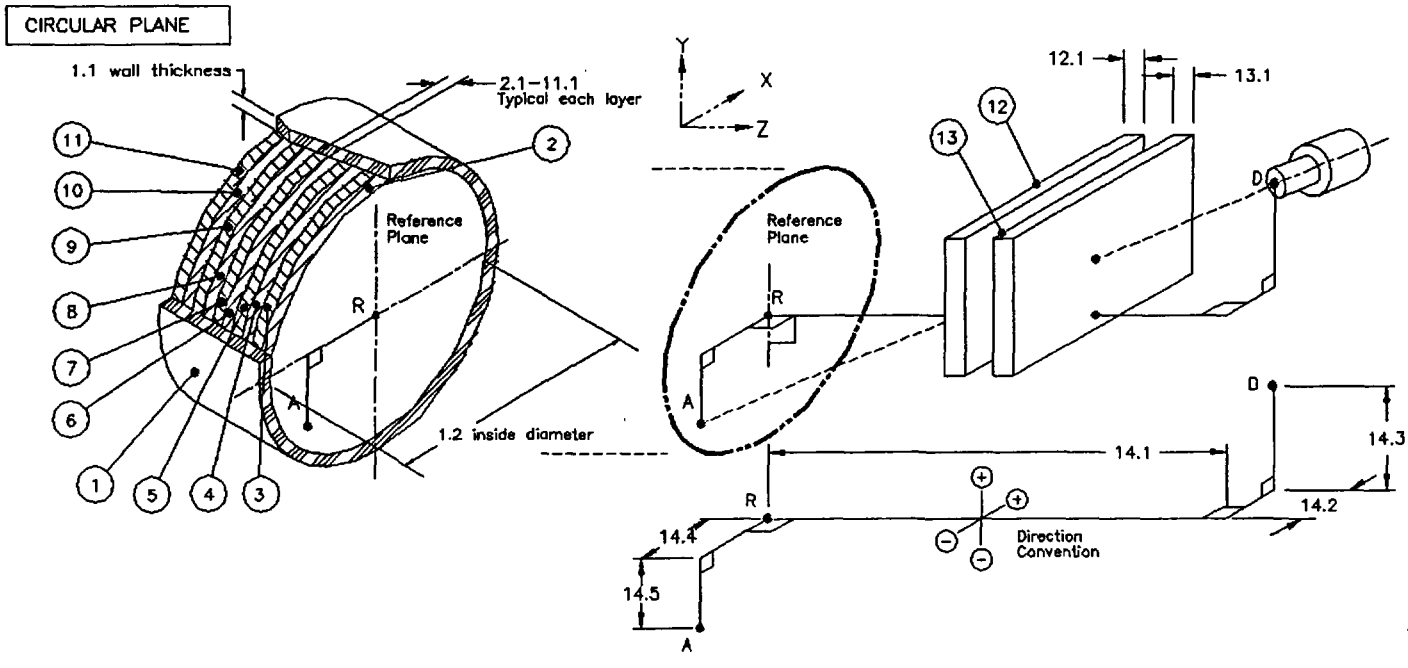
Date: Monday, November 29, 2004
Description: Soil_2m90d
Comment: Surface
File Name: E:\7780\7780 Geometries\In-Situ\CIRCULAR_PLANE\Soil_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Implemented and Authorized for use 11/29/04
W Burnham 11/29/04

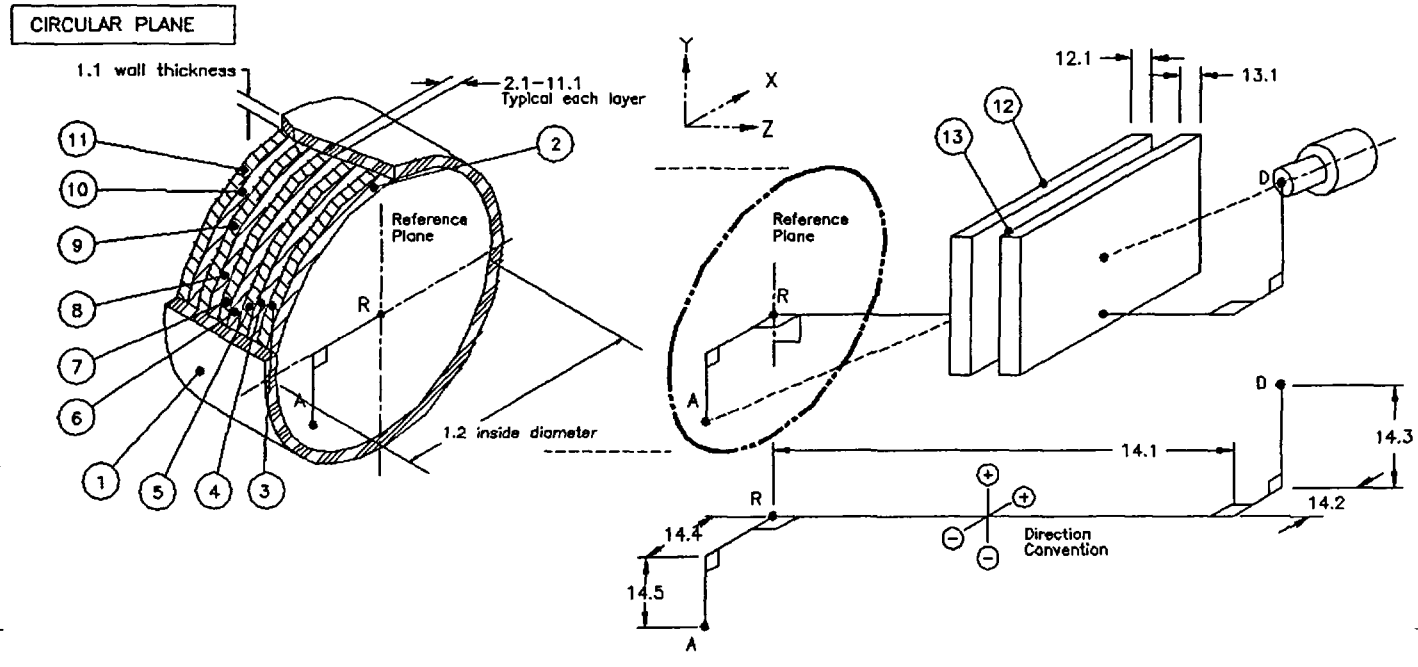
Date: Monday, November 29, 2004
Description: Soil_at_3m90d
Comment: Surface
File Name: E:\7780\7780 Geometries\In-Situ\CIRCULAR_PLANE\Soil_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



7605

Geometry Composer Report

Date: Thursday, March 03, 2005
Description: 50cm_50_180d_soil 7605-50cm-180d-soil 3/8/05
Comment: 50cm_50_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\50cm 50 180d soil.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

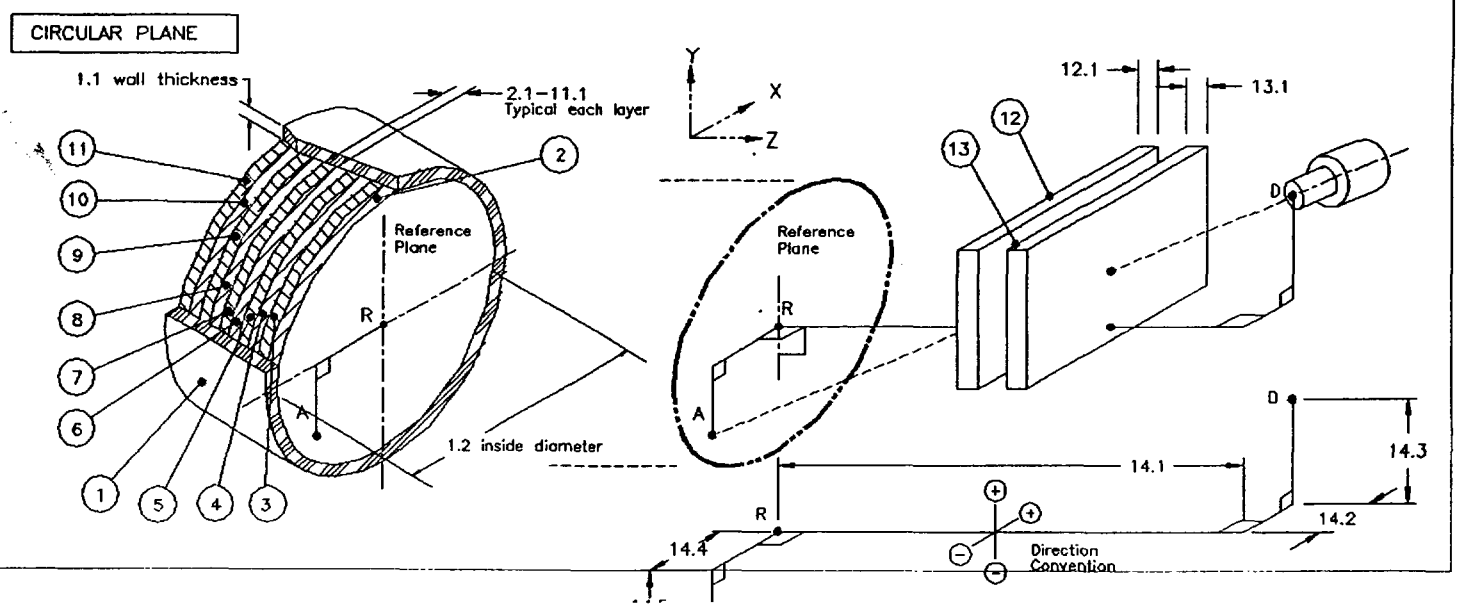
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		500.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	50.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] MAR 03 2005
Reviewed by DR 3-8-05



Geometry Composer Report

Date: Thursday, March 03, 2005
Description: 1m_50_180d_soil 7605_1m_180d_soil ~ 3/8/05
Comment: 1m_50_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\1m 50 180d soil.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		1000.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	100.00								

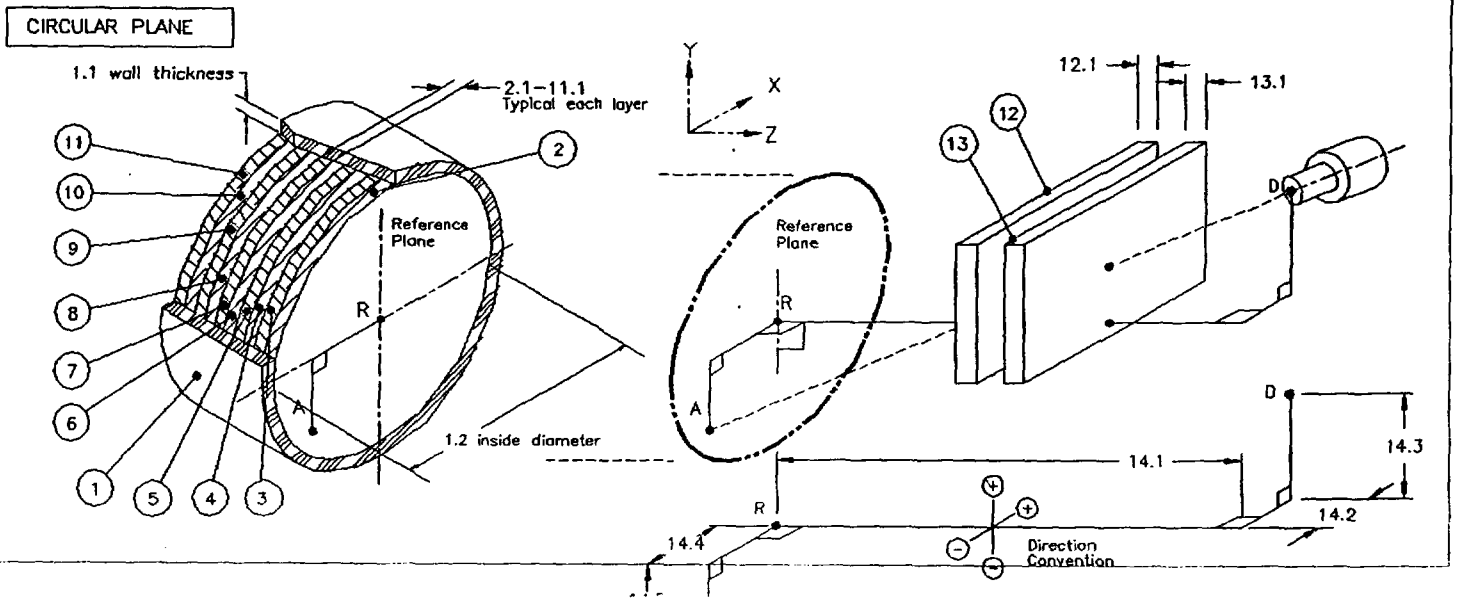
COPY

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by ~ MAR 03 2005
Reviewed by DR 3-8-05



Geometry Composer Report

Date: Tuesday, February 22, 2005
Description: conc_70cm90d
Comment: Surface
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-conc_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

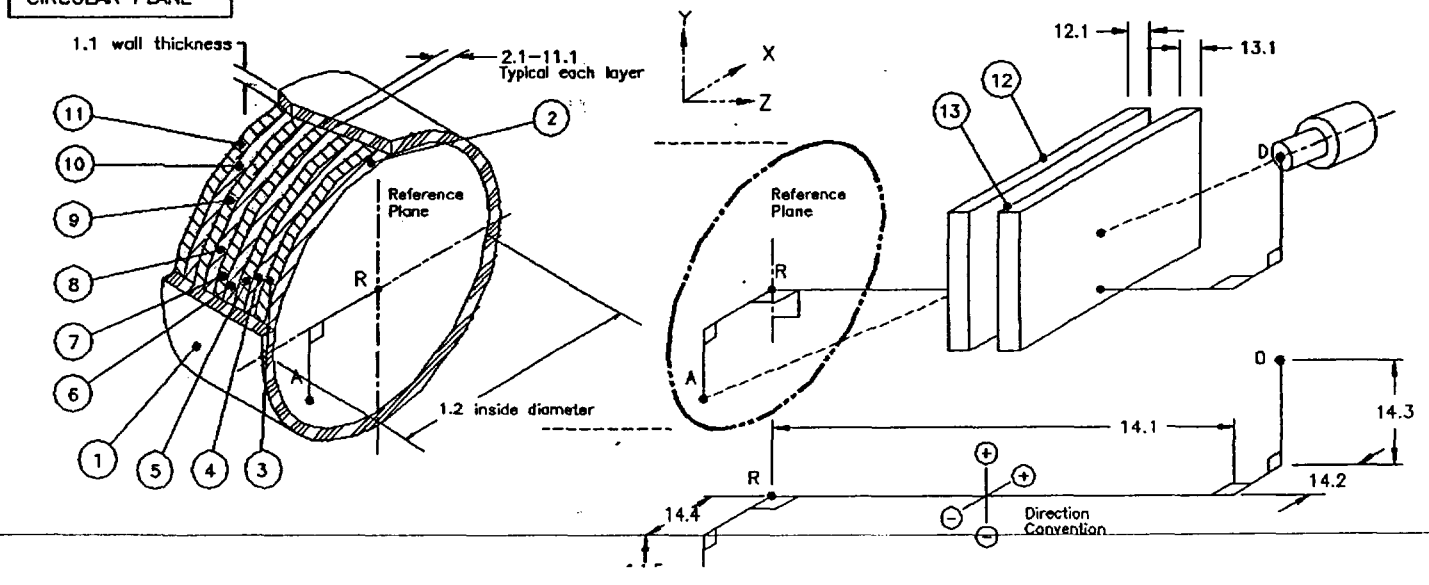
Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by — FEB 22 2005
Reviewed by: [signature] 2-22-05

CIRCULAR PLANE



Geometry Composer Report

Date: Thursday, February 10, 2005
Description: Soil_70cm90d
Comment: Surface
File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-soil_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

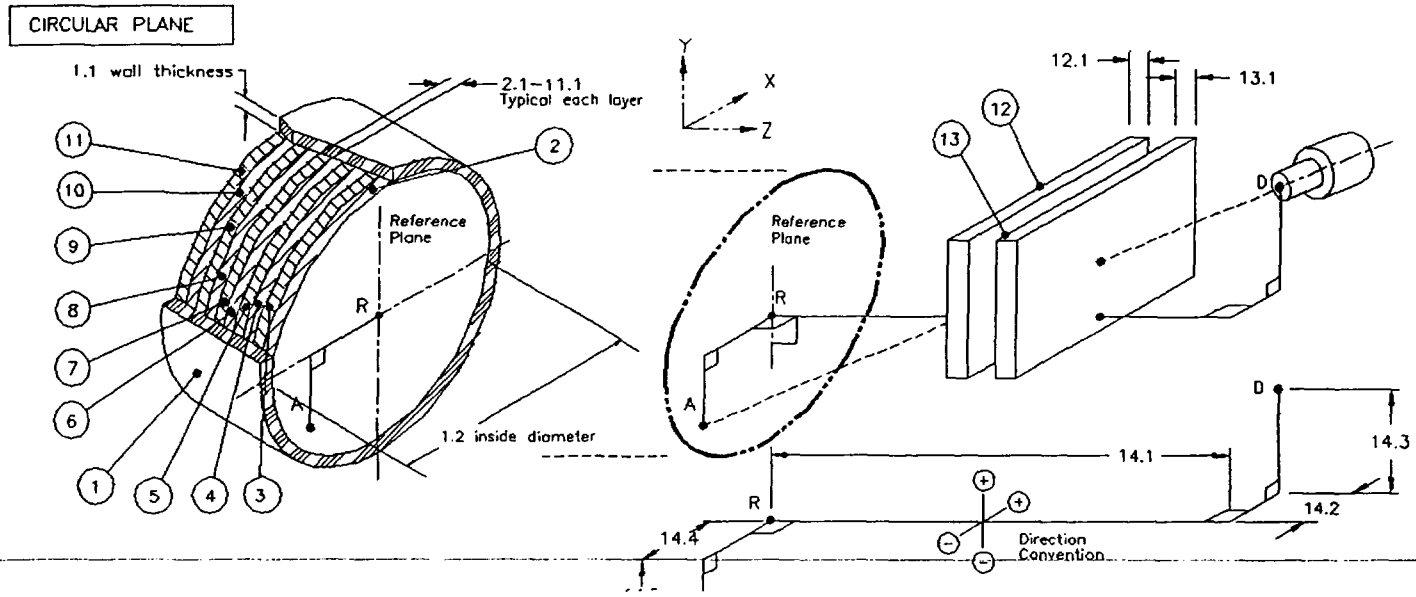
ORIGINAL COPY

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] FEB 10 2005
Reviewed by [illegible] 2-10-05



Geometry Composer Report

Date: Thursday, February 10, 2005
Description: Soil_3m90d
Comment: Surface
605 File Name: c:\7605 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7605-soil_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7605
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

ORIGINAL

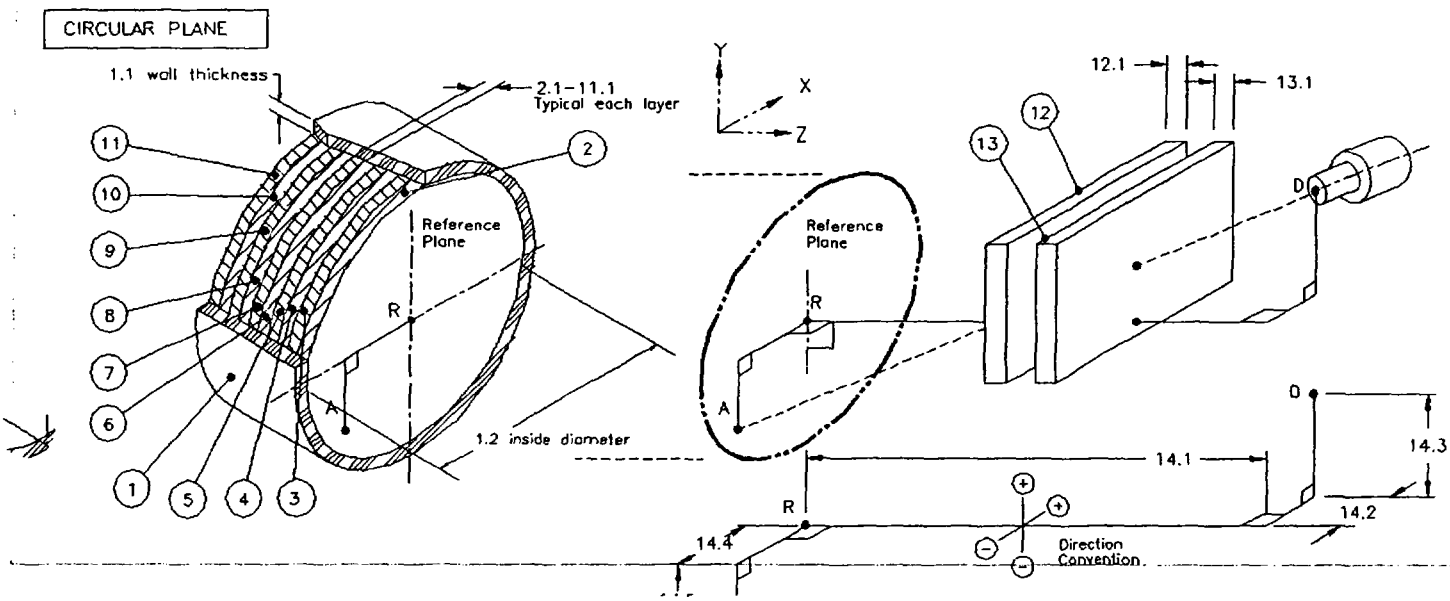
COPY

n-90 Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by A FEB 10 2005
Reviewed by JPF 2-10-05



7607

Geometry Composer Report

Date: Tuesday, March 08, 2005
Description: 7607_50cm_180d_soil
Comment: 7607_50cm_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7607 50cm 180d soil.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

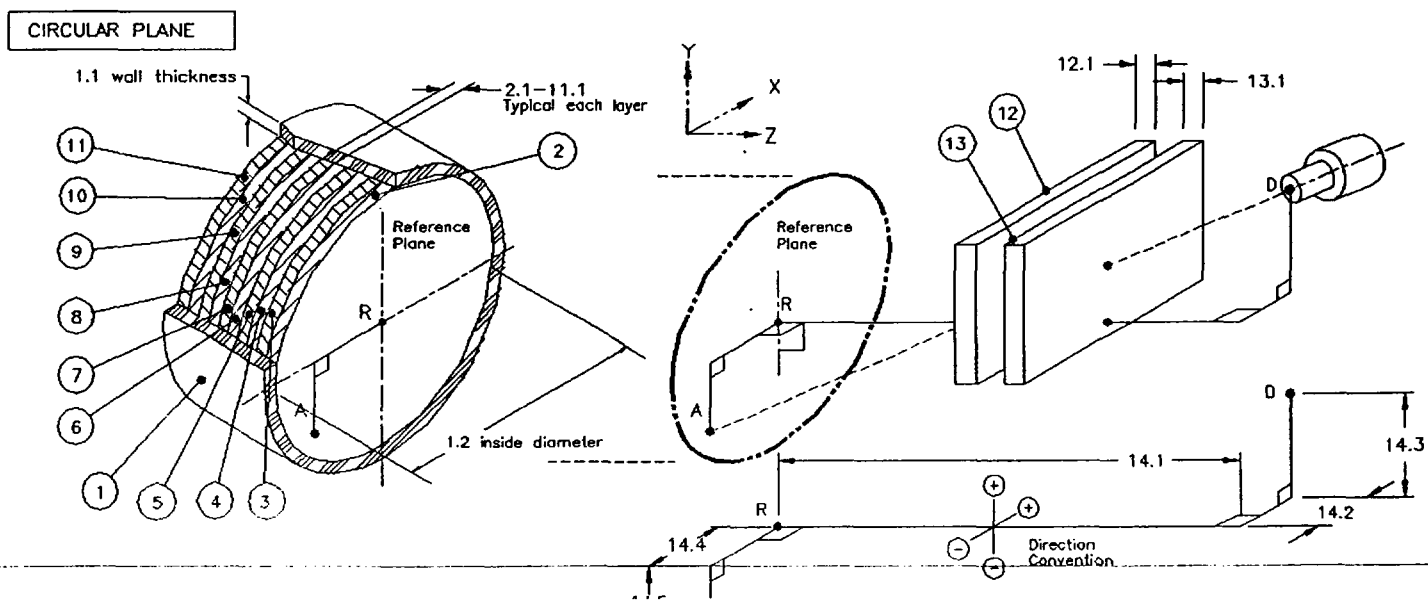
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		500.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	50.00								

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] MAR 08 2005
reviewed by Jeff Chiles 3-8-05



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7607
ISOCS/LabSOCS Time: 03/08/05 09:41:58
Template: CIRCULAR PLANE
Geom Description: 7 50CM 180D SOIL
Comment: ISOCS:UNITS=ACT/G 7607_50CM_180D_SOIL
Detector: 7607
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 1.9635e+001 (C)
Mass [Grams]: 4.7124e+006 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	1.33456e+001	10.0	-0.219056	10175
88.03	2.92994e+001	10.0	-0.146812	10175
122.06(X)	3.75674e+001	10.0	-0.135412	10175
165.85	3.89963e+001	8.0	0.149927	5065
391.69	3.00597e+001	8.0	0.129098	5065
661.65	2.46940e+001	6.0	0.129771	5065
898.02	2.29202e+001	6.0	0.128124	5065
1173.22	2.13925e+001	4.0	0.125586	5065
1332.49	2.08678e+001	4.0	0.130185	5065
1836.01	1.88956e+001	4.0	0.129370	5065

(X) = Crossover Energy

Geometry Composer Report

Date: Tuesday, March 08, 2005
Description: 7607_1m_180d_soil
Comment: 7607_1m_180d_soil
File Name: c:\genie2k\isocs\data\geometry\in-situ\circular_plane\7607 1m 180d soil.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

		Dimensions (cm):								
#	Geometry Compon.	d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		1000.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	100.00								

COPY

Collimator: 50mm-180d_new
newISOCS_50mm_side_180deg_collimation_[no_collimator]

List of energies for efficiency curve generation:

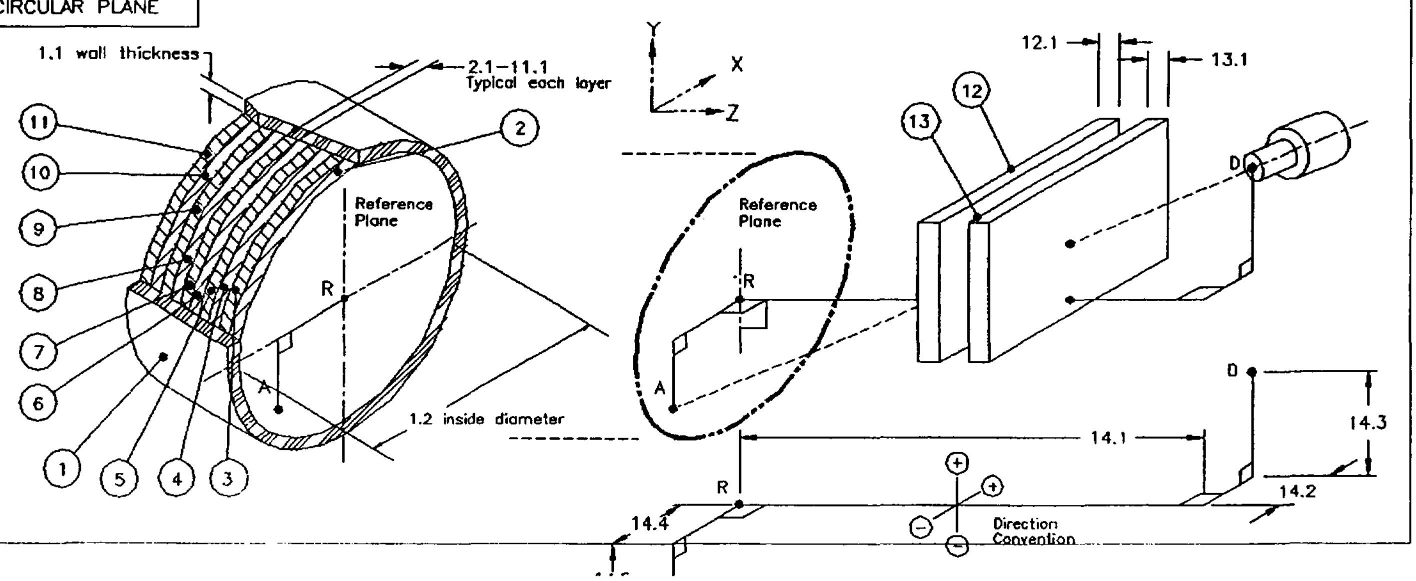
59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by

MAR 08 2005

reviewed by 3-8-05

CIRCULAR PLANE



ISOCS/LABSOCS RESULTS

ISOCS/LabSOCS File: C:\GENIE2K\Isocs\Data\Geometry\In-Situ\circular_plane\7607
ISOCS/LabSOCS Time: 03/08/05 09:40:00
Template: CIRCULAR PLANE
Room Description: 607 1M 180D SOIL
Comment: ISOCS:UNITS=ACT/G 7607_1M_180D_SOIL
Detector: 7607
Collimator: 50MM-180D_NEW
Convergence: 1.00 %
Area [Sq Meters]: 7.8540e+001 (C)
Mass [Grams]: 1.8850e+007 (C)
Length [Meters]: not used
(C) = Value calculated by ISOCS
(U) = Value modified by user

Energy	Efficiency (X Mass)	%Uncertainty	%Convergence	Final # of Voxels
59.54	1.31514e+001	10.0	-0.078452	10185
88.03	2.89588e+001	10.0	-0.214924	5075
122.06(X)	3.71739e+001	10.0	-0.202822	5075
165.85	3.84807e+001	8.0	-0.194693	5075
391.69	2.98095e+001	8.0	-0.134455	5075
661.65	2.46440e+001	6.0	-0.123782	5075
898.02	2.29023e+001	6.0	-0.119966	5075
1173.22	2.13219e+001	4.0	-0.117832	5075
1332.49	2.07417e+001	4.0	-0.113292	5075
1836.01	1.88818e+001	4.0	-0.105780	5075

(X) = Crossover Energy

Geometry Composer Report

Date: Tuesday, February 22, 2005
Description: Conc_70cm90d
Comment: Surface
File Name: c:\7607 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7607-conc_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

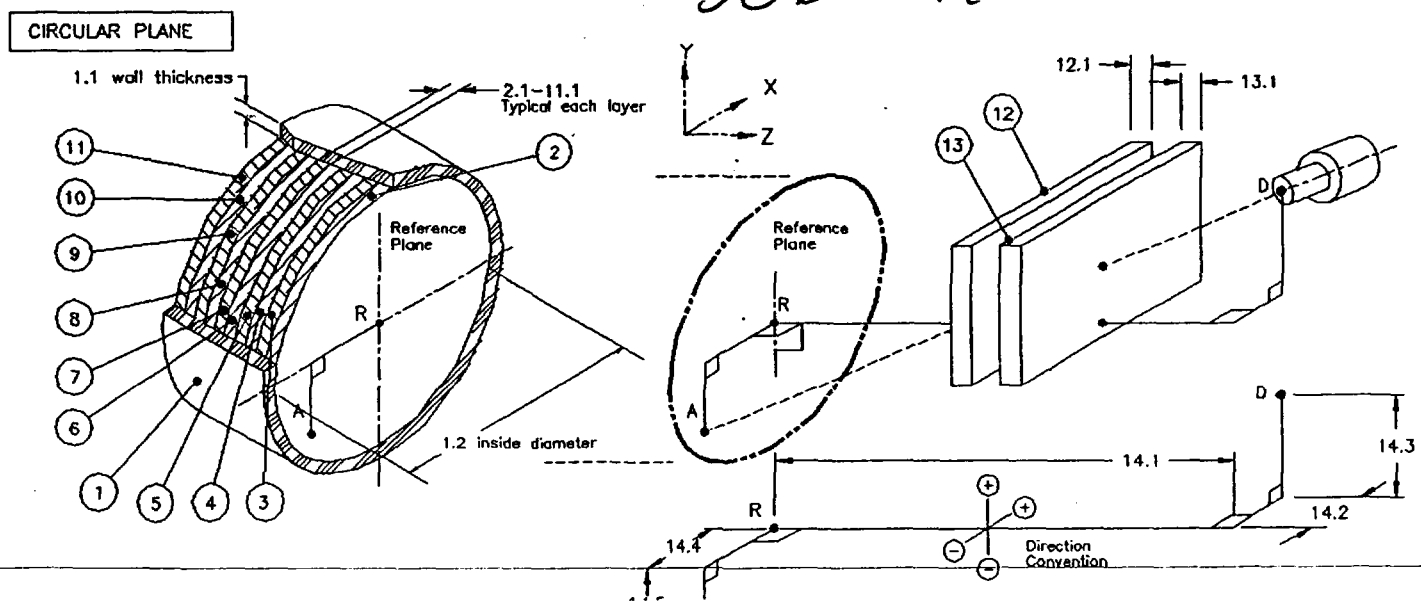
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] FEB 22 2005
Reviewed by [illegible] 2-22-05



Geometry Composer Report

Date: Monday, February 07, 2005
Description: Conc_2m90d
Comment: Concrete_Wall
File Name: s:\fss\isocs systems\data files\genie2k\approved geometries\7607-conc_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

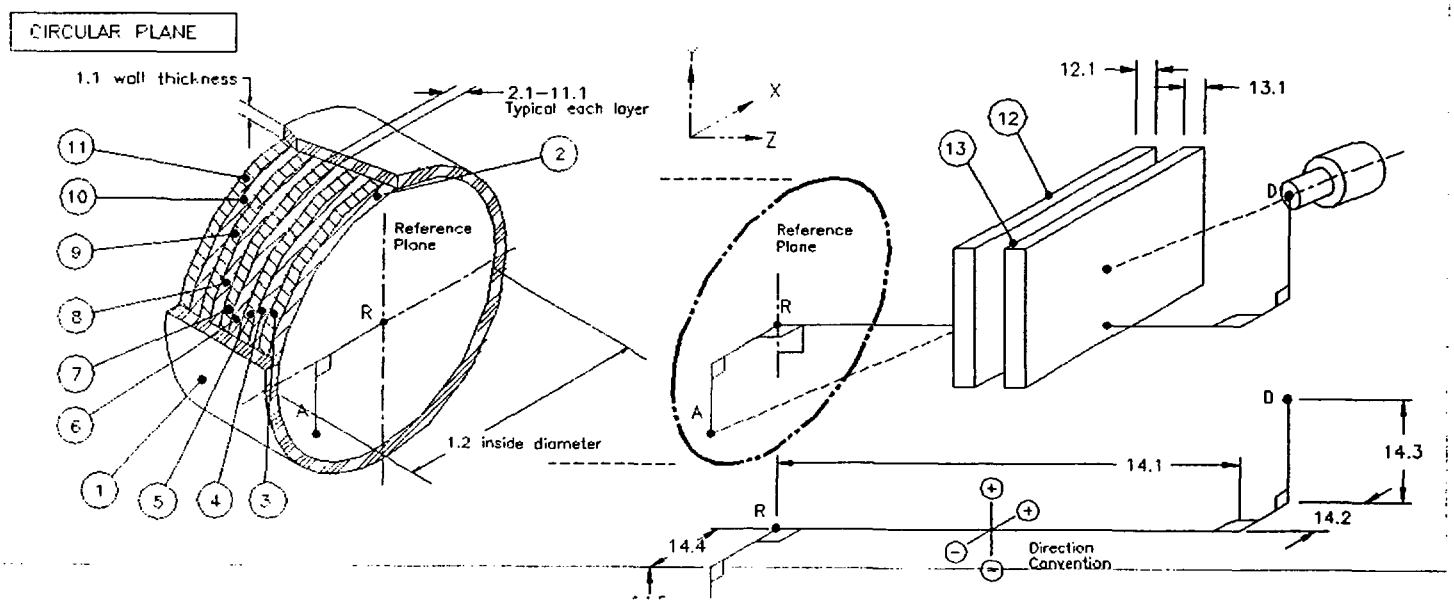
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by
Reviewed by DJR 2-7-05



Geometry Composer Report

Authorized/Implemented 12/7/04 WB

Reviewed DR 12-7-04

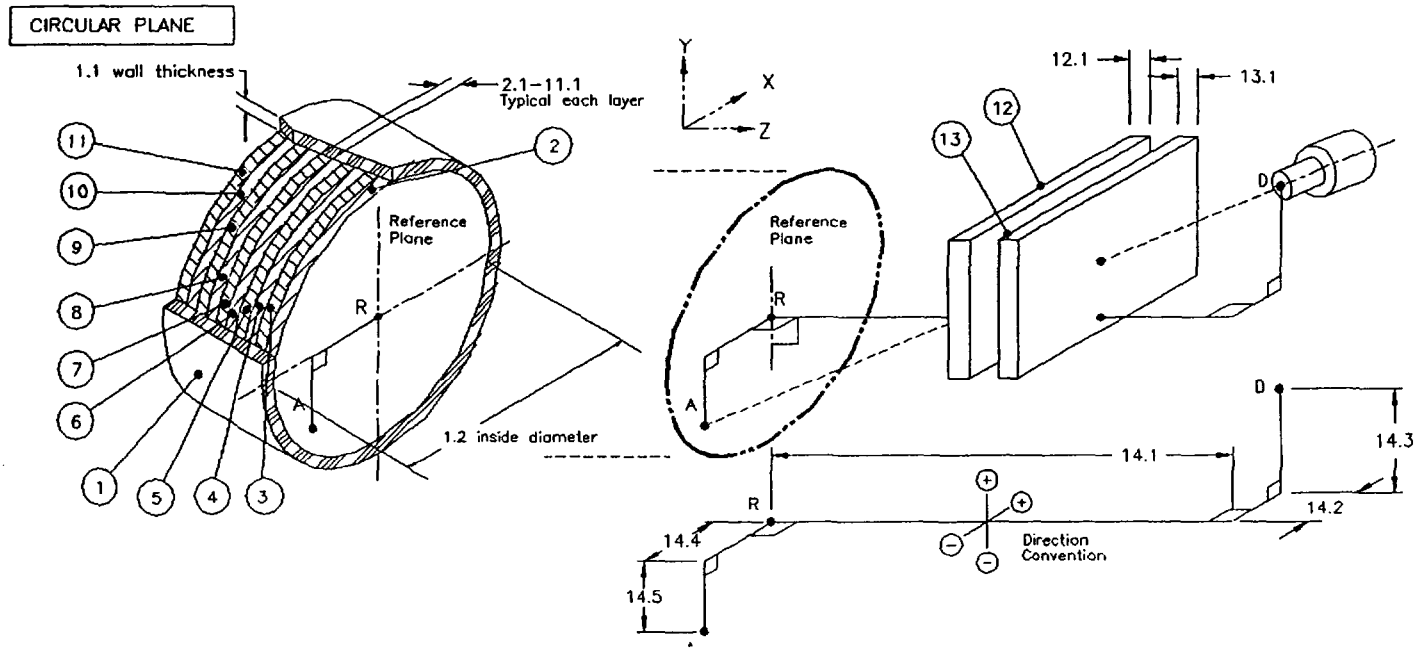
Date: Saturday, November 27, 2004
Description: Soil_70cm90d
Comment: Soil_Investigations
File Name: C:\7607 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil 70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Authorized/Implemented 11/30/04 W Bunker

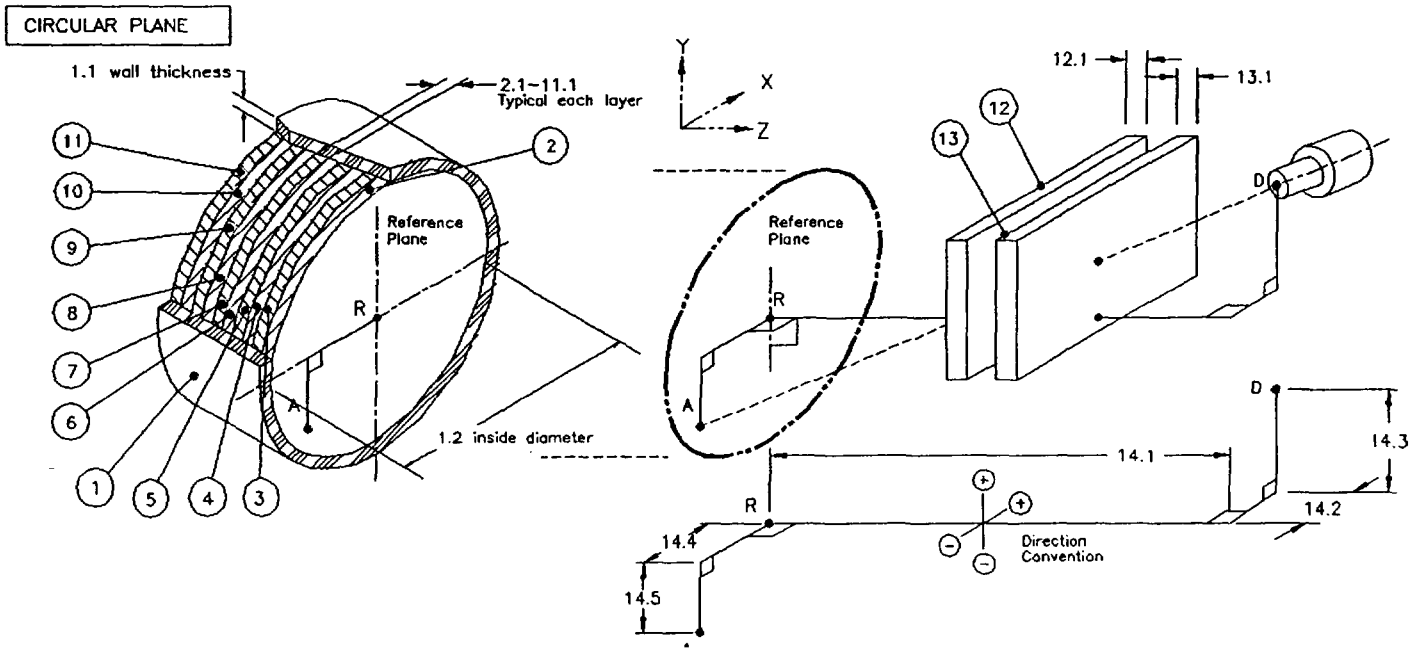
Date: Tuesday, November 30, 2004
Description: Soil_2m90d
Comment: Surface
File Name: C:\7607 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_at_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Authorized / Implemented 11/30/04 CW Burnham
Reviewed / DR 12-1-04

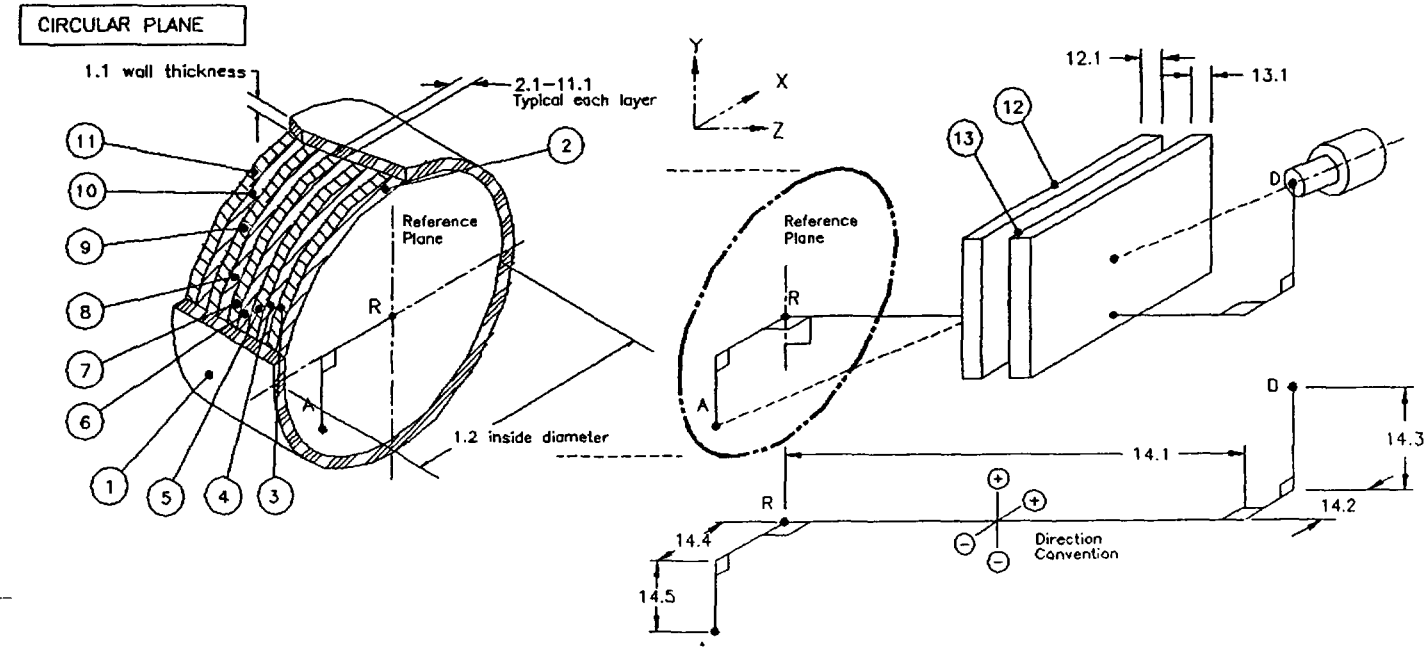
Date: Tuesday, November 30, 2004
Description: Soil_3m90d
Comment: Surface
File Name: C:\7607 Backup\Genie2k\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7607
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



7722

Geometry Composer Report

Date: Monday, February 07, 2005
Description: Conc_2m90d
Comment: Concrete_Wall
File Name: S:\FSS\ISOCS Systems\Data Files\GENIE2K\Approved Geometries\7722-Conc_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7722
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

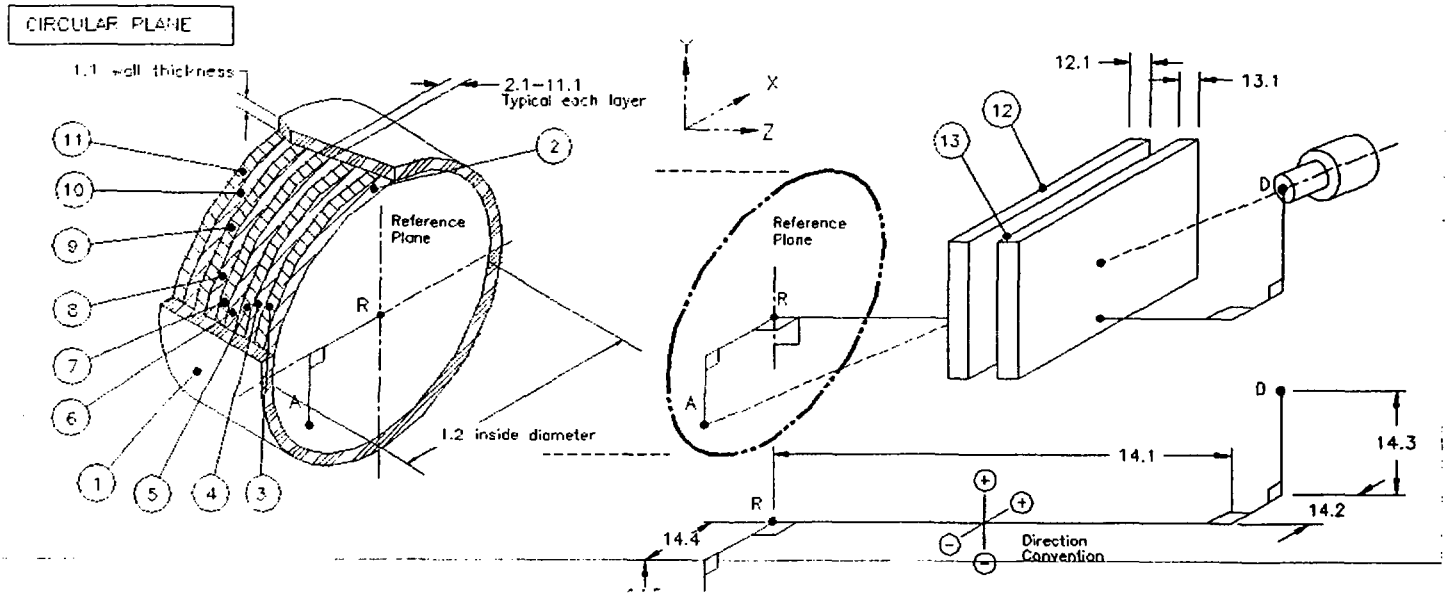
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Reviewed by: DR 2-7-05



Geometry Composer Report

Reauthorized/Implemented 11/29/04
W Burnham

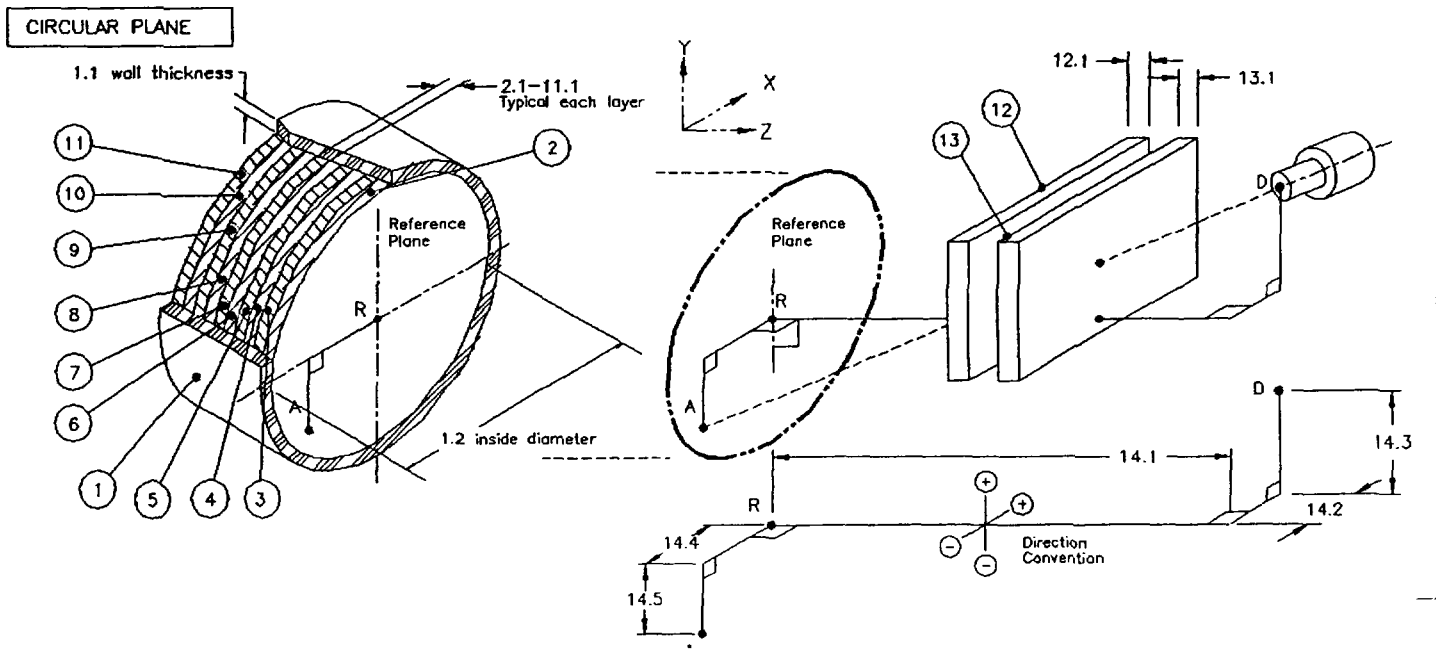
Date: Monday, November 29, 2004
Description: Soil_2m90d
Comment: Surface
File Name: C:\7722 Backup\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7722
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Authorized / Implemented 11/29/04
Reviewed / DR 12-1-04 W Burnham

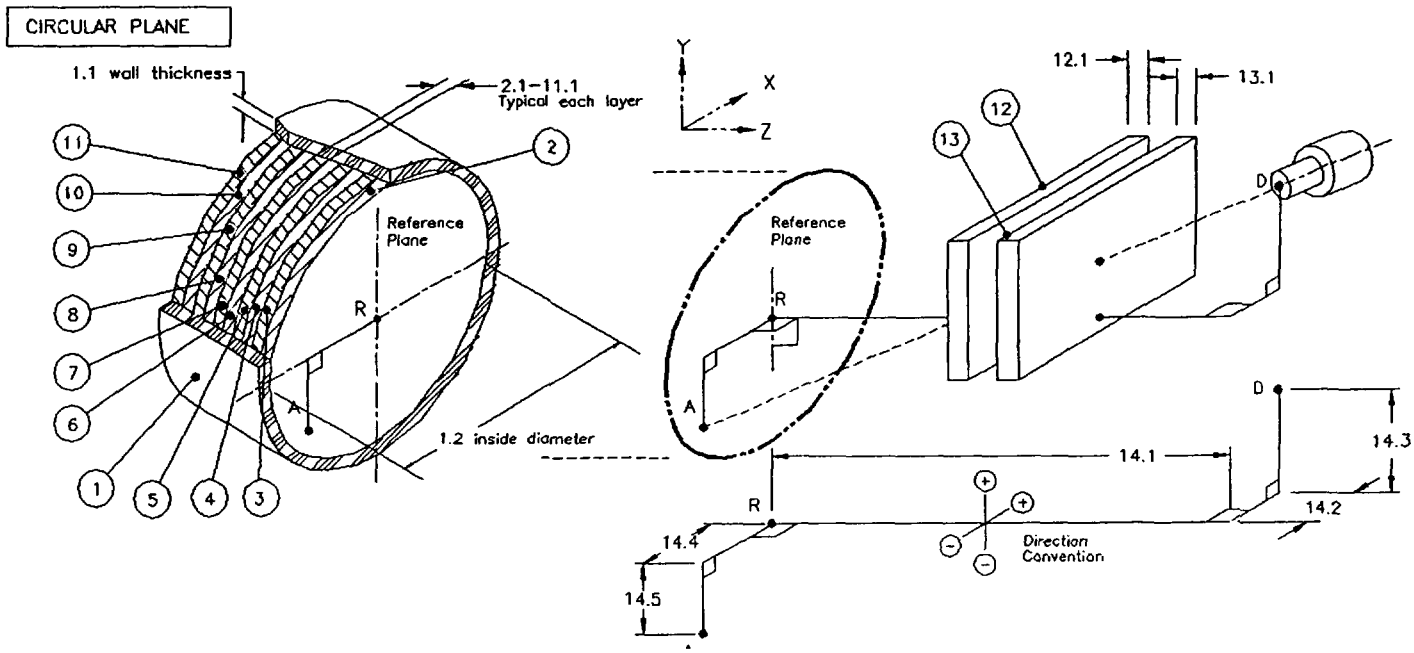
Date: Monday, November 29, 2004
Description: Soil_3m90d
Comment: Surface
File Name: C:\7722 Backup\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7722
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

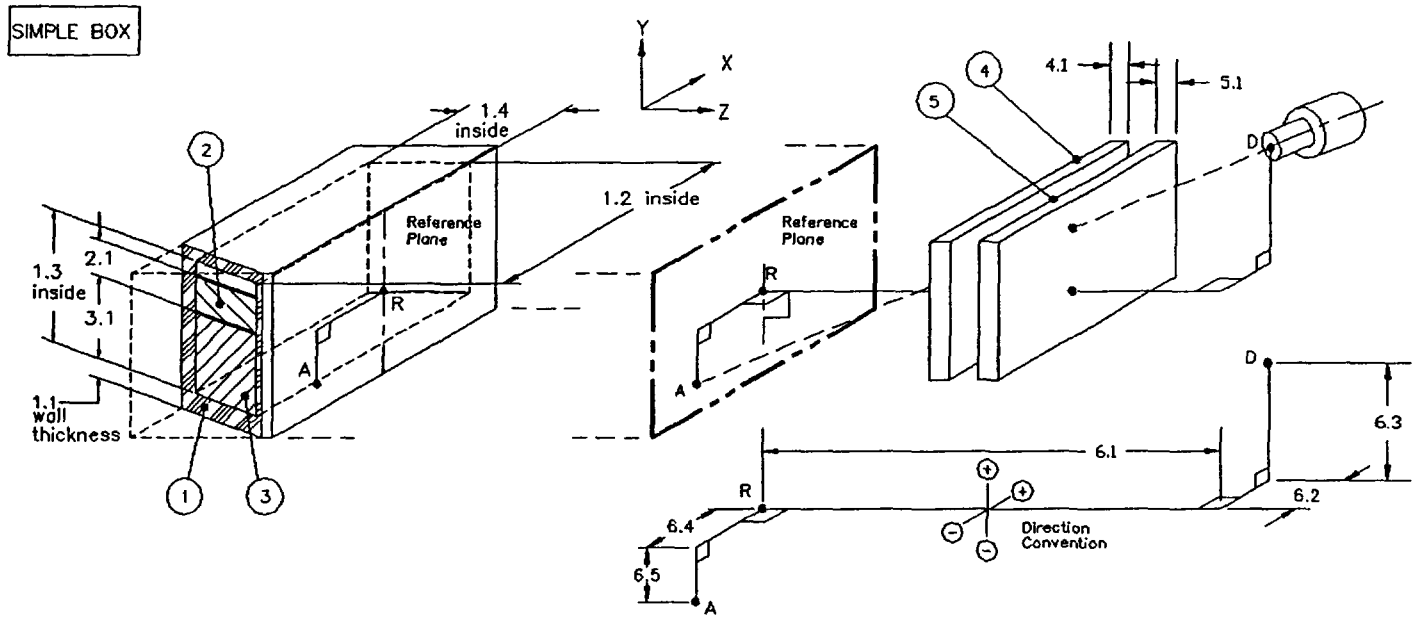
Date: Tuesday, November 23, 2004
Description: Truck_3314
Comment: Backyard
File Name: E:\Truck_3314.geo
Software: ISOCS
Template: SIMPLE_BOX, Version: default
Detector: 7722
Environment: Temperature= 0 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (foot): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Box		16.01	7.00	4.50			none		
2	Source-Top Layer	7.00						dirt1	1.60	1.00
3	Source-Bottom Layer							none		
4	Absorber1							none		
5	Absorber2							none		
6	Source-Detector	9.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Loaded into detector 7722 11/23/04 @ 1030
and implemented W Burnham 11/23/04

7780

Geometry Composer Report

Date: Tuesday, February 22, 2005
Description: Conc_70cm90d
Comment: Surface
File Name: c:\7780 backup\genie2k\isocs\data\geometry\in-situ\circular_plane\7780-conc_70cm90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

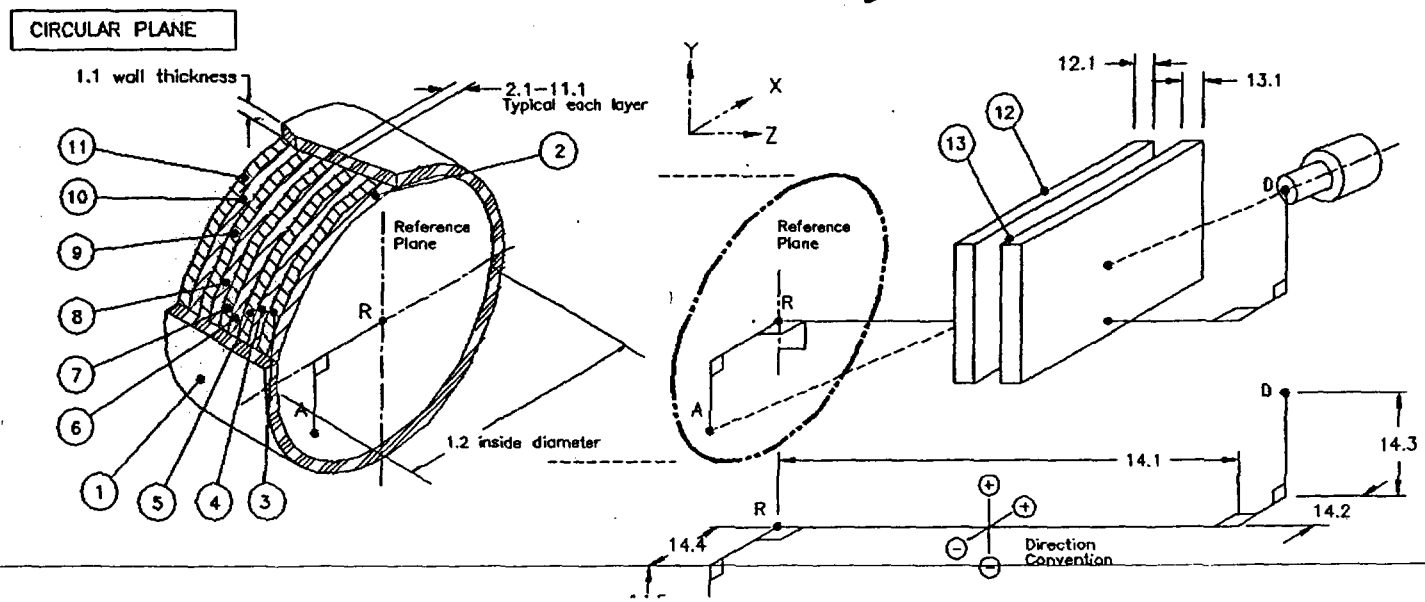
#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		140.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	70.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Created by [illegible] FEB 22 2005
Reviewed by [illegible] 2-22-05



Geometry Composer Report

Date: Monday, February 07, 2005
Description: Conc_2m90d
Comment: Concrete_Wall
File Name: S:\FSS\ISOCS Systems\Data Files\GENIE2K\Approved Geometries\7880-Conc_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	5.00						concrete	2.20	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

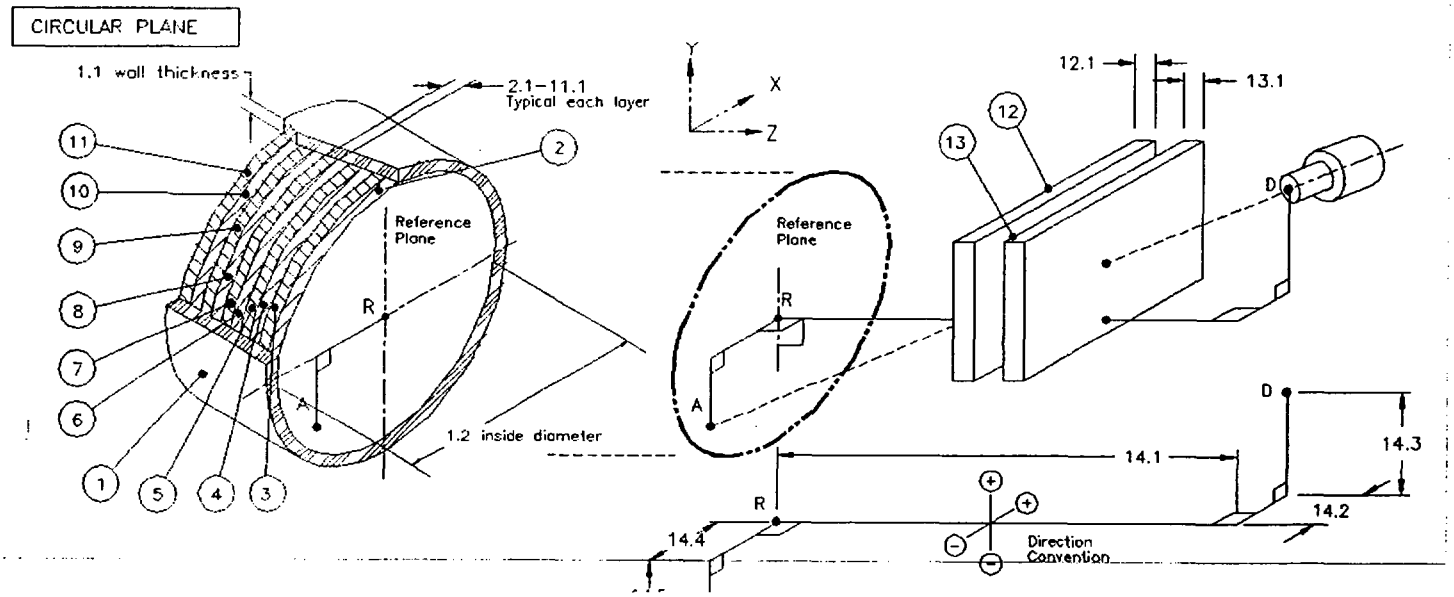
COPY

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 88.0 122.1 165.9 391.7 661.7 898.0 1173.2 1332.5 1836.0

Checked by A.F.
Reviewed by DR 2-7-05



Geometry Composer Report

Authorized/Implemented 11/29/0
W Bunton 11/29/04

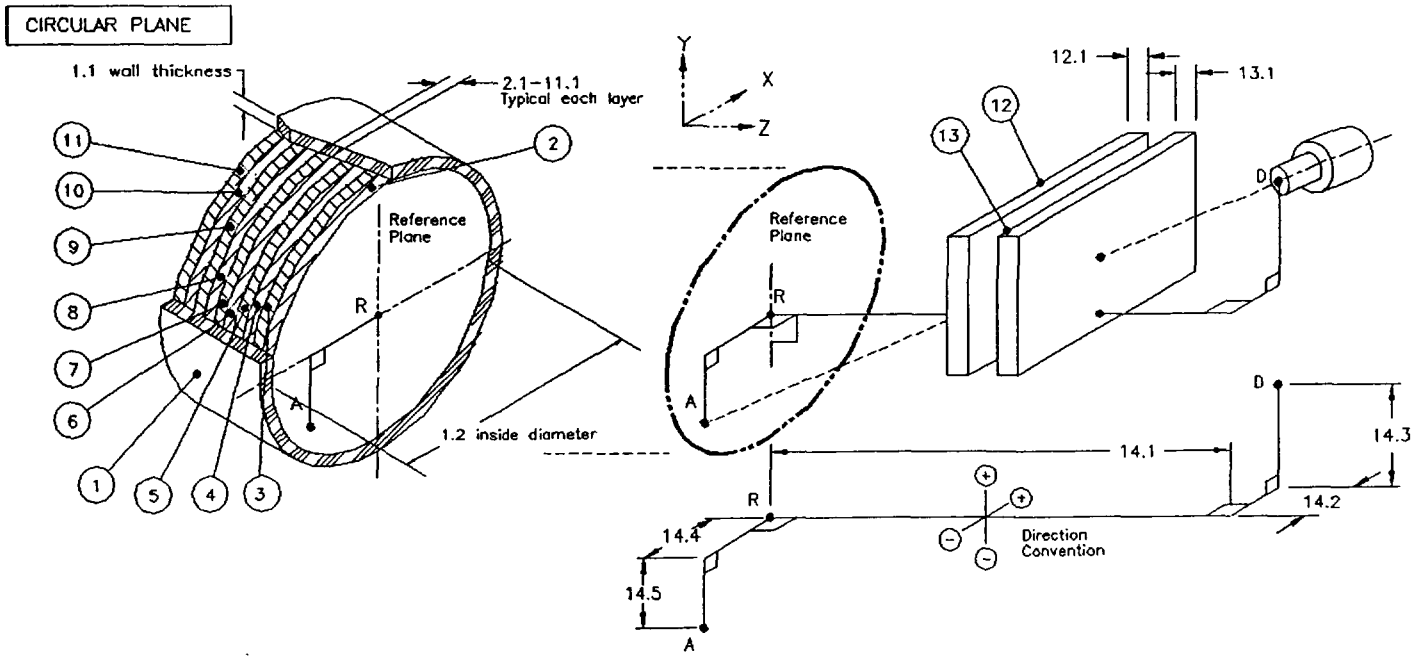
Date: Monday, November 29, 2004
Description: Soil_2m90d
Comment: Surface
File Name: E:\7780\7780 Geometries\In-Situ\CIRCULAR_PLANE\Soil_2m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		400.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	200.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

Implemented and Authorized for use 11/29/04
W Burnham 11/29/04

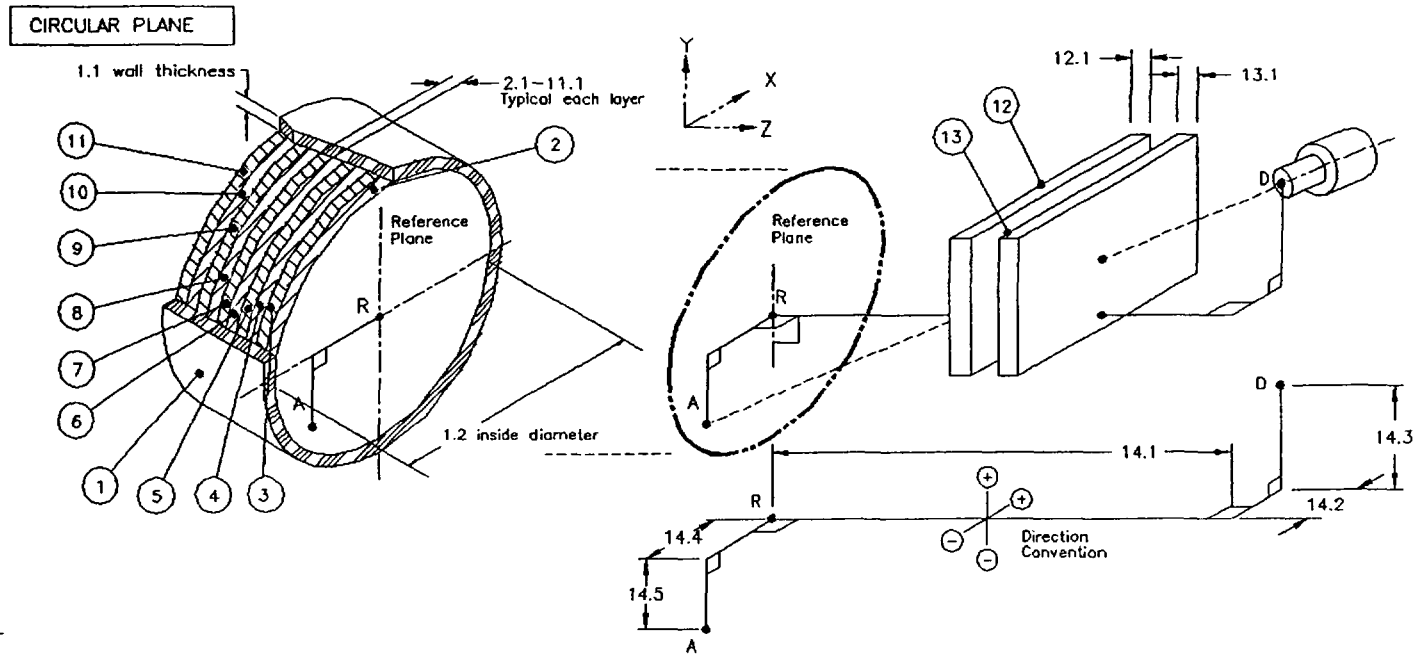
Date: Monday, November 29, 2004
Description: Soil_at_3m90d
Comment: Surface
File Name: E:\7780\7780 Geometries\In-Situ\CIRCULAR_PLANE\Soil_3m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		600.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	300.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Geometry Composer Report

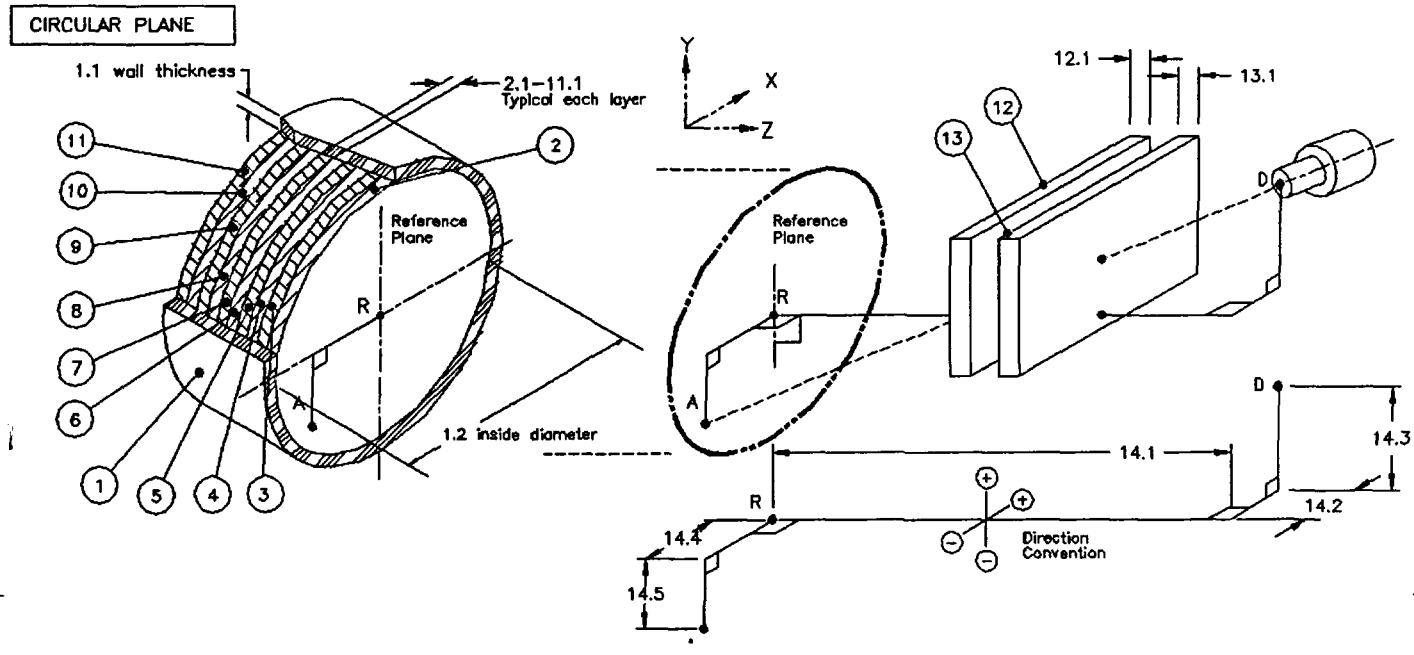
Date: Saturday, November 27, 2004
Description: Soil_at_4m90d
Comment: Surface
File Name: C:\7780 Backup\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\Soil_4m90d.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: default
Detector: 7780
Environment: Temperature= 22 C, Pressure= 760 mmHg, Rel.Humidity= 30%
Integration: Convergence= 1.00%, MDRPN= 2^(4) CRPN= 2^(4)

#	Geometry Compon.	Dimensions (cm): d1	d2	d3	d4	d5	d6	Material	D(g/cm3)	R.Conc.
1	Side Walls		800.00					none		
2	Layer 1	15.00						dirt1	1.60	1.00
3	Layer 2							none		
4	Layer 3							none		
5	Layer 4							none		
6	Layer 5							none		
7	Layer 6							none		
8	Layer 7							none		
9	Layer 8							none		
10	Layer 9							none		
11	Layer 10							none		
12	Absorber1							none		
13	Absorber2							none		
14	Source-Detector	400.00								

Collimator: 50mm-90d_new
newISOCS_50mm_side_90deg_collimation_[large_hole_collimator]

List of energies for efficiency curve generation:

59.5 661.7 1173.2 1332.5



Appendix C

FR-0111-SU-15

Form 4 "Survey Design" dated 3/31/05
Form 5 "Survey Instructions" dated 3/31/05 (2 pgs.)
Form 9 "Investigation Setpoint Form" dated 4/4/05

FR-0100-SU-03

Form 4 "Survey Design" dated 12/29/04
Form 5 "Survey Instructions" dated 12/30/04 (2 pgs.)
Form 9 "Investigation Setpoint Form" dated 12/21/04

FORM 4
SURVEY DESIGN

FSS Package #: FR 0111 U15	Design Form #: 01	Page 1 of 1

Survey Area Name: Restricted Area Sub-surface Excavation Soil Footprint.
Survey Area Location:. Restricted Area back yard bounded by Maine State coordinates 623940E/407633N, 623826E/407659, 623846E/407752N, 623960E/407727N.
Survey Area Description: The Survey unit is 1029.5m^2. It is a rectangular shaped area 35.5 meters wide (east/west) by 29 long (north/south). The area (a shallow hole) is primarily exposed flowable fill, soil and concrete/rebar wall edge remnants left after demolition and removal of the Primary Auxiliary Building down to the 17'elevation.
WCF # (s): 01

Survey Unit	Material Codes	Classification	Survey Unit Location	Survey Unit Description
15	S/C	1	(same as "Area" above)	(same as "Area" above)
S=Soil C=Concrete				

Survey Unit	Survey Type	Survey #	Survey Type	Survey #	Survey Type	Survey #	Survey Type	Survey #	Survey Type	Survey #	Comments #
15	GS	100%	SS	40	N/A	N/A	N/A	N/A	N/A	N/A	**1, 2, 3**
GS = ISOCS Gamma Scan SS = Soil Samples											

Survey Type	Instrument	Detector	Comments #
GS	ISOCS	Portable HPGe	1
SS	MCA	HPGe	2,3

#	Survey Design Comments
1	Ensure ISOCS count times are sufficient to achieve a MDA of approximately 0.6pCi/g Cs-137 and approximately 0.25pCi/g Co-60.
2	Maintain Chain of Custody for all samples. Place samples in secure storage until prepped or analyzed.
3	Soil Samples to be counted by HPGe. Direct count room technician to set count time to achieve MDA of approximately 0.15 pCi/g Co60 and Cs-137.

Prepared By/Date [signature] 3/30/05 FSSS

Reviewed By/Date [signature] 3-31-05 FSSE or Designee

Routing: 1) Applicable Survey Package

FORM 5

SURVEY INSTRUCTIONS

FSS Package #: FR 0111	Survey Instruction Form #: 1
Survey Unit #: 15	
Classification: 1	Page 1 of 2

Map #: FR 0111U15-SITE, FR 0111U15-SCAN, FR 0111U15-DIRT, FR 0111U15-INFO

General Instructions

Survey Type	Instrument Model	Detector Model	Instrument Mode	Count Time
GS	Portable MCA	ISOCS HPGe	Per DI 6-163	Sufficient to achieve MDA approximately equal to 30% of the $DCGL_W$.
SS	MCA	HPGe	Per Chemistry	Sufficient to achieve MDA approximately equal to 0.15pCi/g Co-60 and Cs-137

GS = ISOCS Gamma Scan, SS = Volumetric Sample

Additional General Instructions/Comments:

- These instructions are for the footprint of the post-excavated soil area (hole) located in the Restricted Area back yard bounded by Maine State coordinates 623940E/407633N, 623826E/407659, 623846E/407752N, 623960E/407727N.

- **Instrument Setup: ISOCS** setup IAW DI 6-163

- **Area Setup:** **Ensure area is properly posted prior to performing surveys.**

  - For scan locations that include portions covered with water (snow or ice), estimate the percentage of the scan coverage area that is covered and enter the comment (percentage) on the ISOCS computer and in the comment section of the appropriate data form 6.

    NOTE: NO SCAN LOCATION MAY CONTAIN MORE THAN 5" OF WATER, SNOW OR ICE. FOR SCAN LOCATIONS THAT CONTAIN MORE THAN 2" OF WATER, SNOW OR ICE, ENSURE COUNT TIME OF 2000 SECONDS.

- **ISOCS Surveys: (SCAN: 90^0 3m Soil)**

  - Perform ISOCS measurements at locations indicated on map # FR 0111U15-SCAN.
  - Using the 90^0 collimator, position the detector 3 meters above the surface (downward looking) directly over the points indicated on map FR 0111U15-SCAN.
  - Include all Area, Volume, Density and Mass data (Geometry Composer Report) with ISOCS data reports.

FORM 5

SURVEY INSTRUCTIONS

FSS Package #: FR 0111	Survey Instruction Form #: 1
Survey Unit #: 15	
Classification: 1	Page 2 of 2

Additional General Instructions/Comments:

- **Soil Samples: (Directs)**
  - At the locations indicated on map # FR0111U15-DIRT, collect an adequate volume of material to provide a 1 liter prepared sample.
  - Note sample composition (if other than soil) in "comments" section of the appropriate Data Form 6.
  - After preparation and drying are complete, direct Count Room to achieve a MDA of 0.15 pCi/g for Co-60 and Cs-137 for both samples.

NOTE: Sample locations S028, S029 and S030 will be the QC Splits.

S028 SPLIT TO FORM FR0111-15-1-S043SS-DIRT
S029 SPLIT TO FORM FR0111-15-1-S044SS-DIRT
S030 SPLIT TO FORM FR0111-15-1-S045SS-DIRT

  - **All samples are to be controlled by Chain of Custody at all times.**
- **Safety Precautions:**
  - Proper PPE to be worn at all times.
  - Coordinate with Safety Department for access into trenches and holes.

Instructions Prepared (FSSS) By/Date: [signature] 3/30/05	Instructions Reviewed (FSSE) By/Date: [signature] 3-31-05

Routing: 1) Applicable Survey Package

FORM 9

INVESTIGATION SETPOINT FORM

NOTE

The source and/or derivation of design input values must be documented.

FSS Package #: FR0111 Setpoints Form #: 01

Survey Unit #: 15

Classification: 1

Page 1 of 1

Survey Unit Area	1,029.5	m^2	MDC Direct $\frac{3 + 4.65\sqrt{Bkgd}}{\left(E_t \times \frac{probearea}{100cm^2}\right)}$	**Soil Scan Alarm Setpoint ******* $SSPA - 3\ Scan = 3\left[\sqrt{\frac{Bkgd}{60}} X60\right] + Bkgd$
n	40			
Sample Area	26.0	m^2		
L	5.0	m		
AF* (note 1)	1.8			

***** For setpoints at the $DCGL_W$, add the $DCGL_W$ to background within the radical.

Detector Model	ISOCS (Cs-137)		ISOCS (Co-60)	
Eff. (E_t for surfaces)	N/A	%	N/A	%
Eff. Source**	N/A		N/A	
BKG	N/A	pCi/g	N/A	pCi/g
BKG Source***	N/A		N/A	
$DCGL_{EMC}$ Total Activity *	4.27	pCi/g	1.54	pCi/g
DCGL Total Activity	2.39	pCi/g	0.86	pCi/g
10% of DCGL Removable	N/A		N/A	
MDC Direct	0.15	pCi/g	0.15	pCi/g
MDCR Direct	N/A	CPM	N/A	CPM
MDC Scan for $1m^2$ soil **	0.6	pCi/g (Note 2)	0.25	pCi/g (Note 2)

* Only required for Class 1 Areas **Source = EC-009-01 or list other *** Package # or other source

Investigation Setpoint Direct	N/A	pCi/g	N/A	cpm	N/A	cpm
Basis of Setpoint****	N/A					

**** LTP Table 5-7 or list other

Investigation Setpoint Scan	1.0	pCi/g	0.36	pCi/g
Basis of Setpoint****	EC-003-04			

Comments: Note 1: 1.8 is an interpolated AF value per the LTP, table 6-12.
Note 2: MDC Scan specified to be less than the investigation levels.

FSSE: Dale Rowland Date: 4-4-05

Independent Reviewer: [signature] Date: 4 Apr 05

Routing: 1) Applicable Survey Package

FORM 4
SURVEY DESIGN

FSS Package #: FR 0100 Survey Unit 3	Design Form #: 01	Page 1 of 1

Survey Area Name: RA Yard West

Survey Area Location: Restricted Area back yard bounded by Maine State coordinates:
1). 407,373N – 623,652E 2). 407,299N – 623,717E 3). 407,315N – 623,873E 4). 407,277N – 623,864E 5). 407,290N– 623,816E 6). 407,179N – 623,742E 7). 407,227N – 623,702E 8). 407,245N – 623,718E.

Survey Area Description: This Survey Area is a portion of open land not originally included or surveyed as part of completed Survey Packages FR0500, FR1000 and FR0400. This area will be incorporated into FR0100 as a Class One Survey Unit. Significant portions of this area were within the Restricted Area and the Forebay, which were both Class One areas.

The Survey Area is a 1476 m^2 area composed primarily of relatively flat and gently sloping soil and backfill. The southern portion consists of a sloping ravine with exposed ledge walls and there is a small pool of standing water/ice in the most southwest corner.

WCF # (s): 01

Survey Unit	Material Codes	Classification	Survey Unit Location	Survey Unit Description
3	S,L	1	(see above)	(see above)
S = Soil L = Ledge				

Survey Unit	Survey Type	Survey #	Survey Type	Survey #	Survey Type	Survey #	Survey Type	Survey #	Survey Type	Survey #	Comments #
3	GS	100%	SS	43	VS	See comments	N/A	N/A	N/A	N/A	1-6
GS = ISOCS Gamma Scan SS = Soil Sample VS = Volumetric Sample											

Survey Type	Instrument	Detector	Comments #
GS	ISOCS	Portable HPGe	1,6
SS	MCA	HPGe	2,3,4,5
VS	MCA	HPGe	2,3,4,5

#	Survey Design Comments
1	Ensure ISOCS count times are sufficient to achieve a MDA of 0.6pCi/g Cs-137 and 0.25pCi/g Co-60.
2	Maintain Chain of Custody for all samples in accordance with DI 6-157. Place samples in secure storage until prepped or analyzed.
3	Soil Samples to be counted by HPGe. Direct count room technician to set count time to achieve MDA of 0.15 pCi/g Co60 and Cs-137.
4	40 Soil Samples are required for Survey Unit 3; however due to the L of the grid map, 43 points fell in and will be taken. Note: If the sample location identified is found to be on material other than soil, a volumetric sample (VS) of the material will be substituted for the soil sample.
5	Three samples from Survey Unit 3 are to be split for QC purposes (5% of all samples).
6	Historical Site Assessment shows FR0100 meets the criteria for a Class 1 area; Scan percentage to equal 100%. FR0100 Survey Unit 3 classification and design based on Section 5 of the LTP (Revision 3).

Prepared By/Date 12-23-04 FSSS

Reviewed By/Date 29.DEC.04 FSSE or Designee

Routing: 1) Applicable Survey Package

FORM 5

SURVEY INSTRUCTIONS

FSS Package #: FR 0100	Survey Instruction Form #: 1
Survey Unit #: 3	
Classification: 1	Page 1 of 2

Map #: FR0110-3-SITE, FR0100-3-REF, FR0100-3-DP REF, FR0100-3a, FR0100-3b

General Instructions

Survey Type	Instrument Model	Detector Model	Instrument Mode	Count Time
GS	Portable MCA	ISOCS HPGe	Per DI 6-163	Sufficient to achieve MDA of 0.6pCi/g Cs-137 and 0.25 pCi/g Co-60.
SS	MCA	HPGe	Per Chemistry	Sufficient to achieve MDA of 0.15pCi/g Co-60 and Cs-137
VS	MCA	HPGe	Per Chemistry	Sufficient to achieve MDA of 0.15pCi/g Co-60 and Cs-137

GS = ISOCS Gamma Scan, SS =Soil Sample, VS = Volumetric Sample (if needed)

Additional General Instructions/Comments:

These instructions are for ISOCS scans and soil samples of open land of the Restricted Area back yard for FR0100 Survey Unit 3.

- **Instrument Setup:**
  - **ISOCS** setup IAW DI 6-163.

- **Area Setup:** **Ensure area is properly posted prior to performing surveys.**

- **ISOCS Surveys: (Scans)** [Data set 1]
  - Perform ISOCS measurements at locations indicated on map # FR0100-3a.
  - Unless otherwise noted, using the 90^0 collimator, position the detector 3 meters above the surface (downward looking) directly over the points indicated on map

    NOTE: Points with arrows (and at the location of the arrowhead as indicated on the map FR0100-3a (S078. S079, S080 and S081) are to be scanned using the 90^0 collimator with the detector positioned 3 meters from the surface. Center the detector at a right angle to the scan surface.

  - Include all Area, Volume, Density and Mass data with ISOCS data reports.

FORM 5

SURVEY INSTRUCTIONS

FSS Package #: FR 0100	Survey Instruction Form #: 1
Survey Unit #: 3	
Classification: 1	Page 2 of 2

Additional General Instructions/Comments:

- **Soil Samples: (Directs)** [Data set 2]
  - Perform 0-6" depth soil samples at the 43 locations shown on map FR0100-3b. Collect adequate material to allow for a 1-liter sample following sample preparation.
  - Samples to be identified on containers and COC using the following protocol: Location **S001** = FR0100-03-1-**S001**SS

Original Sample ID	Split Sample ID	Comments
FR0100-03-1-S010 (SS)	FR0100-03-1-S044 (SS)	QCSplit
FR0100-03-1-S029 (SS)	FR0100-03-1-S045(SS)	QCSplit
FR0100-03-1-S039(SS)	FR0100-03-1-S046(SS)	QCSplit

    - Collect adequate material to allow for 2, 1-liter samples following sample preparation and place entire sample in one plastic bag.
      - Mark "Split" across the top of the bag.
      - Write both the original sample location ID and the split sample ID on the bag.
      - The original and split samples should be recorded on the same COC, with each sample identified.
  - Samples shall be prepared as necessary to support gamma analysis (drying and mixing as appropriate).
  - Prepared samples should be counted by HPGe with sufficient count time to achieve MDA of 0.15 pCi/g for both Co-60 and Cs-137.
  - If the sample location is found to be on material other than soil, obtain a 0.25- liter volumetric sample (VS) of the material that will be substituted for the soil sample.
  - Denote change on Form 6.
  - Use pink flags to mark sample locations.
  - **All samples are to be performed and controlled by Chain of Custody in accordance with DI6 157.**
- **Safety Precautions:**
  - Proper PPE to be worn at all times.

Instructions Prepared (FSSS) By/Date:	Instructions Reviewed (FSSE) By/Date:
12-30-04	30.DEC.04

Routing: 1) Applicable Survey Package

FORM 9

INVESTIGATION SETPOINT FORM

NOTE

The source and/or derivation of design input values must be documented.

FSS Package #: FR0100 Setpoints Form #: 1

Survey Unit #: 3

Classification: 1

Page 1 of 1

Survey Unit Area	1476	m^2	MDC Direct $\frac{3 + 4.65\sqrt{Bkgd}}{\left(E_t \times \frac{probearea}{100cm^2}\right)}$	**Soil Scan Alarm Setpoint ******* $SSPA - 3\ Scan = 3\left[\sqrt{\frac{Bkgd}{60}} X60\right] + Bkgd$
n	40			
Sample Area	37	m^2		
L	6.1	m		
AF* (Note 1)	1.6			

***** For setpoints at the $DCGL_W$, add the $DCGL_W$ to background within the radical.

Detector Model		ISOCS (Cs-137)		ISOCS (Co-60)		
Eff. (E_t for surfaces)		N/A	%	N/A	%	
Eff. Source**		N/A		N/A		
BKG		N/A	pCi/g	N/A	pCi/g	
BKG Source***		N/A		N/A		
$DCGL_{EMC}$*	Total Activity	3.82	pCi/g	1.38	pCi/g	
DCGL	Total Activity	2.39	pCi/g	0.86	pCi/g	
10% of DCGL	Removable	N/A	$dpm/100cm^2$	N/A	$dpm/100cm^2$	
MDC Direct		0.15	pCi/g	0.15	pCi/g	
MDCR Direct		N/A	CPM	N/A	CPM	
MDC Scan for $1m^2$** soil		0.6	pCi/g (Note 2)	0.25	pCi/g (Note 2)	

* Only required for Class 1 Areas **Source = EC-009-01 or list other *** Package # or other source

Investigation Setpoint Direct	N/A	pCi/g	N/A	cpm	
Basis of Setpoint****					

**** LTP Table 5-7 or list other

Investigation Setpoint Scan	1.00	pCi/g	0.36	pCi/g	
Basis of Setpoint****	Memo TSB 01-07/06/2004				

Comments: Scan measurements to be performed by ISOCS

Note 1: The AF is interpolated (natural log) from the LTP, table 6-12.
Note 2: MDC Scan specified to be less than the investigation levels.

FSSE: _____ Date: 21 DEC 04

Independent Reviewer: _____ Date: 12/21/04

Routing: 1) Applicable Survey Package

Appendix D

FA-2600-SU-01 LSA Test Pit

Final Remediation Gamma Survey dated 3/18/04

FINAL RAD REMEDIATION SURVEY

Related FSS Package #: FA2600 **Survey Unit #:** 1

Survey Area: LSA Test Pit

Survey Date: 3/18/04

Survey Team
Lee Reid (signature)

Review: (signature) 3/24/04

Instrument	S/N	Cal Due	Detector	S/N	Cal Due
E-600	2489	6/19/04	SSPA-3	726560	7/28/04
E-600			SSPA-3		

Surveys

Grid #	Scan Result K (cpm)	Elevated Area Cm2	Comments
20	26.2	N/A	
39	35.6		Survey in area to be demo'd
1	36.5		Survey in area to be demo'd
2	35.4		Survey in area to be demo'd
21	22.7		N/A
22	23.4		
23	23.5		
47	22.5		
48	20.8		
4	23.9		
3	28.9		
5	24.5		
24	18.77		
26	16.8		
40	15.49		
7	16.82		
6	18.85		
25	18.55		
23	19.9		
49	21.9		
50	23		
10	19.9		
11	21.5		
29	20.6		
30	28.5		
9	18.16		
8	16.05		
41	15.09		
27	16.21		
28	18.2		
N/A	N/A	N/A	

Surveys

Grid #	Scan Result (cpm)	Elevated Area Cm2	Comments
N/A			

Comments:

FINAL RAD REMEDIATION SURVEY

Related FSS Package #: FA2600 **Survey Unit #:** 1

Survey Area: LSA Test Pit

Survey Date: 3/18/04

Instrument	S/N	Cal Due	Detector	S/N	Cal Due
E-600	2619	9/12/04	SSPA-3	725328	6/16/04
E-600			SSPA-3		

Survey Team
Jack Sprucinski

Review: 3/24/04

Surveys

Grid #	Scan Result (Kcpm)	Elevated Area Cm2	Comments
19	23.9	N/A	N/A
46	18.3		
38	21.5		
54/55	31.5	1/2 FT²	Elevated area in crack after - remediation 29.3
56	24.8	N/A	N/A
45	19.26		
37	28		
18	25.7		
16	24.9		
17	20.8		
44	19.89		
36	22.3		
35	26.1		
53	33.1	1 FT²	Area runs between 53 and 52
52	30.1	1 FT²	After sample taken down to 22.5
34	20.8	N/A	N/A
33	18.1		
43	12.3		
14	19.41		
15	20.7		
11	21.6		
12	21.3		
13	19.26		
42	17.25		
32	18.4		
31	19.8		
30	20.1		
51	28.7		
N/A	N/A		

Surveys

Grid #	Scan Result (cpm)	Elevated Area Cm2	Comments
			N/A

Comments:

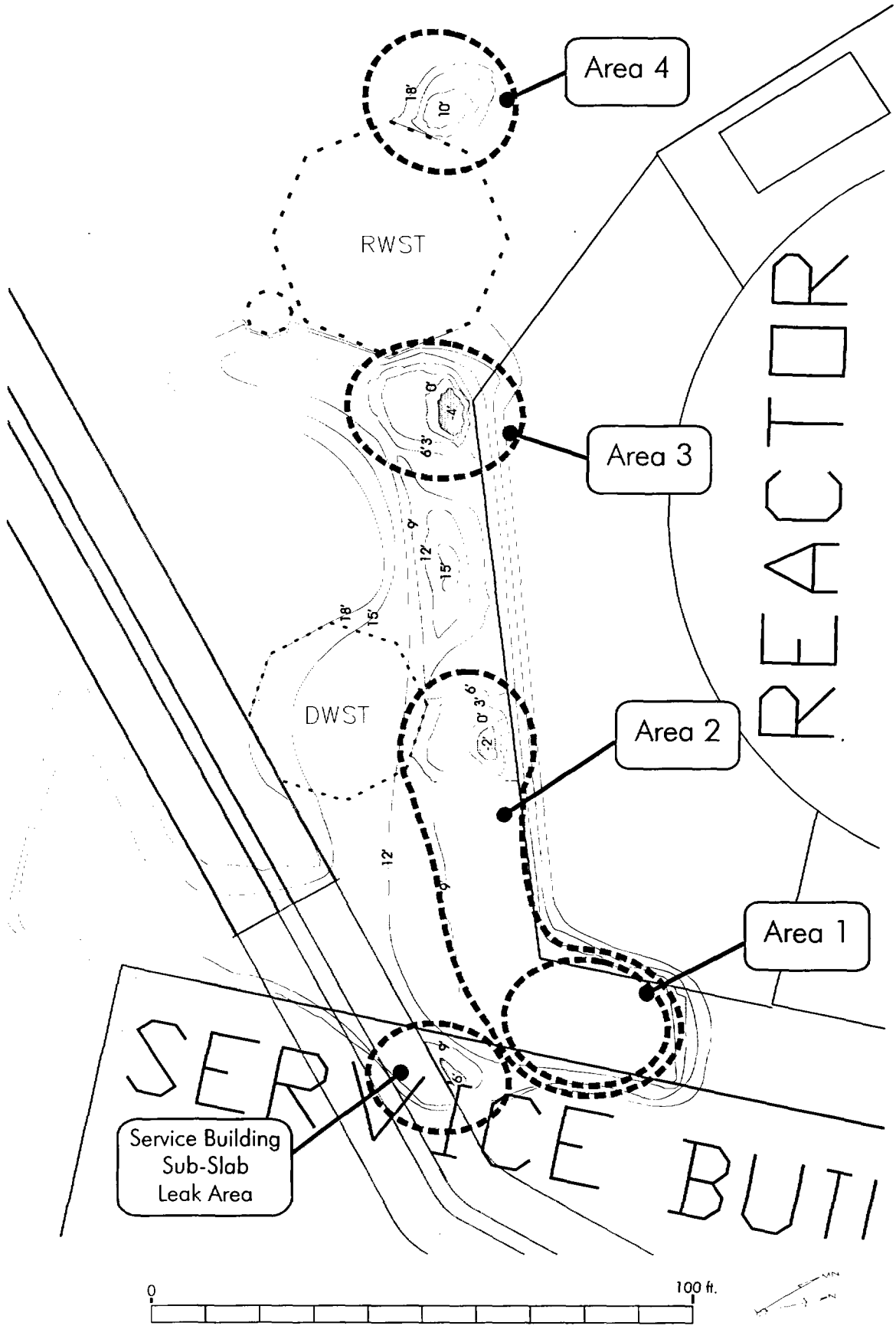
Appendix E

FR-0111-SU-3 Yard West Excavation (Soil Remediation Area)

Excavation Water Samples from March 29, 2004 through May 25, 2004

Map and Data

Maine Yankee Decommissioning Team	***Maine Yankee Decommissioning Project Survey Map***	Map ID# FR0111-Excavations
Survey Type: Sample location areas for ground/rain water run-off samples collected during soil excavation operations from 3/29/05 to 5/25/05		Survey Area Name: Restricted Area Soil Excavations



ALLEYWAY (East-West), SU 2 Excavation

Service Bld Sub-Slab Leak Area

Date	uCi/mL Cs-137	uCi/mL Co-60	pCi/L H-3	Comment
3/29/04	<4.0E-8	<4.4E-8	**12,100**	Carslick's cavern
4/8/04	<6.7E-8	<7.7E-8	**9,930**	sample 19
4/28/04	<5.1E-8	<5.3E-8	**5540**	sample 60
4/29/04	<3.6E-8	<5.9E-8	**4570**	sample 64
5/4/04	<4.7E-8	<5.4E-8	**4670**	
5/5/04	<5.7E-8	<6.5E-8	**2860**	
5/11/04	<6.0E-8	<6.2E-8	**6120**	
5/13/04	<6.5E-8	<4.7E-8	**5730**	
5/14/04	<3.8E-8	<5.4E-8	**7510**	
5/17/04	<3.0E-8	<7.1E-8	<2480	
5/18/04	<6.6E-8	<7.2E-8	<2480	
5/19/04	<4.8E-8	<4.0E-8	**4500**	
5/20/04	<4.9E-8	<4.4E-8	**7290**	
5/24/04	<5.8E-8	<7.2E-8	<2590	
5/25/04	<5.5E-8	<7.9E-8	<2560	

Area 1 Date	uCi/mL Cs-137	uCi/mL Co-60	pCi/L H-3	Comment
3/31/04	<7E-8	<1.2E-7	**22,100**	ric-wil water
3/31/04	<5.1E-8	<5.7E-8	<2300	outboard pipe
3/31/04	<6.0E-8	<7.3E-8	<2180	inboard pipe
4/8/04	<8.6E-8	**2.70E-07**	**4670**	sample20

Area 2 Date	uCi/mL Cs-137	uCi/mL Co-60	pCi/L H-3	Comment	
3/31/04	**3.20E-06**	**2.70E-06**	**1.36E+06**	ric-wil water	
4/2/04	<9.8E-8	**1.10E-06**	**13,400**	SCC Test Well break	sample 1
4/2/04	<5.4E-8	<3.4E-8	**7130**	SCC Test Well break	sample2
4/2/04	<9.2E-8	<1.4E-7	**8780**	SCC Test Well break	sample 3
4/2/04	<7.3E-8	<1.0E-7	**5330**	SCC Test Well break	sample 4
4/2/04	<1.0E-7	**1.40E-06**	**3700**	SCC Test Well break	sample 5
4/5/04	<7.5E-8	<6.8E-8	**11,900**	East trench water	
4/6/04	<4.6E-8	<6.9E-8	**14,500**	sample 8 water	
4/8/04	<2.1E-7	**3.70E-06**	**8,410**	Sample 18	
4/9/04	<5.2E-8	<4.8E-8	**8,860**	sample 22	
4/9/04	<5.5E-8	**8.90E-08**	**10,038**	sample 24	
4/12/04	<6.8E-8	<8.4E-8	**4,780**	sample 25	
4/13/04	<6.9E-8	<9.2E-8	**5,170**	hole water sample after rain	
4/14/04	<7.1E-8	<6.5E-8	**4,470**	sample 34	
4/14/04	<7.0E-8	<6.2E-8	**5,190**	sample 35	
4/15/04	<4.8E-8	<4.5E-8	**4,730**	sample 36	
4/15/04	<5.1E-8	<5.3E-8	**3,890**	sample 38	
4/19/04	<7.0E-8	<5.4E-8	**4,190**	sample 39	
4/20/04	<5.9E-8	<4.7E-8	**4,640**	sample 42	

4/21/04	<5.2E-8	<7.1E-8	**4,120**	sample 45
4/22/04	<6.8E-8	<7.7E-8	**3,340**	sample 50
4/26/04	<6.4E-8	<5.1E-8	**7,350**	sample 53
4/27/04	<6.0E-8	<6.5E-8	**4,400**	sample 56 after rain
4/28/04	<6.1E-8	<7.7E-8	**3,540**	sample 59
4/29/04	<7.3E-8	<4.4E-8	**2,700**	sample 63
5/4/04	<5.0E-8	<4.2E-8	**1,850**	
5/5/04	<5.3E-8	<5.7E-8	**2,110**	
5/11/04	<7.1E-8	<8.0E-8	**1,920**	
5/13/04	<4.6E-8	<5.4E-8	**3,440**	
5/14/04	<4.7E-8	<6.7E-8	<2560	
5/17/04	<7.3E-8	<6.0E-8	<2480	
5/18/04	<5.1E-8	<5.1E-8	**2,930**	
5/19/04	<5.6E-8	<5.6E-8	**3,540**	
5/20/04	<4.6E-8	<8.0E-8	**9,660**	
5/24/04	<6.4E-8	<8.7E-8	<2590	
5/25/04	<6.0E-8	<5.8E-8	<2560	

Area 3	uCi/mL	uCi/mL	pCi/L	Comment
Date	Cs-137	Co-60	H-3	
4/1/04	<1.3E-7	**3.10E-06**	**36,300**	ric-wil water
4/6/04	<5.1E-8	<8.6E-8	**11,900**	after soil removal
4/6/04	<7.5E-8	<7.9E-8	**4450**	sample#7
4/6/04	<6.6E-8	<9.6E-8	**7940**	sample#11
4/6/04	**7.20E-07**	**3.00E-05**	**8450**	bucket sample
4/6/04	**7.80E-08**	**1.50E-06**	**7530**	sample#12
4/7/04	<7.0E-8	<7.6E-8	**8150**	sample#13
4/7/04	<7.5E-8	<8.8E-8	**9620**	sample#14 pipe
4/7/04	<5.2E-8	**1.80E-07**	**4530**	sample#15 pipe
4/7/04	<4.7E-8	<5.9E-8	**8930**	sample#16 center
4/8/04	**2.40E-07**	**2.40E-06**	**7150**	sample 21
4/9/04	<6.6E-8	<5.8E-8	**6810**	sample 23
4/12/04	<6.8E-8	<4.8E-8	**5360**	sample 26
4/13/04	<8.4E-8	<9.8E-8	**5360**	hole water sample after rain
4/19/04	<6.7E-8	<6.4E-8	**3990**	sample 40
4/20/04	<6.0E-8	<5.6E-8	**4510**	sample 43
4/21/04	<5.6E-8	<5.3E-8	**4110**	sample 46
4/22/04	<5.7E-8	<6.0E-8	**4150**	sample 49
4/26/04	<5.9E-8	<5.6E-8	**3540**	sample 52
4/27/04	<7.0E-8	<7.2E-8	**4010**	sample 55 after rain
4/28/04	<6.4E-8	<7.6E-8	**3500**	sample 58
4/29/04	<7.4E-8	<3.8E-8	**3810**	sample 62
5/4/04	<8.0E-8	<9.6E-8	**1810**	
5/5/04	<7.2E-8	<7.5E-8	**1600**	
5/11/04	<4.4E-8	<6.0E-8	**1570**	
5/13/04	<7.7E-8	<7.8E-8	<2510	
5/14/04	<7.0E-8	<5.4E-8	**2650**	
5/17/04	<4.8E-8	<5.3E-8	**2970**	
5/18/04	<6.1E-8	<6.7E-8	**2710**	

5/19/04	<5.3E-8	<5.4E-8	**4870**	
5/20/04	<5.8E-8	<4.1E-8	**6120**	
5/24/04	<4.3E-8	<4.8E-8	**3130**	
5/25/04	<5.2E-8	<7.5E-8	<2560	

Area 4	uCi/mL	uCi/mL	pCi/L	Comment
Date	Cs-137	Co-60	H-3	Siphon Htr Hole
4/1/04	**3.00E-07**	<4.9E-8	**3250**	RWST Htr water
4/13/04	<9.6E-8	<6.8E-8	<2480	RWST Htr water sample 29
4/13/04	**6.80E-07**	<7.8E-8	**4450**	RWST inside sump sample 30
4/13/04	<	<	**3050**	RWST Htr well water sample 31
4/14/04	<6.9E-8	<6.9E-8	**2480**	sample 33
4/15/04	<8.5E-8	<8.4E-8	**3180**	sample 37
4/19/04	<5.6E-8	<4.7E-8	**2540**	sample 41
4/20/04	<5.4E-8	<3.2E-8	**2560**	sample 44
4/21/04	<5.7E-8	<5.9E-8	**3060**	sample 47
4/22/04	<6.9E-8	<1.8E-8	<2580	sample 48
4/26/04	<3.4E-8	<4.8E-8	**4490**	sample 51
4/27/04	<4.9E-8	<4.6E-8	**2970**	sample 54 after rain
4/28/04	<5.6E-8	<5.1E-8	**4280**	sample 57
4/29/04	<5.3E-8	<1.2E-8	**3530**	sample 61
5/4/04	<4.9E-8	<6.4E-8	**2380**	
5/5/04	<5.4E-8	<5.9E-8	**2110**	
5/11/04	<5.6E-8	<6.2E-8	**2910**	
5/13/04	<4.3E-8	<5.8E-8	<2510	
5/14/04	<4.2E-8	<6.3E-8	<2560	
5/17/04	<3.6E-8	<6.1E-8	<2480	
5/18/04	<4.4E-8	<4.6E-8	<2480	
5/19/04	<4.5E-8	<4.7E-8	**3950**	
5/20/04	<4.1E-8	<5.9E-8	**4920**	
5/24/04	<3.6E-8	<6.4E-8	<2590	
5/25/04	<7.0E-8	<6.7E-8	<2560	

MISCELLANEOUS

	uCi/mL	uCi/mL	pCi/L	Comment
Date	Cs-137	Co-60	H-3	
3/1/04	<1.3E-8	<1.5E-8	**6230**	PAB Test Pit Split B1
3/1/04	<1.2E-8	<1.3E-8	**6900**	PAB Test Pit Split B2
3/31/04	**1.70E-07**	<9.6E-8	**4800**	CTMT Floor Water
4/7/04	<4.6E-8	<6.6E-8	<2510	Svc Bld Pipe Chase
4/14/04	<7.4E-8	<6.7E-8	**2300**	sample 32 Trap Iso
5/20/04	**7.90E-08**	<1.1E-8	**4270**	RCP#2 Base Ground Water

FRAC TANKS

	H-3 uCi/mL	pCi/L H-3
Frac#1	**4.28E-04**	**428000**
Frac#3	**3.68E-04**	**368000**
Frac#4	**3.59E-04**	**359000**
Frac#5	**3.41E-04**	**341000**

Frac E	**3.97E-06**	**3970**

CTMT Foundation Sump

	H-3 uCi/mL	pCi/L
4/15/04	**2.39E-06**	**2390**

Historical Data

Source	date	uCi/mL	pCi/L	
Refuel Cav	4/1-4/3/02	4.8-4.9E-4	483,000 -489,000	no decay
RWST	6/11/98	1.44E-02	**1.44E+07**	no decay
RCS AIX	3/31-9/1/96	2.36-5.32E-1	**2.36E8-5.32E8**	no decay
RWST Leak	1987		**1.25E+06** estimated, no decay	